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1-79070318 Commission Investigation into the Extended Outages of the Beaver Valley 1 Nuclear Generating Station (Pennsylvania Power Company.) Hearing.

P-79040173 - Counterion Trial Staff Petition to modify the net energy clause of Duquesne Light Company. Hearing.

P-79040174 - City of Pittsburgh and Major Sichard S. Caliguiri Petition to modify the net courty clause of Duquesno Light Company. Mearing.

Harrisburg, Peancylanda

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Pages 101 to 22k

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#### PUBLIC UTLINEY COMMUNICION

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I-79070314 Commission Investigation into the Extended Outages of the Beaver Valley 1 Nuclear Generating Station (Euguesne Light Company.) Hearing

6 1-79070318 Commission Investigation into the Extended Cutages of the Braver Valley 1 Nuclear Generating Station (Pennsylvania Power Company.) Searing

P-790401/3 Commission Trial Staff Patition to modify the net every clause of Ducusine Light Company. Hearing

P 2-790801/4 City of Pittaburgh and Mayor Michard S. Caliguiri Entition to modify the Let energy clause of Duqueron Light Company. Hearing

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Stency applic report of hearing hold in Hearing Room No. 2, North Office Building, Marrisburg, Permsylvania.

## Wednesday Ap:11 2, 1980 at 10:00 o'clock a.m.

HARRY G. BANZHOFF, ADMINISTRATIVE LAS JUCCE

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APPEARANCES:

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THOMAS & THOMAS P. O. Box 999, Harrisburg, Fennsylvania 17108 By CHARLES E. THOMAS, SR., ESQUIRE PATRICIA L. ARMSTRONG, ESQUIRE For: Decesses Hight Convenue Pennsylvania Foder Convenue

GREGO C. EAYRE, ESQUIRE JOUN A. LUMIN, ESQUIRE North Office Dullding, Marrichurg, Pennsylva For: Cramission Trial Starr IRWIN POPOWSKY, ESQUIRE 1425 Strawberry Square, Harrisburg, Fennsylv Vor: Office of Consumer Advocate MARVIN A. PUIN, ESQUIRE 313 City-County Building Pittsburgh, Pennsylvania 15219 For: City of Pittsburgh Mayor Richard S. Caliguiri	in a conservation of a second
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MARVIN A. PUIN, ESQUIRE 313 City-County Building Pittsburgh, Pannsylvania 15219 For: City of Pittsburgh Mayor Bichard S. Caliguiri	
313 City-County Building Pittsburgh, Pannsylvania 15219 For: City of Pittsburgh Mayor Richard S. Caliguiri	
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Mayor Richard S. Caliguiri	

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5	DUQUESNE DIRECT CROSS	Contraction of the
4	Clifford N. Dunn 144	
5		and a strength
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2	INDEX TO EXHIBITS	Condia anto 1
5	TRIAL STAFF IDENTIFIED ADMINTE	D
10	No. 1 - Drawing	
2.2. [		
12.1	DUQUESME	
42	Statement and Mchibits, previously described	
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15	CONSULER ADVOCATE	and other range of
17	No. 1 - Previously described	Street of the second
<u>3</u> 2		And Designation
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CLIFFORD M. DONN. celled and discourse, having team proviously duly sworn according to lar mas electined and F testified as follows:

MR. THOMAS: If your Honor pleases, we ask that f there be marked for identification as Dugradue Exhibit L a communication addressed to J. M. Arthur, Chairman of the T board and Chief Executive Officer, Duquedue Light Company, a latter dated May 25, 1979, by J. W. Landis, Senior Vice Treatdont, Stone & Webster Engineering Cornoration, and the inclosure referred to in that latter, which is a latter defensed to Mr. Harold Denton, Director, Office of Nuclear Feactor Regulation, U.S. Nuclear Regulatory Commission, insted 5-18-79 and signed by W. J. L. Konnedy, Vice Fresident, Stons & Febster Engineering Corporation.

This is the letter which was used by Mr. Poporsky in cross examination yesterday. We think the Noticer should be in the record? May it be so identified?

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Esc.

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THE ALMINISTRATIVE LAW JULCE: Granted.  $\mu(0)$ 

(Duquesne Exhibit L, photocopy of latter dated May 25, 1979 to Mr. J. M. Arthur from J. M. Landie with enclosure, was produced and marked for identification.) 2 BY MR. THOMAS:

53	Q Mr. Durn. I show you what has been warked for
1	identification on Ducuence Exhibit I and not you it that
2	isenvilleation as Duquesne Exhibit D and Esh you if that
2	exhibit is two letters, one addressed to Mr. Arthur by
5	Mr. J. W. Landls, Senior Vice President, dated May 25, 1979,
7	in which there was enclosed a copy of a letter from a
8	Mr. Kennedy, a Vice President of Stone & Webster Engineering,
6,	Senior Engineering Manager, to Marold Denton of the Nuclear
20	Regulatory Commission?
11	A Yes, it is.
12	Q Is this the letter to which you referred
33	yesterday in your testimony and which Mr. Popowsky used in
14	eross exemining you?
15	A Yes, 1t is. As you recall yesherday, I
20	indicated the Stone & Webster letter to Mr. Denton was undated
27	at least the copy I had, and the date which now appears on
10	buct lotter as per the exhibit is my bandwriting.
29	MR. THOMAS: Thank you very much. The witness
29	is available for cross.
21.1	
22	CROSS EXAMINATION
20	MR. SAVRE: Mr. Dunn, I am Gregg Sayrs. I
2.1	capropent the Commission Trial Staff. With your Honor's
25	permission I will ask a few questions and then Mr. Levin
i	

fittill take over for the Staff.

2 BI MR. SAYRE:

25

8 Q Your responsibilities for the supervision of 4 the operation and maintenance of the company's generation 5 stations, would those responsibilities involve technical 6 decisions like whether a plant is being operated properly 7 within its design limitations?

A It would involve responsibility associated fifth the measuring of the performance of plants, yes.

9 But apart from measuring them do you make
11 technical decisions as to exactly how the plant is to be run?
12 A No. There are general guidelines as to how
13 the pinnis are to be run. I do not make recessary day by day
14 decisions from a technical standpoint.

15 A lot of the technical decisions, a lot of the
15 technical work, although it would be under my general
15 responsibility, would really be delegated to the General
19 Superindement of Power Stations, or further down the line,
10 to the specific Station Superintendent and even rurther down
20 the line to the technical group which supports the station
21 operations.

So depending upon what you are talking should 27 and the scope of the responsibility it could be anothere in 26 are organization.

Q But all of those declaters eventually come up to an antiput, many a termination of the second s

Dunn-cross 1.17 1 to you, at least as far as the chain of command? 2 What decisions? A 53 0 The technical decisions on how a plant is to be run. Or do some of them have their ultimate responsi-1. 51 bilities elsewhere in the corporation? 61 A If you mean do I approve every operating 7 procedure which is a form of technical decision which governs 81 the way a plant is operated, the answer is no. 5 If your question is, do I approve every ing maintenance procedure as to how a plant is maintained, the 111 answer is no. That is done at lower levels in the 19 organisation. 第二 0 But all of those lover levels report through 344 you or do they report up to anyone else? 15 They report ultimately to me along the lines A 161 of counted I just indicated, and, of course, I report to the 29 fresident, the President reports to the Chairman of the Board, so I guess the ultimate responsibility lays with the 15 Chairman from an organizational standpoint . 20 9. On page 2 of your testimony you teffer to you: runctions in your 1956 position. In subsection (d) there you 23.1 22 rafer to tacholcal problems. What kind of technical problems? 20 A Problems which come no at one time or another 214 bl the poster station level. For instance, months a presentar or thether or not we overhaul a unit as a resticutor size. THE TART A PARTICLE. THE ATTACH AND ADDRESS TO A STREET PARTY. THE PARTY

	Dunn-cross 148
T.	when we take the outage. I would work with other people in
2	the organization and determine when was the best time for
3	that outage. In some cases I would actually approve or
5	recommend the outage be taken at that time.
10	There may be problems on air preheators, there
5	way be chemical problems, especially in the chemistry area,
R	which would come to me.
6	That is generally it, it is a very broad field.
9	Q Have you been trained as a chemist?
10	A Yes, I have.
21.	Q You mentioned today in your testimous that one
1.7.	of the early problems with this unit was resonance in the
13	niping system, is that correct?
36	A Yes.
25	9 Do you know whether it is normal procedure in
10	design work to consider the possibility of that kind of a
22	casonance and to design a system in such a way as to avoid it?
30	A X au not a design engineer, as I testified
10	yesterday, so I really can't answer the question with any
20)	Gagree of expertise.
72	Q You don't know whether that is a factor that
22.1	goes into plauning the design?
25	A I cannot testify from personal knowledge os Go
3.7	how the plants are designed. I can only assume that such
35	things are taken into consideration.
10	and the second

### Dunu-czoss

It is my general impression in retrospect in 2 reviewing the problem, what was done, it as one which 3 probably could not be anticipated because not only did it 4 involve the pipe configurations, it also involved the trim on 5 a valve, and also involved the number of impellers and the 6 speed of the water feed pumps.

So there were a number of combinations of events which created this rather unique problem and it only coccurred at approximately 20 percent of rated capacity and it did not occur every time.

Q Would you agree that the licensee is primarily
responsible for assuring that a nuclear plant is safe?
A The prime responsibility does rest with the
licensee. I testified to that yesterday. However, you do as
the licensee retain consultants, shall I say, who have certain
e mertise in various technical fields, from pipe design to
fluids flow to electrical systems, controlled instrumentation,
what have you, who halp you in the design and construction
and initial stages of operation of any facility, be it nuclear
or be it fossil.

27 C But if there is a safety problem with the MRC, 22 the buck stops with the licenses, is that right?

A That is the MRC's position, yes. We, mathing the utility that has the license, is the one the MRC turns to 25 for any resolution of technical problems.

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12	Q If a plant is not safe as designed, then,
2	would you say that it is the licensee's responsiblity?
3	A It would have to come out of some sort of
2	investigation as to in what way the plant was unsafe and how
5	unsafe and in whose judgment unsafe.
6	Safety is a relative question. Now safe is
2	safe? Not even the NRC to this date has answered that
8	question.
0	Q If it is unsafe in the opinion of the NRC, then
;c	limiting the question in that way would you agree that it is
11	the licensee's responsibility?
1,2.	A It depends on the fact situation.
2.5	Q Under that eircumstances would it not be the
24	liconses's responsibility?
1.5	A Where there is an honest difference of opinion
2.4	botween the NRC and the licensee, including the technical
17	support the licenson may call upon as to what the fact
23	Altuation is, and what judgments are used. I don't believe
35	the MRC is the ultimate authority, the court of last resort,
20	us to whother a plant is safe or unsafe.
25.	Again, I will repeat what I said before. Even
22	the NRC today caunct define how safe is safe. Safety is a
20	relativo term.
	Q When the licenses and the MRC get together and
0.1	agree that for safety's sake certain things must be done to
	a meneral administration of the Share of the Post Share and the Share of the same a meneral state of the same a

2 the plant, then that is the licensee's responsibility, isn't 2 it?

A Once we agree that certain modifications must d be made to the plant, then it becomes the responsibility of the licensee to see that that commitment is fulfilled.

The licensee made the commitment. The licensee should fulfill it.

9 You just mentioned that in the course of
9 You just mentioned that in the course of
9 building a plant the licensee has belp from contractors. To
10 your knowledge, did your architects and orgineers, Stone &
11 Webster, get any outside opinions on their design procedures
12 in the course of designing Beaver Valley 19

A . I do not know.

23

Q Is it correct that in the course of the seismic
is stress problem Stone & Webster was reviewing the stress
calculations because of notification from Westinghouse that
there was an error in their specifications as to the valve
weights? Is that what started it off?

A The whole thing started as the result of a
design change we made at Deaver Valley which I testified to
earlier restarday. In the course of this design change it
come to the attention of Stone & Webster that there was a
difference in the weight of a valve between what showed on the
drawing and which Stone & Webster used in their seizmic
analysis, and their which they had available to them from

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Dunn .cross

11 other sources. 2 According to Stone & Webstor's seismic analysis and according to the information they had available 2 to them at the time they did it, the valve weighed 250 pounds. le They learned later that the valve actually weighed \$50 pounds. 5 And that was an error by Westinghouse in 6 0 71 specifying how heavy the valves were? 21 No. I don't know whose error if indeed it was A 9 an error. 70 0 Well, the specifications you say said 250 and 11 the valves are really 450. 12 A No. I didn't say the specifications said that. 72 1 I said the drawing indicated the valve weighed 250 wounds. 241 The drawing would not necessarily be a specification. The 151 drawing is one which the engineer doing the seismic 26 design would use in his input to his calculation. 27 There is a valve there. According to my print 供信书 it weighs 250 pounds, therefore I input that into the 29 Horogrem. 70 No you know what person or entity was 0 714 responsible for labeling the valve on the drawing at 250 23 instand of 450? 20 No, I do not. 2.1 1 If the valves had actually weighed 200 nounds, 251 do you know whether or not the whole stains system would have

STREETLY, CHERRY OF CLASS WARKING AND A CONTRACTOR OF AN ADDR

153 Dunn-cross I leon adequate using the NUMIPE computer program? A I do not know. 2.1 Q Do you know whether Stone & Webster or anybody 5 Allat Duquesne made that kind of analysis? A I do not know offhand. Perhaps that analysis 6 ans made. You said NUPIPE, which is not the code used in the design of the plant by Stone & Webster. 211 MR. THOMAS: Read that answer back, please. RI 01 (Answer read.) 101 11 BY MR. SAYRE: 121 Q What about the PSIRESS Shock ITI program that 131 changed the method of adding the force factors, would it have 1. been accoptable using that program if the valves actually 15 weighed 250 pounds? 14 A I do not know without going back and looking at the records. The data possibly exists scheplace but I seanch 171 if recall it offband at this point in time. 201 Q You have testified that no loss of safety function would have occurred with excessive stress in one of 2011 the six flow paths, in that correct? 211 27. A That was the information which was provided in the various reports which were sent to the NRC and it is the 17. 19 2' hasts for my bestimony. My testimony is based upon the 27 | tecords, not unon my personal involvement.

attraction of the state of the second supervised and second states and the

	Dunn-cross	154
R	9 But somebody at Duquesne come to tast	
2	conclusion and reported it to the NRC, is that right?	
З	A Stone & Webster came to that conclusion.	Their
4	conclusion was reviewed by at least the on-site safety	
5	committee and came to the same conclusions, yes.	
5	9 I presume that with too much of a stress i	n one
7	of the flow paths then the reason the safety function wou	1.d
0	not have been lost is that the other five would be avails	. <b>b</b> 1.e
3	in a redundancy kind of situation, is that right?	
10	A Redundancy is the answer to the question.	
12	Q But is it correct that all six flow paths,	
12	under the later calculations that did not use algebraic	
<u>1</u> 3	addition, all six were stressed beyond the allowable stre	ss,
14	ot least as far as the NAC determined it, is that right?	
15	A . I don't believe so, no.	
1.5	9. What is the difference between allowable s	tress
17	and yield stress?	
33	A I can only give you my interpretation. Ag	aic,
12	I am not an expert in the area of seismic analysis. I wi	3.2.
20	answer the question on the basis of my qualifications in	the
7.1	testimonr.	
2.2.	Allowable may be a standard established by	some
20	urganization, not necessarily the NRC, as to what is a	
24	reasonable level from the standpoint of design.	
20	Vield stress is that point where the pipe	
	and a second second a contraction. But will reprint the contraction of the second seco	an an an the statements

31	14	413	14 14	10.15	100 12	125
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in may hand or trist but not necessarily breck.

24

There is another value, and I have forgetten 5 what it is called, in which there is a high probability the Afgipe will break if it exceeded that number.

So you have a design number, you have a yield for sumber, and you have a failure number.

I may not use the exact connotation from the firstandpoint of the technical people, but that is the way I put it is my words.

19 9 When the calculations were vorum were any 11 of the pipes above the yield number?

A I believe the answer to thet question you can find unge 3 in my direct testimony in answer 7 in the last sentence. The recalculated stress levels enceeded allowable thereeses. However, they did not enceed yield stresses, that is, deformation with or without breaking, anoset in one case with of the six flow paths.

10 Q After reviewing that particul of your testimony 10 it is still your recollection that loss then six of the flor 20 paths were stressed beyond the cllowable stress, is that 21 right?

A My bestimony specks for itself. I don't income 25 tow I as add suything more to it, both in my direct 26 statement as tell as the various exhibits attached to it. 28 thich is really the basis for the testimony. The reports we

2	nade to the MRC can be found in either Exhibit A, B or C.
2.	Q That does not quite specifically ensuer my
2	question. I am interested in how many of those flow paths
4	under the new calculations in how many of those paths
5	cllouable stress was exceeded.
6	A I do not know the answer to your question.
Đa	Q Would you turn to Exhibit D, the NRC show
2	cause order. On page 2 of the show cause order about balf
9	way down, the MRS refers to a General Design Criterion 2.
10	Is that a different document from Regulatory Guide 1.92?
22	A I do not know.
12	9 Do you know when General Design Criterion 2
2.7	was issued by the NRC?
141	- A No, I an not a design engineer?
25	Q Was Duquesno the first company to uncover this
16	particular design problem?
17	A That is my understanding.
18	Q Mas it Dugnosne rather then Stone & Febster or
10	any other company that actually made the first report to the
201	1907
25	A As far as I know, the problem surfaced as the
20.1	vesult of a design change which was initiated at Benvar
23	Valley. The design change, among other thirgs, resulted in
201	the computation of stresses in certain pipes using two
25	different computer codes. The negative from the two

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5 calculations showed significant differences by a factor of, 7 I have heard three to six, and as a result of that difference 3 the whole question was raised.

Q But my question, though, was whether Duquesne 5 was the first entity to report to the NRC. And that is 6 correct?

A As for as I know, yes.

7

Q Were the other plants that were shut down at
 P or about the same time by the NRC for these seismic
 10 calculation reasons all designed by Stone & Webster?

A I am not a hundred percent sure. It is my understanding that at least some of them, if not all of them, were, because the commonality which the NEC seemed to be looking at was the Stone & Webster calculation technique. But I am not a hundred percent sure.

16 It is easy to verify by looking in the Gray

Also on Exhibit D going back to the first
page of the order to show cause, I am interested very such in
the whole recital of facts that the NRC makes in thet
Paragraph II of the order that runs from the first page
through, I guess, the last full paragraph on the third page.
I would like you to enalyze, in light of the
facts that you are aware of now, each of these paragraphs of
the order to show eause and tell us in what respects. If cus,

is a second state that an error of the president state of the second state of

5	The statement of t
1	
0	the rocical of facts by the MRC is incorrect,
-	Perhaps we could just do 10 on a paragraph by
2	Faragraph basis, and if you feel you need more time than we
11	have more time to take a look at it, we could look at it
5	egain after lunch.
5	A No, I will do it now.
E.C.	MR. THOMAS: How far does your question go?
6x	Clear over to page 4?
54	MR. SAVRE: No, just page 3. I would leave
10	out the bun-over paragraph from 3 to 4. That seems not to be
22	a recitation of fact.
12	THE WITNESS: With regard to the first
15	garagraph, and this is the NRC's show cause order, so
ki j	therefore it is what they wrote reflecting their interprets-
	tion, their understanding, in the third line the word
14	Landvortently, is used. I don't know whether that is a true
17	obaractorization or not.
11	I simply say that what we reported on
10	December 5 in LER 78-53 is shown in Exhibits C. The whole
20	report in there.
2.1	Whether the stress computations inedvertently
272.	bad not bost completed, I don't know. I con't egree with that
22	at this wolnt in time.
24	BY MR. SATE:
25	9. For the record, could you doging LEST
	In a second to the second to the second s

	Dunn-cross 159
1	A License Event Report
2	Q Thank you.
2	A With regard to the first full paragraph on
1.	page 2, I do not necessarily agree with the statement starting
5	in the fourth line, the fact that the piping analysis code
6	specified in the application for an operating license uses an
7	elgebraic summation. It is not clear to me and I don't think
- 8	it is clear to the people who are doing the review what the
2	commitments vere in our operating license.
40	I don't necessarily say that as a hundred
51	percept fact. That is something which is being reviewed.
32	Again, it is comething based upon interpreta-
23	tion by people for more expert in the field than I cm.
14	Q Wouldn't that question be enswered if the
25	operating license application simply said that the code to
35	analyze this would be PSTRESS Shoch II?
XŸ	A The licensing will speak for itself. I guase
10	the answer to the question is if the law was written as clear
10	that you are implying this should be written here, then there
20	rould be no need for lawyers. It is an interpretation of what
21	was written.
22.	9 Can you tell me, does the application for an
20	operating license specifically state that the science analysis
20	would use PSTRESS Shock II?
10.24	

į.

A E don't believe it dues but E have not gone to

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10	1111	the a	Sal	14	213	

look at the operating license, and the commitment, really, I 2 Con't know if it is in the operating license or if it is in the FSAR, Final Safety Analysis Report. 3 2 I guess I would like to make that request of 1 you to tell us at a later date whether it is specified in 5 either of those documents that PSIRESS Shock II was used. 57 7 MR. THOMAS: We will look at it. . 8 THE WITNESS: Again, in that same paragraph ---2 and this is a matter which we discussed yesterday -- the sentence in the middle of the paregraph says: this incorrect 161 11.11 treatment of such loads was not recognized at that time. 12 Again. I am not convinced it was an incorrect prestment at the Wi time the plant was designed. It may have been an incorrect 141 treatment under regulatory requirements in 1976 or 1977 15 | than we got our operating license. REMENT MR. SAVRE: 27 1 Q Are you tostifying that it was convert at that 10 time or that you don't know whether or not it was incorrect 29 || ever' 201 A Ac what time? 221 6 At the time the original calculation was made. 20 Are you testifying that that calculation was correct at that

A I am testifying that in the arm when Prever 2 Welley well being designed, egain we are delbing about 1972,

and the second second

271 time?

### Dunn-cross

1973, 194, it is my understanding that there were no pecific MRC guidelines as to what was being done, and therefore each architect/engineer -- and that goes beyond Stone & Nebster -- was pretty much left to his own methods of making these calculations.

The NRC, to the best of wy knowledge, did not 7 go into any detail on the codes. It is my understanding if 8 you go back in that period there were about 29 plants which 9 were designed using a technique which uses this algebraic 10 summables.

The technique may have been used to various the technique may have been used to various the degrees depending on the plant. Some plants may have used it sonly our small systems. Other plants, such as Beaver Valley, it was used on all systems for which the computer calculations for which the computer calculations

So in 1972, 1973, 1974 it is my understanding-

It was acceptable in terms that it was nover rejected, when you had something like 25 plants that were preting at that time which were designed and constructed is using that type of computer code.

9 But referring to what you identified bls 25 morning re Schibit L on page 5 of seven, the second full

# L'unu-exess

S	
2	paregraph on page 5 of seven, the second sentence, they
2	indicate, do they not, that even Stone & Hobster used a
3	square root of the sum of the squares summation, or at least
4	had available to it that type of computer program in 1972 and
5	1973, isn't that correct?
6	A They may have had it available to them but
2	there was no requirement that that procedure be used.
3	Q But they not only had them available, they
9	used that program in 1972 and 1973?
10	A They may have used it. They may have been
18	still in the development stage. I do not know what was
32	going on in the Stone & Webster organization in terms of the
23	development of that computer and what degree of confidence
7.4	they may have had in that model at that particular time.
23	MR. THOMAS: If your Honor pleases, I think
26	this letter from Stone & Webster to the NRC has to be taken
57	in its full context because on page 1 at the bottom of the
28	yage it says the NRC has contended that the use of algebraic
3.0	summation in this case was incorrect we do not egree.
20	I think you have to take the full context of
31	the letter. I don't believe you can take one or two
22	sentences. I think you have to take the full letter.
-33	MR. SAYRE: Your Honor, that is a matter for
2.4	crgument.
25	MR. THOMAS: Well, it may be a matter for
	a contraction of the second

1 ergument but I just don't think that we should ask questions
2 which may be out of context because I think you get the wrong
3 result.

A EY MR. SAYRE:

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9 Shall we continue with paragraph 2 of 9 Exhibit D? Have you finished your comments on the first full 7 paragraph of page 2?

A You have to read the whole paragraph in f context of the comments I have already made. For instance, the next sentence says: such loads should not be algebraically added unless far more complex time-history analyses are performed. That is the NRC's position.

Q And you disagree?

A I don't necessarily disagree. I am saying that is a subject which is now being discussed, and again the are tolking about time differences. What existed and what is acceptable in 1979 was not, in my opinion, based on information I have evailable to me, necessarily the controlling factors in 1972, 1973, 1974.

In that period there wave a number of plants, 21 23 operating plants, four under construction, which were using 23 the algebraic summation technique.

So it was the state of the art. Was it 21 accepted? Well, it was accepted in that it was not rejected. 22 Q Mr. Dunn, I would like you to confine your

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1 cnswers, if you can, to my question. All I asked you at that 2 time was do you agree or disagree with that statement.

3 MR. THOMAS: Now, if your Honor pleases, one de l thing that has to be kept in mind -- and I object to 51 Mr. Sayro's remark to my witness -- the paragraphs or pages 5 to which Mr. Sayre has referred in his question contain not 81 only factual statements but they contain judgments and 8 opinions by the NRC and I think that the witness has a right 0 to comment to the extent that he says he is qualfied to 10 1 comment.

If I have not objected to questions because I
want it to go if it can. But at the same time, if these are
judgments and opinions of NRC, then it is not a factual
question, is this right or is this wrong; there can be
differences of opinion and I think it has to be answered in
that context.

If that is the content in which the question is
asked, I have no objection. But if it is asked as a straight
out right or wrong, then I would object to the question
because is is asking my witness to comment on opinions and
judgments of the NRC.

MR. SAYRE: Your Honor, I don't think there is
either at objection to the question or a motion to strike
pending, so I am not sure what the last remark was in aid of.
MR. THOMAS: I will tell you what it was in

the gran management of many program and the

	Dunn-cross 165
N.	aid of, Mr. Sayre. If you are asking the question in the
2.	context, is this statement right or is this wrong, in that
23	context I object.
-6	In the context of asking the witness to
S	comment in those instances where they are not factual
6	statements, they are judgments or opinions, then I wouldn't
7	object.
51	You have asked my witness an extremely
G.	difficult and complex question involving a lot of assertions,
10	and he is trying to answer the question. I don't think he
15.	is responsible for judgments or opinions of the NRC in
12.	respect to design matters as to which he has said he is not
13	a design englacer. He is trying to cooperate.
24	THE ADMINISTRATIVE LAW JUDGE: Continue,
15	Mr. Sayra.
30	DY MR. SAVRE:
17	9 Have you completed your comments with respect
20	to the first paragraph on page 2?
10	A Yes, I have, and the comments I wake would
20	apply not only to the specific parts I have talked about
21	but the varegraph as a whole.
22	In the third paragraph the word in the very
20	first live, the inappropriate analytical treatment, the word,
2.1	inappropriate, I think is a judgment on the MRC's part which
23	may any not be true.
1	

#### Dunn-cross

In the very last solutions it says: it is in these runs that the predicted earthquake loads may differ significantly. Again, that is a judgment. They may differ. Whether or not it is significant is something which would for out by the actual calculations themselves. What is significant is a judgment.

7 Q Could we go on to the run-over paregraph 8 from 2 to 3?

A In hindsight I take exception to the whole managraph. Again, this was written in March 1978 where the INRC really didn't know the answers to the questions which had been related. They indicated an honest concern: is there an unreviewed safety question?

So the whole paragraph reflects a foresight is and an assumption on their part that there is a significent is problem.

If I think in retrospect if you look at the 10 number of design changes which were node in some of these 10 plants as a result of the review you will find them rather 20 insignificant, at least in the case of Maine Tankee where 21 there were essentially no modifications required of the 22 plant, as I understand it, and in Beaver Valley where the 23 number of modifications is rather small in terms of the 24 number of supports which were analyzed.

13

Statistically, as I recall some figures that

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10.74	
3	I read someplace, there were very few design modifications
52	necessary, 1 or 2 percent, something like that.
3	So I would take exception in hindsight to
100	the implication of that paragraph which was foresight on the
Se	part of the NRC.
5	Q Now, in the next paragraph I am not going to
2	esk you to analyze the last portion of it that talks about
8	based on this more detailed review the NRC staff has
0	concluded, but do you take any exception to any of the
20	statements in the preceding portion of that first full
22	paragraph on page 3?
12	A The second line, by this error. I don't agree
13	that becossarily an error was made. How far in that paragraph
24	do you wish me to go?
85	Q Stop with a sentence that says: concurrently
3.6	on March 9, 1979 the licensee suspended power operation of
17	the facility. After that I won't ask you to review it.
18	MR. THOMAS: In other words, does the witness
30	have any comment on the first five lines, is that the
20	question?
21	THE WITNESS: First seven.
22.	MR. SAURE: The first seven lines, yes.
25	THE WITNESS: Other than-the question of
24	-bether or not an error was made, I think that paragraph, to
2.1	the extent I have reviewed it, the first seven lines, in

Dumn-cross 168 1 1 inconal. 2 H BY MR. SAYRE: 2 Q Who at Duquesne Light is most familiar with Stone & Webster's past or present methods of calculating C: 51 seismic stress? 61 A It would be someone in our Mechanical 7 Engineering Department. I don't know who specifically. 8 MR. SAYRE: I would make the request that that 0 verson be identified. iG. MR. THOMAS: We will have to find out. 13 MR. SATRE: I would also request that you 12 dentify the person at Duquesne Light who is most familiar 13 With past and present NRC standards for-selsaric designs. 1.41 MR. THOMAS: Just a minute. Let me get the 751 first one down. The first one is who at Duquesne is most till familiar with what? 12 MR. SAYRE: Stone & Webster's gast and present 18 wotheds of calculating seismic stress. -10 MR. THOMAS: I would think Stone & Nebster 20 should answer that question. 21 MR. SAYRE: Are you objecting to the data 22 requested? 2. MR. THOMAS: Well, 1t is going to require 21 somebody at Duquesne to analyze Stone & Webster. I would 25 think Stone & Webster would be the ones who know what they TOTO O MARCHAE, WAR -- AT IT, LOUISED & COUNTRY -- TOTOMOUND, DA. 1910A ------

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1 have and have not done, otherwise we are going to have to 2 form a judgment.

I am willing to examine into the problem. I will come back to you if I think we can answer.

5 MR. FEIN: It was my understanding that 6 somebody at Duquesne was the one who flost ascortained that 7 there was an error in these calculations. That would be 8 probably the person that would be most familiar with this 9 problem.

10 THE WIINESS: No, that is not correct, Marvin. 11 It was not sumeone at Duquesne who first indicated there was 12 on error in the calculation. There was someone in Duquesne 13 who first observed there was a difference as between the 14 results from two calculations, there were discrepancies. 15 Whether or not they were errors is a second question.

16 MR. FEIN: All right, it would be that percon 17 the is most familiar, I would essume, because that person was 18 looking at the calculation in Duquesne's organization.

MR. THOMAS: The question, at least as I understand it, is: who at Duquesne is most familiar with 27 Stone & Sebster's past and present methods as to stress 22 analysis?

Now we can say this guy, wheever he is, knows nore about Shone & Webster's stress calculations in Dequand than anybody clea, but we are not saying he is going to be

	Dum-cross 170
7	the answers as to what they are.
2	But let's go on. I will try to find something
3	out.
4	THE WITNESS: What is the second one?
5	MR. SAYRE: Who at Duquesne is most familiar
6	with the NRC past and present standards for selsmic design?
8	MR. THOMAS: We are going to try to find out
82	but that is a real load.
S	MR. SAIRE: I just want the name of one person,
10	MR. THOMAS: I understand what you want.
11	MR. FEIN: Could we also have the name of the
12.	person that discovered the discrepancy?
13	MR. THOMAS: You say you want the name?
35	MR. FEIN: Yos.
35	MR. THOMAS: We will get the name.
36	ET MR. SATRE:
88	9 Do you know who in the company made the
18	decision to report this problem to the Nuclear Regulatory
10	Commission?
20	A Yes.
21	Q Who was that?
22	A Mr. Werling, the Station Superintendent. He
23	makes all such reports.
24	Q What is his first name?
27	A James. He signed the letter which is shown in

Dunn-cross 171 褒 Data bit . 2 D. I think. G 3 A It is also C. B is an earlier one. 2 And he has authority in the company to send 0 5 1 that off without approval at higher level? 5 A He had a responsibility to do it. 7 0 I gather from Exhibits A and B -- and I'm going . All to ask you to correct me if I am wrong --- that originally in " i the discovery of this problem there were some actual errors 19 vucovared in using the hand-calculation we had, is that 19 corroct? 12 A I don't have that impression, no. I recognize 221 the words which were used in there, they talk about 3.6 || inappropriate use of a hand calculation, but I don't know 251 whether or not there was an error made. Q Could you turn to page 1 of Maibit A, the 27 | buird paragraph thore, starting with the second line, states sodeant there were errors in the piping stress analysis isonibing 20 irom an error in the hand-calculation method, is that correct? 201 That is what it says at that particular point A Alita time but I ma under the impression that Stone & Mebster bas 30 changed their continue based upon a further review of the 120 problem and whether or not there was an error made is something that has yet to be determined. 251 Sub aven't we talking about two different kinds strategies, million grant highlight have built a mean same as a post of the

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a of things? On one hand, the use of the hand-calculation g method, and on the other hand, the difference in computer codes and the way stresses were added up in those computer codes, or are all those part of the same thing?

5 A You use both hand-calculation aethod as wall as computer codes to do your design work and hand-calculation 61 methods, as I understand them, are really charts which a 7 design engineer can use because he has a straight run of . 11 11 011 tipe with a certain weight and a certain pressure, and somebody has made the calculation many times before, and here 11 It is a table you can go to and find out what the frequency is it and what the weights are and what sort of hanger would be appropriate based upon past experience or past calculations. 12

It is a simplified method. From a practical is standpoint you cannot use seismic type dynamic computer codes is no analyze every pipe in a nuclear reactor plant.

17 9 Looking at the next to the last line of 10 Exhibit A, page 1, ogtin it refers to errors in the applica-11 alon of the chart method. What kind of errors does that 20 rater to?

A I do not know. I have tried to get an ensure 25 to the same question. It is my interpretation of this point 35 in time that there may not have been an error, but I do not 34 know. This is something which is being studied by our outside 25 consultant, who is an expert in the field, who is going to

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I review whet Stone & Webster did.

This word, error, appears many times in Exhibit A and appears in some of the other exhibits which reflected someone's opinion based upon limited information savailable to him at the time he wrote the letter.

6 It is my impression, based upon subsequent 7 review at a later point in time, whether or not errors of any 8 mognitude were made is still subject to review, judgment and 9 ultimate decision.

9 9. I still don't understand, though, whether the
11 errors referred to in Exhibits A, B, and C with respect to the
12 hand calculations or the chart method have anything to do with
13 whether or not stress vectors were added algebraically or in
14 some other method. Can you answer that?

A No, I cannot.

15

22.

22

Q In Exhibit C on page 1 of the Licensce
 Drent Report, which is the third page of that exhibit, under
 the paragraph 27, cause description and corrective action,
 again there is a statement about the error.

A I am not with you. Where are you reading

Q About balf way down the page.

A Which page?

2 The first page of the Licanson Erent Berort, 25 Thich is the third page of Exhibit 9, about half may down the

#### Dunn-cross

page, I quess line 10, it refers again to the error and the misapplication of the chart method, but at the same/it states that corrective action was completed. Is that correct?

Yes.

A

die

Q Do you know whether or not the NRC approved the steps that had been taken at the time of that Licensee Event Report as closing the matter of the errors as they are referred to here in the chart method?

A I don't know what the NRC may have done with in regard to the question of whether or not an error was made. If I do know that the NRC did review the design change which we wade to this particular system and we are satisfied that it is was edequate.

9 So what you are saying is, then, thet after 15 this Licensee Event Report, the question of the errors in the 16 chart method was closed, is that right?

A No, I did not say that. I am saying I don't is know smactly where that question ultimately ended an and how is was resolved.

I do know from the standpoint of the physical ananges we made to the plant, the additional supports we put in, one snubber, the NRC was satisfied that the piping was adequate in terms of the design changes made.

24 9 Although you subsequently had to shut dorm and 25 make further mulifications?

se regententi, qu'int, les registes transpresentations à grit, les terministants près motores de la r

		ar, 18 - 54 - 54 - 54 - 54	Dunn-cross 175
1		A	I don't think we made further modifications
8	of this )	artic	ular system.
3			MR. THOMAS: If your Honor pleases, I have an
4	urgent te	lepho	one call to make and I was wondering if we could
5	lave thre	e or	four minutes, I don't want it to be long, but
6	I would !	ike t	o make the call.
8			THE ALMINISTRATIVE LAW JUDGE: We will take a
.0	ten minut	e rec	ess.
51			
20			(Snort recess.)
12			CLIFFORD N. DUNM, resumed.
22	DY MR. SA	YRE:	
13		ର୍	Mr. Dunn, does Duquesse have available to it
14	either th	a NUF	IFE computer program or the FSIRESS Shock III
25	orogram?		
10		A	In-house?
£2 j		8	Right.
20		A	To the best of my knowledge, co.
LC		ନ	Stone & Webster ran those programs on the
20	occesions	that	you refer to them in your testimony, is that
23	right?		
32.		A	Yos.
20		ŋ	Are you aware of any NRG document that
36.4	specifing !	lly a	oproves algebraic addition for delamic stress
1	enleulati:	0.6125 ?	
		mnder	- The state of a solution of the transmission of the second
Duan-cross

2	A I am not aware of any that approve it, I aw not
2	aware of any that disepprove it, if you are talking about
3	periods before December 1974, which is the date the Regulatory
4	Guide 1.92 was initially issued, and its effective date which
5	I believe was April 1975.
0	Q Does Duquesne have any insurance to cover the
7	cost of purchase power during extended outages of nuclear
59	plants?
9	A You can't buy such insurance at this time.
1.0	Q Has Duquesne considered buying a transportable
11	transformer?
12	MR. THOMAS: I want to hear the question,
13	please.
14	(Question read.)
15	THE WITNESS: Considered at what point in time
16	and what size transformer? As a general answer to the
17	question, yes, we always consider it, and yes, we do have
18	portable transformers.
19	DY MR. SAYRE:
20	Q I mean one of the size that would be .
21	sufficient to replace the one that caused the early outage
2.2.	at Beaver Valley.
23	A This was evaluated at the time the station was
24	being designed on the basis of an economic evaluation made.
25	At that time the decision was made not to have a spare
. (	

	U. provide the second
L	transformer.
2	However, with a second unit coming on and the
173	fact that we do have a spare transformer at this particular
4	point in time, we will maintain at the site, at least of
5	today, one spare transformer which is available to be used at
6	either units in event of a future transformer failure.
2	BY MR. THOMAS:
8	Q By any units you mean BV-1 or BV-2?
9	A Both units, BV-1 and BV-2, and we would also
10	make that transformer available to any other utility who got
1.1.	into serious problems and wanted to borrow it or even buy it.
12.	EY MR. SAYRE:
13	9 What is the cost of that kind of transformer?
14	A I would be guessing: I don't know offhand:
15	Q Could you turn to page 12 of your testimony.
16	At the bottom of the page you refer to the purchase power
17	credit on the net energy clause for March through June of 1979
8.8	of \$751,000. Am I correct in understanding from your
9	testimony on cross examination yesterday that that amount
105	would have been increased by the \$19,880,000 that you referred
27.	to in answer 15 on page 14 if Beaver Valley had been running
2	at 91 percent capacity factor?
0	A No.
4	Q What is incorrect about that statement?
5	A The time period you are looking at. The
	THE PARTY AND

	Dunn-cross 178
X	\$751,000 is for a purchase power expanse for the period
2	March through June 1979 and those are calendar month veriods.
3	The figure you refer to later, the \$19,880,000,
4	involves a calculation which covered 162 days and included
5	not only purchase power but increased production costs on our
0	own generating facilities. So they are not the same.
2	Q Would all of that \$19,880,000 have been
8	reflected in the net energy cost?
9	A That is the basis for the calculation, yes.
10	Q Is Mr. Werling still Station Superintendent at
RR	Beaver Valley?
12	A Yes, he is.
13	Q He would be familiar, would he not, with the
34	errors that he referred to in his report regarding the hand-
15	calculation method?
1.6	A Not necessarily. He, again, is not a seismic
17	design engineer. His reports reflect information surplied to
18	him by Stone & Webster. In the interest of safety he would
39	have to assume the information is correct and act accordingly
20	until such time as the information is either proven right or
21	wrong.
22	9 Then I guess I would like to make another data

22 R Then I guess I would like to make another data 23 request of you, the name of a person at Duquesne who could 24 explain what Mr. Werling referred to as errors in the chart 25 method or hand calculations in his reports to the NRC.

	Dunn-cross 179
2	A His report is based on the information shown
2	in Exhibit A which is a memorandum to Mr. Werling from Stone &
3	Webster personnel.
4	Incidentally, Exhibit A also contains some of
5	the answers to the questions you asked earlier involving the
6	valve weight question, paragraph 2, specifically.
2	Q That is right, Westinghouse furnished the
. 6	drawing, is that right?
9	A That is right.
10	Q But is there anybody at Duquesne who would
11	understand the problems with the hand-calculation method?
1.2	A Possibly, yes. I don't know who that
23	individual would be.
14	Q Could you furnish either that name or inform
25	us that there is not anybody there who understands it?
16	MR. THOMAS: We will inform you as to whether
37	Werling based the statement on in-house information or Stone &
10	Webster information.
19	MR. SAYRE: My request goes beyond that. I
20	would like to know if there is anybody at Duquesne who can
21	explain the natures of the errors that Mr. Werling referred to.
22	MR. THOMAS: Well, then, you have changed your
23	request. I thought your request was who gave Werling the
24	information upon which he used the phrase, error.
25	MR. SATRE: No, I want to know if there is anybody there

	200 x x x x x x x x x x x x x x x x x x
3	who can explain the situation.
2	MR. THOMAS: We will try to find out. I would
33	like to go off the record a moment if I may.
4	THE ADMINISTRATIVE LAW JUDGE: All right.
53	
6	(Discussion off the record.)
8	BY MR. SAYRE:
8	Q I just have one last question or pair of
9	questions. What were the available percentage and the
10	capacity factor for Beaver Valley 1 for the full year 1979?
11	MR. THOMAS: The availability factor is already
12	in the record in answer to a Staff interrogatory in
1.3	Exhibit 10A which I think is Item No. 9. It is in there
14	through July. I don't know about the capacity factor.
15	MR. SAYRE: I am interested in the full
16	calendar 1979 figure. I don't think 10A would have that.
17	MR. THOMAS: No, I don't think it does. If it
10	is not in the record we will provide it.
19	MR. SAYRE: I yield to Mr. Levin.
20	MR. LEVIN: Thank you.
21	BY MR. LEVIN:
22	Q Mr. Dunn, your original training was in
23	chemistry?
24	A I hold a Degree in Chemistry from Carnegie
25	Mellon University.
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		Dunn-cross 181
	1	Q Did you specialize in any branch of chamistry
	2	or was that a general chemistry specialization?
	53	A It was general chemistry but I did take a
	4	graduate course in Nuclear Chemistry.
	5	Q What year was that in?
	6	A Approximately 1955, 1954 or 1955.
	7	Q Can you tell me whether all aspects of nuclear
	8	chemistry, such as metallurgy, physics, and radiological
	9	subjects were covered?
	10	A That is a big broad field and you could not
	11	possibly cover that scope of technical information in the
į.	12	course of a one year or year and a half program.
	13	It involved both lab courses in terms of
	14	dealing with radioactive materials. It involved actual
	15	experiment involving radioactive materials such as lodine 131,
	16	Cesium 137, Cobalt 60 perhaps.
	27	It involved classroom discussions on theoretic
	18	theoretical physics at least from the standpoint of radiation
	19	chemistry.
	20	It involved concepts such as half life,
	23	shielding, decay, nuclear structure, very broad.
	22	On top of that, of course, I had specialized
	23	training programs in preparation for my-assignment at
	24	Shippingport involving the theoretical aspects of health
	25	physics, radiation chemistry, radiation training, as well as
	1	Mantenen & Marshal, Inc 27 R. LOCKPILLOW AND MADENDURG, PA. 17120

	Dunn-cross 182
ĩ	practical applications of such techniques at the Material
2	Testing Reactor in Idoba Palla Idaba
	resting heactor in itemo rails, idano.
3	Q What was your assignment at Shippingport?
4	A I had many assignments. Initially I was
5	responsible for the chemistry program, subsequently promoted
6	to a position which involved responsibility for the training
8	of operating personnel as well as general plant training, and
8	ultimately I held a position where I had the total
9	responsibility for chemistry, training and plant testing
10	Q When you say chemistry are you referring to
21	chemistry of primary and secondary coolant loops or general
12	plant chemistry or what?
13	A Yes, to all of those. Total plant chemistry
14	involving both primary and secondary.
15	Q You would be the individual who would have
16	general supervision over anything having to do with plant
17	chemistry and radiological safety?
1.8	A Plant chemistry, not so much radiological
19	safety.
20	Q Would you say that you spent a few years at
21	Shippingport?
22.	A I was there from March 1957 through October
23	1962.
24	Q Was Shippingport a pressurized water reactor?
25	A Yes, it is.
1	MCHINDACH & MARCHAL, DIG 27 R. LOCTIVILLOW AVE MARCINDUNG, PA. 15112

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2	Q	Was that one of the first pressurized water	
3	reactors built	in the country?	
513	A	Yes. it was.	
4	Q	It was operated, of course, by Duquesne Lig	ht?
5	A	Yes.	
6	9	And you were an employee of Duquesne Light	at
7	the time?		
8	A	Yes.	
9	Q	Would you say that as a result of having	
1.0	worked at Ship	pingport for those years that you have a goo	d
11	conversational	understanding with the hardware of a nuclea	r
12	power plant the	at is a pressurized water reactor?	
13	٨	Generally, yes.	
13	Q	Is Beaver Valley Unit 1 a pressurized water	
15	reactor?		
16	А	Yes, it is.	
27	ę	Consequently, when you discuss the various	
18	events and engi	incering problems in your testimony, that is	
20	partially based	on the experience that you obtained from	
20	working at Ship	opingport, is that right?	
21	А	Partially from Shippingport but also partia	lly
22	from approximat	tely one year experience at Beaver Valley.	I
23	spent full time	e at Beaver Valley in about the years 1974.	1975,
24	I don't recall	specifically, but anyhow, the period just p	rior
2.5	to the plant b	eginning its start-up.	
	Sum memory and the second seco	D MADDINAL INC ET D. LOCITIVILLOUS ANT MADDINEDURG. PA. 19912	CROSS BREAM AND

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1	Q Are there any areas in your statement that are
2	not from personal knowledge but are from basically
3	discussions with or selected from conclusions of other
4	individuals?
5	A A lot of the information in my testimony is
6	based upon what I have read, particularly information
2	involving engineering concepts, design concepts. As I
8	testified before, I am not a design engineer, particularly in
9	the area of seismic, nor am I a nuclear engineer, as I
10	testified before.
11	Q Of course, to the extent that you obtain that
12	information from other individuals and sources that would
13	be hearsey?
34	A No, the information I get from people in
15	Duquesne Light's organization I consider to be credible in
16	terms that it is being prepared and submitted to me by
27	individuals who are technically qualified in their own
18	specialized areas.
19	Q On page 3, question A-7, is your response there
20	from personal knowledge?
21	A It is primarily based upon the documents which
22	are available in this record as well as, again, I would have
.73	to go back to that particular time whether or not I got a
24	telephone call from either Mr. Moore or Mr. Werling on the
25	subject. I don't specifically recall.
1	MEMITTARY & MARDHAL. ING IT N. LOCKVILLOW ANE - HAPPIDDURD, PA 17120

My knowledge on the basis of this testimony
 was information which was supplied to Duquesne Light Company
 by Stone & Webster and subsequent reports from Duquesne Light
 Company to the NRC.

9 The last five lines on page 3, are those your 6 own words or were those selected from some other report or 7 statement?

A Those are my words.

. 8

9 Q Did you testify earlier that while you used the 10 word, yield stress, that you could not tell what it meant with 11 regard to NRC terminology?

12 A I don't believe so. I indicated there were 13 essentially three or four numbers which I normally see. 14 Number one is a design figure, allowable figure. Number two 15 is a yield figure, yield stress, which I indicated is a 16 figure widch indicates the pipe may deform, bend, twist, what 17 have you, but not recessarily break, and that is why I but those words which appear in the next to the last line in 181 19 parentheses -- yield stress (deformation with or without 20 breaking).

21 Q When you say allowable stress, is that 22 allowable stress according to your own calculations or 23 allowable stress with regard to NRC regulations?

A Allowable stress based upon whatever the design 25 criterion is, be it some code or be it an NRC requirement.

	Dunn-cross 1.86
2	Not all design requirements are necessarily NRC documents.
2	Many of them are other codes.
3	Q Can you tell us what thet design criterion
4	is you are referring to there?
5	A It would be whatever the allowable stress would
6	be for that particular pipe. I cannot define it any better
2	than that.
8	Q Do you know in whose opinion allowable stress
9	is defined?
10	A The words I used in my testimony are based
11	upon information supplied to me by Mr.Werling via Stone &
12	Webster and you can find these words in the various exhibits.
13	Q That is my recollection, too.
14	A I must rely on information supplied to me.
25	Q On page 4 you discuss the difference between
16	the algebraic summation and the square root of the sum of
27	the squares. Can you tell us why the square root of the sun
18	of the squares is a preferable method for making stress
19	calculations?
20	A It is preferable today because it, as a general
21	rule, results in more conservatism in the design.
2.2.	Q The word, conservatism, is not very
23	illuminating. Can you tell us mathematically why that results
24	in a better calculation of stress?
25	A I don't know if it results in a better or worse
140.4	HOWRDACH & MARCHAL INC 37 N. LOCKWILLOW AND - HATRIEDURG, P. SP 14

24.1	1 2 14	1.00	100 100	Phil.	12.00
11	111	1.40	CI	03	4.24

1 calculation of stress. My word, conservatism, is a word which 2 aptly describes the difference between the two results. It 3 is a question of how safe is safe. How conservative is a 4 design.

9 With regard to the algebraic summation, is it possible for the algebraic summation to predict no stress in a situation where actual stress or deformation would occur? A I do not know. Anything is possible. It is a statistical calculation. It depends upon the numbers involved.

Again, I have never used the computer program.
My general understanding, based upon the information
available to me, is that you have two computer codes for
making seismic type calculations. They can, under different
circumstances, yield different results.

16 When there is one set of circumstances, one 17 computer code may give a more conservative result than the 18 other and vice versa. But the general opinion seems to be 19 that the technique which uses the square root of the sum of 20 the squares gives a more conservative result in terms of 21 design criteria than the algebraic summation.

Q So basically what you are telling me is that the opinions which you have polled indicate that the square root of the sum of the squares is a preferable method? A It is preferable today, and if we knew about

ACH & MARTMAL, 1910. - 37 N. LOCITUILLOW ANT. - DATAIODURG, PA. 12113 -

	Dunn-cross 188
	it in 1045 mouthe it would have been proferable then. It is
-	At in 1949 maybe it sould have been preservoit onen. To is
2	a question of what was the state of the art when Beaver valley
3	was initially designed, what were the computer codes which
4	were acceptable acceptable meaning that they were not
5	precluded.
6	Q Of course, my question did not raise that
2	issue.
8	A I volunteered that information.
9	Q That is right. Whose opinions did you poll
3.0	when you were determining the state of opinion with regard to
11	the state of the art?
12	A I didn't poll anybody personally. It is based
23	upon information I have read in letters, opinions I heard
2.1	expressed by Stone & Webster, opinions expressed perhaps by
15	some of our own engineers, testimony I have read in other
16	proceedings where this question was raised.
1?	Q You are not testifying from your personal
18	opinion but you are testifying to the opinions of others?
19	A I am testifying on the basis of what I have
20	read in terms of opinions of many other people which seem to
21	all come to the same general conclusion, that the state of the
2.2.	art today and the methods which are now acceptable to the NRC,
22	in terms of seismic design, requires a computer code which in
24	subroutine
2.5	Q Stop right there, please.
1	Planterer a Marchae Marchae Mar + 29 Pl Late 10 Love 102 - INCRIDEURO, PA 10818

	Dunn-cross	189
1	A uses the square root of the sum of the	
2	squares method.	
3	MR. LEVIN: May I have my question read be	ack,
4	please?	
5	(The following was read by the reporter:	
5		
2	Question: You are not testifying	
8	from your personal opinion but you	
0	are testifying to the opinions of	
10	others?)	
11	o oners. y	
12	NR THOMAS: Read the answer please	
13	(The following was read by the reporter)	
24	(The following was read by the reporter.	
15	Answert. Them tootifuting on the basis	
16	of what I have word it towns of	
171	of what I have read in cerms of	
10	opinions of many other people which	
10	seem to all come to the same general	
	conclusion, that the state of the	
20	art today and the methods which are	
41	now acceptable to the NRC, in terms	
22.	of seismic design, requires a	
X3	computer code which in subroutine	
24	uses the square root of the sum of	
25	the squares method.)	

	Dunn-cross 190
2	MR. LEVIN: Your Honor, if the situation
2	continues I will ask for a direction from the Bench. But it
3	appears to me that the witness is not focusing in on the
la	questions.
5	MR. THOMAS: Quite the contrary, your Honor,
G	the witness is.
7	THE ADMINISTRATIVE LAW JUDGE: I see nothing
. 8	wrong with his answer to your question.
9	MR. LEVIN: My question was simply
10	THE ADMINISTRATIVE LAW JUDGE: Go ahead,
11	simply what?
12	MR. LEVIN: Was simply: Are you relying on
23	others' opinions and his answer was, yes, and their opinions
14	are. That last portion was not asked for in the question.
15	THE ADMINISTRATIVE LAW JUDGE: I can understand
15	why the witness would want to answer the question the way he
17	did.
18	MR. LEVIN: I can understand it, too.
19	MR. THOMAS: If your Honor pleases, this
20	witness has a right to inform himself, he has a duty to inform
21	himself, he has a right to form opinions. It is no different
2.2	than education we had in law school.
23	THE ADMINISTRATIVE LAW JUDGE: Continue.
24	MR. LEVIN: Thank you, your Honor.
25	
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Du	0.0	10	-10	0	13	0
214	1117	- 6		5	2	s:

夏 b/ MR. LEVIN: 2 On page 6 when you state in the 6th line from 0 3 the bottom, currently acceptable techniques, you are referring to what currently acceptable techniques? 4 5 A To answer your question specifically, the 6 techniques involved in the application of computer codes such 8 as NUPIPE, or PSTRESS Shock III. Both those computer codes 8 use a subroutine which does not include the portion which 0 uses an algebraic summation technique. There are other 10 acceptable codes, I am sure. 31 Q On page 10 you state -- and I will make a 32 direct quote: customers realize the cost benefit of large 13 units when these large units operate and should realize the 夏令 cost penalties (or regular business risks) of extended 15 cutages. 16 Now, Mr. Dunn, if an extended outage is due 17 to a failure or misfeasance or malfeasance on the part of the 18 contractor, would your statement be the same? 29 MR. THOMAS: If your Honor pleases, I believe 20 Mr. Popowsky cross examined on the same subject matter and 21 almost sume question yesterday. 22. MR. POPOWSKY: I think you objected to the 23 question at the time and I don't think that specific question 24 was answered. 25 MR. THOMAS: All right, if you think not. MONTRACH & MARSHAL, MA. - OF N. LOUINMLLOUPATT. - MARHODURG, PA. 19118 -

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	Dunn-cross 193
E	the last few words, based upon what?
2	MR. LEVIN: His expertise as a chemist.
3	MR. THOMAS: Your Honor
4	MR. LEVIN: Your Honor, otherwise if he is
5	giving opinion evidence I would like to know the basis for
6	the opinion evidence. He is qualified as a chemist, and I
7	don't know although this is an administrative hearing
8	whether we want to have random opinions floating around in
9	testimony.
3.0	I would think that those would be more
11	appropriately the subject of argument.
12	THE ADMINISTRATIVE LAW JUDGE: You have not
1.3	hesitated in phrasing your questions to ask for opinions
14	which certainly go far beyond that of a chemist.
15	The WITNESS: My qualifications, as I outlined
1.6	in my direct statement, are beyond that of a chemist.
17	THE AUMINISTRATIVE LAW JUDGE: Are considerably
18	beyond those of a chemist,
19	THE WITNESS: Yes.
20	BY MR. LEVIN:
2.1	Q On page 11, the 7th line down, you use the
22	words, absolute guarantor. Where did you find the words
23	absolute guarantor?
24	A I believe those words can also be found in one
23	of our reply briefs. Now whether I was the author of the

words or whether counsel was the author of the words in 1 preparing the brief, I am not sure at this point in time. 2 My recollection is -- and the record will 3 speak for itself -- that those words can also be found in 4 one of our reply briefs. 5 6 Q That is my recollection, too. Can you give me 7 a definition of the words, absolute guarantor, as you have 3 used them there? 9 Essentially it means Duquesne Light guarantees A 10 anything and everything under all conditions and 11 circumstances. 12 On page 12, question A-13, the 2nd line, you Q 13 state: the question is now moot as far as the outage which 14 started in March 1979 since the unit was returned to 15 operation (synchronized). What do you mean when you say, 16 returned to operation (synchronized)? 17 A It is a unique point in time when the unit is 181 delivering energy to the customers. Synchronized means it is 19 electrically connected to the company's transmission system. 20 Would that be true even if the unit was 0 21 providing only 10 percent of its rated capacity? 22. It is providing electricity to the customers A 23 regardless of whether it is 10 percent or 101 percent. Q In fact the unit was not providing 101 percent 24 25 of its capacity after August 17, 1979, is that right?

Montready & Marchal, INC. - 27 M. LOCKWILLOW AVE. - MARRIDDURG, 26. 37110 -

	Dunn-cross 195
1	A I would have to go back and review what the
2	daily outputs were. I don't think it hit 101 percent. How
3	close it came to its rated canacity of 800 I am not sure.
4	O What documents would you be reviewing?
5	A Deile recents which show what the real lead
6	A Daily reports which show what the peak load
	was on each day of the year.
1	Q Do you have such daily reports?
8	A Absolutely.
9	Q May I ask what kind of reports you keep with
10	regard to the various repairs and modifications being made to
11	Beaver Valley Unit 1 now?
1.2	A For every design change which is being made
13	there is what is called a design change package, and I have
14	used that terminology in my direct statement. A DCP is a
1.5	design change package.
16	With regard to maintenance work there would
17	be an equipment history card somewhere in the station which
18	would reflect the work done. There may be other documents
19	which I am not familiar with.
20	Q And for modifications?
21	A We have talked about two things. We talked
22	about modifications. All modifications are handled as decign
23	change packages, to the extent it constitutes a design change
24	as defined in our technical specifications, our license.
25	Maintenance work is work which does not involve

	Dunn-cross 1.95
1	a design change, it is strictly maintenance, and they are
2	handled under two separate procedures from the standpoint of
3	how the work is accomplished.
4	Q What kind of material do you have in the
5	design change package for the low pressure turbing spindle
6	problem?
7	A We have a whole new turbine, two spindles.
8	These are the prime pieces of material and they are
9	physically on the size
10	Ven have reactived them?
44	A Non
	A les.
2.2	Q Are you familiar generally with the
14	construction and operation and design of turbine spindles?
14	A I have general knowledge of operation. I am
15	not thoroughly familiar with design nor construction.
16	Q Have you ever seen a low pressure turbine
17	spindle?
18	A Absolutely.
19	Q. You have?
20	A Oh yes, many times.
21	Q Did you personally inspect the low pressure
22	turbine spindles that were removed?
23	A Personally, no. People under my supervision
24	and direction did. The actual inspection was performed by a
25	Westinghouse team who had been specially trained to make the
	MORTHAGE & MARSHAL, MC 27 F. LOCKWELOW ANT MARSHAUNG, PA. 17110

ŝ	Dunn-cross 197
1	type of inspection referred to, that is, the inspection to
2.	determine whether or not there are cracks on these disks.
3	This Westinghouse team is not only at Beaver
ų	Valley but it is also at Indian Point and any other spindle
5	which may be in trouble.
5	Q Have you
7	A I personally did not oversee the inspection but
8	people in my organization did.
9	Q Have you seen the cracked turbine spindles?
1.0	A No, I have not. I have seen sketches indicat-
11	ing where the cracks are and their location.
12	MR. LEVIN: Your Honor, could I have a moment?
13	BY MR. LEVIN:
14	Q Mr. Dunn, I'm going to hand you a blue marker.
1.5	I will ask you to the best of your ability to draw a low
16	pressure turbine spindle for illustrative purposes.
17	MR. THOMAS: Can you draw it?
18	THE WITNESS: Within my capability.
19	MR. THOMAS: We have not contended that this
20	witness is qualified as an artist.
21	THE WITNESS: Within my capabilities, that is
2.2	a low pressure spindle shaft, blades. The steam
2,3	comes in here, flows in both directions out here.
24	BY MR. LEVIN:
25	Q Could you label the place where the steam

198 Dunn-cross comes in the inlet? 2 2 (Witness marked drawing.) A 3 0 Of course, where steam goes out are the 4 outlets, is that right? 5 A That is right. 6 Could you label those, too? 0 7 A (Witness marked drawing.) 8 Could you just draw a line indicating the Q 0 spindle and label that as well? 10 A The whole thing is a spindle. 31 Q Is the long central portion you have drawn a 12 shaft? 13 A That is called the shaft. 14 0 Would you label that, please? 15 A (Witness marked drawing.) 16 These vertical lines on either side, are those Q 17 the rotors? 18 No, they are blades, blade rings, blade rows. A 19 Q Could you label those appropriately? 20 All of them? A 21 Not all of them but just simply indicate that Q 22 those are blade rings. 23 A (Witness marked drawing.) 24 0 Now what you have given us is a horizontal. 23 cross section of a turbine spindle, is that right? MONROAUT & SCREEKAL INC. - 27 N. LOOKVILLOW AVE. - HADDIDDUNG, PA. 17112 ---

Dunn-cross 199 A Yes. 漢 2 0 Could you also draw us a cross section of it looking toward one end of the shaft? 3 (Witness marked drawing.) A 4 Now on that section could you label the key-5 0 5 way area and give an approximate indication what it looks 7 like? 3 What you have is a shaft. Because of the size A 103 of these rotors and because of their rotating speed, because 10 of the mass involved, it is not possible to forge and 11 manufacture a low pressure spindle of this size in one piece 12 of metal, so what they do is to essentially forge the shaft 13 and then they shrink onto the shaft what they call disks. 14 What you do is actually heat the disks on. 13 push it onto the shaft, cool it, and when it cools it 16 contracts, when it contracts it binds itself, so to speak, to 17 the shaft itself. 18 In addition to binding, there are also keyways 19 in there which help key this disk to the shaft itself. 20 0 Is that kind of like a projection from the 21 disk into the shaft to affix it to the shaft? If you like 22 you could draw the detail you are looking for in a different Len? area. 24 A You have a disk which is shrunk onto a shaft 25 and as I recall it there are keyways, there is an area right MONNDACK & MARSHAL, INC. - 17 M. LOCKWILLOV' AVE. - DARRIGHING. 13. 15.112 ----

1	Dunn-cross 200
1	in here something like this this is very general which
2	a pin goes through that helps position this disk in relation
3	to the shaft itself.
4	Q Could you label that as the keyway?
5	A (Witness marked drawing.)
5	Q Is it at the keyway that these cracks in the
7	low pressure turbines are occurring?
8	A On some, yes, on some, no.
Э	Q The actual cracks we are referring to are
10	cracks in the shrunk-on what do you call them?
11	A It is a disk.
12	Q The shrunk-on disk, are those where the crecks
13	are occurring?
14	A As far as I know, all the cracks are on the
15	disk either in the keyway or in some other part of the disk
16	itself.
3.7	Q It is these disks which are not labeled, I
13	believe could you label those that actually hold the
1.9	blades?
20	A Yes.
21	Q So therefore, if there is a failure in a disk
.22	there would also be a failure in the blade and there would be
23	an accident, is that right?
34	A Yes.
25	Q What kind of accident would that be?
	MONNEACH A MARSHAL, INC 17 N. LOCKY/RLOV AVE - HARRISBURG, PA. 17111

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Я.,

1	A We have had experience. The Shippingport
2	spindle failed this way and you essentially destroy the
0	spindle failed only and you objended by deberry one
2	spindle. There was another reactor which had a similar
4	incident within the last month or so with a turbine failure
5	and the turbine was essentially destroyed from the standpoint
5	of its repairability or future use.
7	Q How long would it ordinarily take to replace a
3	turbine unit that had been destroyed in that kind of an event?
9	A It depends on whether or not there are
10	any available from some other utility as a spare or there is
11	one available because a given unit is delayed and therefore
12	can be made available, such as in our case.
13	If you had to go back and get one from the
14	beginning, probably 18 months to two years, assuming you can
15	get the material.
16	Q Would that be a dangerous event if one of those
17	cracks caused a failure?
18	A Dangerous to whom?
19	Q To anyone standing nearby.
20	A Based upon the two incidents which have
21	happened to date, the answer would be no. No one was hurt
2.2.	when Shippingport failed. There were no missiles which got
23	outside the containment of the turbine itself either at
24	Shippingport or the one that failed up here in New England
25	within the last month.

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1	Dunn-cross 20	12
1	Q That is an area of concern to the NRC. isn't	
2	it?	
3	A Yes, it is. It was an area of concern and a	n
+	area which was considered when these plants were designed,	
5	turbine missile protection.	
5	Q Do you when I say you I am actually	
7	referring to the manufacturer which was Westinghouse in thi	S
3	instance does Westinghouse shrink on one of these disks	
91	for every rotor?	
0	A For every row of blades There is one disk	£ 0
1-1	every row of blades. In the case of Beaver Velley there are	
2	ten disks per spindle and two spindles so we are talking ab	E
3	20 disks.	Su
1	O When you and a new of blade what is	
5	the a new of blades?	an
5	by a rew of brades:	
7	A fnere are any number of rows of blades on bo	th
2	sides of this turbine. In the case of Beaver Valley there	
a	are five rows of blades, therefore five disks here and five	
0	disks on this end so there are ten disks, on a spindle and	
4	since we have two spindles, there are 20 disks total at	
1	Beaver Valley.	
1.	Q Are there other manufacturers that manufactur	re
2	low pressure turbine spindles?	
4	A Yes.	
5	9 Does General Electric manufacture such turbin	ne

	Dunn-croas 203
Test	spindles?
2	
2	A les.
	Q Do they use a different method of manufacture
4	than Westinghouse?
5	A I don't know if they use a different one. I
6	do know they use this technique.
3	Q Do they shrink on their disks in a different
3	manner than Westinghouse?
9.	A I am not familiar with the production
10	procedures of GE versus Westinghouse.
1.1.	Q Is there an individual in your department who
12	1s familiar with the differences?
13	A I doubt it.
14	Q Could you simply sign that. I suppose, since
15	it is your production? Take credit for it.
15	MR. LEVIN: We will have this marked on the
17	exhibit your Honor
18	MD FOMAGE Very set to a terminal set of the
19	MA. INOMAS: IOU can have it marked. That is
20	as far as you are going. I think it is ridiculous and I
21	object to it. It is used for the purpose of describing the
22	spindle. The witness has done an excellent job. He is not
1.4	a constructor of spindles.
2.3	THE ADMINISTRATIVE LAW JUDGE: The objection is
24	overruled.
25	THE WITNESS: Do I have to sign this?
	MUSHDADE GIANTENAL WC 27 N. LOCIWILLCY AVE MARICOURG, PA. 17112

	Dunn-cross 204
1	MR. THOMAS: No, he did not rule that you have
2	to sign it. I assume he is ruling it can be made an exhibit.
3	MR. LEVIN: Your Honor, the drawing which
4	Mr. Dunn just completed for us and has not signed, we would
5	like to have it produced and marked as an exhibit as Trial
6	Staff Exhibit 1.
7	MR. THOMAS: There is no objection to marking.
8	Objection to introduction.
9	THE ADMINISTRATIVE LAW JUDGE: It may be so
1.0	marked.
11	
12	(Commission Trial Staff Exhibit
13	marked for identification.)
14	
15	MR. LEVIN: Your Honor, we move its
16	introduction into evidence.
17	MR. THOMAS: I think it is premature to move
1.8	its introduction. We have not moved introduction of our
19	exhibits.
20	MR. LEVIN: May we have a ruling, your Honor?
21	THE ADMINISTRATIVE LAW JUDGE: It may be
2.2	admittei.
23	MR. THOMAS: Then, your Honor, I offer into
24	evidence all of our exhibits. I should be accorded the same
25	courtes; as the Commission Staff. If they can offer their
	- MORIBACH & MARTHAL, INC 27 N. LOCKWILLO' MAT HARRIDEURG, PA. 17112

	Bunn-Cross 209
	erbibits is suidence then T am estitled to offer mine
*	THE ADJUNT CODARTHE TAN THEY AS A SHARE IN THE
2	THE AUMINISTRATIVE LAW JUDGE: Any objection?
3	MR. LEVIN: No objection.
4	MR. FEIN: May I have a moment to look through
5	them?
6	Your Honor, with respect to objection to
?	particular documents, the only document I would have an
3	objection to would be Exhibit G which was submitted in
8	response to the Commission's order of November 29, 1979 and
10	three quarters of it is a legal brief citing several cases,
11	and obviously was written by Mr. Thomas or somebody in his
12	firm and not by Mr. Dunn, and therefore I would object to
13	Exhibit G but no other exhibits.
14	MR. THOMAS: If your Honor pleases, that
15	response is prepared at the direction of the Commission and
1.6	filed in this proceeding pursuant to a Commission order and
17	we respectfully submit that we are entitled to have in this
13	record the response which we made.
19	I will agree that it has mixed enginerring,
20	legal and everything else in it. But it is signed by
21	Mr. Dunn and it is submitted in response to a direct order of
22	the Commission. We are entitled to have it in the record.
23	THE ALMINISTRATIVE LAW JUDGE: The objection
24	is overruled. The exhibits are admitted.
25	MR. POPOWSKY: Perhaps I should move my one
1	NCHIBACH & MARSTINE HIG - RT N. LOCUNTRILOW AND - MARSIDEURG, PA. STITE

	Dunn-cross 200
1	exhibit in evidence at this time before forgetting to do it
2	at the end of the case. I move for the admission of Office
3	of Consumer Advocate Exhibit No. 1.
4	MR. THOMAS: We have no objection.
3	THE ADMINISTRATIVE LAW JUNGE: Admitted.
5	MR. POPOWSKY: Thank you, your Honor.
2	Mr. Levin?
60	BY MR. LEVIN:
9	Q Mr. Dunn, with regard to the fabrication and
10	design of turbine spindles, who is your resident in-house
11	expert?
12	A To the design of them?
13	Q Yes, sir.
14	A I don't know if we have anybody who is
15	actually a design specialist, who gets into the design of
16	turbines, because we do not design turbines. We have people
17	who are knowledgeable of turbine design, who are knowledgeable
18	of turbine operations and turbine maintenance.
19	But design of a turbine is a very complex,
20	highly technical field, starting with the material of
21	construction to the forces which are applied to the turbine
22	blade, the length of the turbine blades, the speed, all these
2.3	factors.
24	Q However, when you are selecting between
25	turbines made by different manufacturers, how do you select
1	MORT BACH & MINSHAL, INC 27 M. LOCKWILLOW AVE - MADRIDSUNG. PA. 17112

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	Duan-cross 207
	thom?
3	Cilem:
2	A On the basis of competitive bids which may or
3	may not be influenced by previous performance of the vendor.
3	Q Did you have or did anyone in your organization
5	that is Duquesne, have previous experience with Westinghouse
6	low pressure turbine spindles before you purchased the two at
7	Beaver Valley 1?
8	A Yes.
9	Q Were they of the same design and rating as
10	those two spindles?
11	A No.
12.	Q Were they larger spindles or smaller spindles?
:3	A Speaking for Duquesne Light Company's system
14	only, they were smaller spindles because this is a spindle
15	designed for a nuclear power reactor which has far different
16	steam conditions in terms of temperature and pressure and
17	flow than you would find in a modern coal-fired station where
18	the steam flows are different, the steam pressure is
19	different, the steam temperature is different.
20	For instance, nuclear machines have an
21	1800 RFM speed where as you will find most coal-fired
2.2.	stations are 3600 RFM machines.
23	Q Would the pressure be higher or lower?
24	A The pressure, temperature would be much higher.
2.5	9 Why do low pressure turbine spindles for
ľ	NONDRACK & MARCHAL MO 27 IL LOCKWELLOW AV NARSIERUNG, DA. 17111

1	
1	nuclear plants rotate at a slower speed than for coal plants?
2	A Because of the physical limitations of the
3	materials involved, the steam you must flow through these
4	turbines in order to get the energy out, the fact that you
5	are dealing essentially with saturated steam with very little
5	degree of additional heat, superheat, as opposed to a coal-
7	fired station where you are essentially operating with steam
8	at very high temperatures and pressures, therefore a high
2	degree of superheat and therefore more energy per pound of
10	steam flow from a coal-fired station as opposed to the energy
11	per pounds of steam flow for a nuclear facility.
12	Q Are you saying, then, that the construction of
1.3	turbine spindles for nuclear power plants presented a
14	difficult series of engineering problems or a new series of
15	engineering problems for the constructors of those spindles?
16	A No.
17	Q What are you saying?
18	A I am saying the design and construction of
19	spindles for a nuclear plant is different from what you would
20	find in a normal coal-fired station, particularly a modern
21	station of 300, 400, 600 megawatts.
22	Turbines of this particular design, that is,
23	1800 RFM, essentially little in terms of superheat from the
24	steam, were a state of the art back in the 1920's 1930's. It
25	was a state of the art which was abandoned and when you
	- MONTRACH & MARCH'L, INC 27 N. LOCKITLADY ATL - MARRISPURG, PA. 17118

	Dunn-cross 209
1	
ĩ.	started to go to higher temperatures and pressures of steam,
2	they had higher capacities in terms of the size of the units
3	involved.
4	Q Are there new metals or new methods of
5	fabrication employed in the low pressure turbine spindles for
6	Beaver Valley 1?
7	A I am not familiar with the methods of
8	manufacture and fabrication of spindles.
9	Q Let's assume that Duquesne Light Company is
10	to choose between two manufacturers for these turbine
11	spindles and the cost of one is slightly higher than the
1.2	other. What further evidence would Duquesne Light Company
13	need to obtain before it could make a decision to purchase
14	one or the other company's turbine spindles?
15	A Obtain from whom?
16	Q From the manufacturer or from its own resident
17	in-house engineers or from anyone else in the entire world?
18	A The question was based on the premise that
19	you are going to buy a turbine spindle, number one. Two, you
20	have two simple prospective suppliers. Three, everything is
21	different other than a small differential in price and we
2.2.	won't spend too much time on how small is small, but there is
2.3	a differential in price. And really your question, as I
24	interpret it was, given that type of information, what
25	decision would the company make?
	1 MONTIDADE & MARSHAL, INC 27 M. LOSKWILLOV AVE MANDAUSO, PA. 37418

	Dunn-cross 210
1	9 No. my question is what other factors besides
2	price would the company want to consider?
3	A The reliability of the equipment, past history
4	of the equipment particularly from that yendor is number one.
5	Number two, whether or not the equipment can be supplied in
5	the time cohedule we have established and normally that
2	condition is met
8	These would be the fue that come to my mind
0	mese would be the two that come to my mind
10	quickiy.
11	Q Do you know if Duquesne would make any attempt
12	to independently evaluate the design or construction proposed
13	to be used by the manufacturer?
1.0	A No, we would not do that as a normal
1.7	procedure on a turbine. You are essentially dealing with
1.5	suppliers in this country who have been in the business for
16	many, many years. We do have personal relationships in terms
17	of knowing the people, having dealt with them on problems in
18	the past, both GE as well as Westinghouse.
19	We have some degree of confidence in the
20	product based upon past experience, and since there was no
21	previous poor experience record with these turbines at the
22	point we made the decision to buy, at least to the best of my
23	knowledge, there was no reason why we did not go with
24	Westinghouse.
23	Q What assurances do you attempt to obtain f cm

1 the manufacturer in the form of warranties or guarantees or 2 specifications with regard to the service life of these 3 turbines?

A Normal warranty is a time -- and I can't be 5 specific as to this particular warranty -- but normally the 6 warranties read such as the unit is warranted against certain 7 conditions for 30 months from the time of delivery or 24 8 months from the time of initial operation, something like 9 this. Usually it is from the time of delivery.

But the warranties vary from manufacturer to manufacturer -- somewhat similar to your car warranty which expires in one year or 12,000 miles, whichever comes first.

Q What was the expected service life of this 14 type of turbine for Beaver Valley?

A I would say 35 years based upon the expected service life of the plant. Now it would not be unusual to find it may be necessary to replace that turbine in about 20, 25 years after normal attrition. This is based upon experience we have with other units.

They, too, develop cracks and you have to go in and what we call bottle bore. In other words, that shaft on some of your larger spindles is actually hollow, in order to keep the mass down, and you sometimes get cracks in there. To the extent you have enough material left you can go in and bore, take a small layer of metal eway, increase the diameter
	Dann-cross 212
X	of the bore, so to speak, larger in order to remove the
2.	cracks.
3	But it is possible, and we have units like
4	that today where these cracks can no longer be removed by
5	that procedure and we have ordered from Westinghouse a
6	replacement spindle.
7	Q Do you make any provision with regard to the
S	cost of replacement power in the event of untimely failure of
5	turbine spindles?
10	A What do you mean do we make any provisions for
11	replacement power?
12	Q Did you agree with the manufacturer that some
13	of the costs of replacement power would be picked up by the
14	manufacturer in the event of untimely failure?
1.5	A No supplier would give you that type of
16	insurance, that type of warranty.
1.7	Q But the consequences of a turbine failure for
18	Beaver Valley 1, or indeed any plant, would be quite serious
19	for Duquesne, is that right?
2.0	A It depends on the magnitude of the failure.
21	Q In the case of the turbine spindles we are
22	discussing now, the failure was great enough to require
2.3	replacement, is that right?
24	A Replacement was the most economical way to
25	effect a change and return the unit to service in the shortest
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period of time. There are other alternates available to us
and some of these alternates have been taken by other
companies.

4 For instance, one of the things you can do is 5 to remove the row of blades with a cracked disk and put a 6 baffle plate in there in order to give you the pressure drop 7 across it and run the unit for some period of time at reduced 81 capacity while the replacement forging disk is manufacturared 9 and machined and made available for some subsequent outage 10 where you can then out the disk back on, by sending it to it someplace like Charlotte, North Carolina, where they have 12 facilities to do this.

Q That gives you a drop in rating?

13

25

A Yes, but some utilities have taken that option because you cannot get a replacement in a short period of time. We were fortunate.

17 Q Therefore, it is extremely important that the 18 low pressure turbine spindles live up to their specifications 19 and design life, isn't that right?

A Well, you said design life. I did not imply --1 if I did, I will correct it -- that there is any design life. The thrust of your earlier question was what is the expected life, and there is a difference between the concept of a design life and expected life.

Q What is the difference in your mind?

1.	A I don't know of any design life. The expected
2	life time is basically what the utility would expect in terms
3	of performance out of that unit. In other words, as I
4	indicated before, it may be a reasonable assumption that the
5	plant is going to operate for 35 years. In the case of
5	Beaver Valley that is about the length of its operating
7	license. During the course of that 35 years it may be
8	necessary to replace one of these spindles at least one time,
9	maybe twice.
10	Q In addition to considering the operating
1.1.	history of similar turbine spindles made by the same
12	manufacturer, the cost of the units, and the personal
13	relationship you have had with the manufacturer, would you
\$4	not consider it desirable as an engineer to also consider
15	differences in engineering features between the two spindles
16	made by two different manufacturers?
17	A I don't think there is any significant
18	difference between the design in terms of the way the disks
19	are forged, the way the disks are shrunk on the shaft.
20	Westinghouse did make some design changes in
21	that technique. It used to be that keyway was a square
2.2.	keyway. A cquare keyway design gives you a sharp corner thich
23	then becomes a focal point for the development of cracks,
24	stress risers they are called, so they changed the design at
25	some point in time from a square type key to a round type key

- MONROACH & MARCHAL INC. - 27 N. LOCKWILLOW AVE. - MARRICOURG, PA. 17112 --

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	Dunn-cross 215
X	in order to preclude the problem. To and benold, cracks
2	still developed in the rounded key.
3	I don't think based upon my knowledge, that
4	there is any significant difference in terms of the basic
5	concepts involved of building a turbine where you shrink on
6	disks and the disks in turn support blades.
7	BY MR. THOMAS:
8	Q Is that between manufacturers?
9	A Between manufacturers.
1.0	BY MR. LEVIN:
12.	Q Are you aware that it is mainly Westinghouse
12	turbine spindles that are suffering these types of cracks?
13	A Yes, I am.
14	Q Are you aware that there is a peculiarity of
1.5	Westinghouse design which is responsible for the fact that
16	these spindles are developing these types of cracks?
17	A I am not aware of it and if you have that
18	type of information I am sure there are people in the
19	industry who would like to know what it is.
20	MR. THOMAS: Yes, I would like to have it this
21	afternoon.
2.2	THE WITNESS: Westinghouse attributes the
23	cracks to stress corrosion. I don't think that opinion is
24	necessarily fully accepted by the industry nor by NRC, but I
25	meeterstilly fully forepool of one industry not of they are
	CAR & SPEAK IDT THE ARC. I KNOW I JOH & ACCEDE 10,

	Dunn-cross F16
1	personally. They may be right.
2	BY MR. LEVIN:
3	Q Stress corrosion covers a wide range of
4	possibilities, doesn't it?
5	A Well, stress corrosion cracking is a unique
6	phenomenon which has been found in other applications. Stress
7	corrosion of nuclear boiler tubes is a well known fact.
3	Chloride stress in this particular case in terms of boiler
9	tubes. In this particular case they are saying it is
10	caustic stress corresion.
11	Q You were with Duquesne Light Company at the
12	time the decision to build and in the process of building
13	Beaver Valley Unit 1, weren't you?
14	A I have been with Buquesne for a little over
1.5	30 years and yes, I was at Duquesne when that decision was
1.6	made.
17	Q Were you an active participant in that process?
18	A No.
وز	Q Was John Arthur an active participant in that
20	process?
21	A I don't know to what degree Mr. Arthur may
2.2	have participated. I am sure he would have participated at
23	least to the point of signing the piece of paper which
24	authorized the purchase. Now over and beyond that I have no
25	knowledge.
	STATISTICAL STATISTICS AND

		Durin-cross	217
z	ବ	Who did Mr. Arthur rely upon for enginee	ring
2	judgments with	regard to the purchase and construction	of
3	Beaver Valley	1?	
4	A	He would rely primarily through Mr. Scha	ffer,
5	who is the Pre	sident, on the people in our Engineering	
6	Department, ar	nd also rely on input to whatever extent	
7	required from	the operating people.	
3	Q	Who did he rely on principally?	
Э	A	I don't know what he did.	
20	Q	I guess it is safe to say that you were	not
11	that person?		
12	A	That is safe to say, yes.	
23		MR. LEVIN: Well, your Honor, thank you	. I
14	think that con	cludes our cross examination at this time	
15		THE ADMINISTRATIVE LAW JURGE: Mr. Popowe	sky?
1.6	BY MR. POPOWSK	Ү:	
17	Q	Could you distinguish for us the phrases	,
18	state of the a	rt and industry practice?	
19	A	For what?	
20	Q	Well, I don't think it is necessary but I	L will
21	give as an exa	mple methods of determining seismic stress	5. S
2.2	Α	Would you repeat the question?	
2.3	Q	I wanted you to distinguish between the	
7.4	concept, state	of the art, and the concept, industrial	
25	practice, if y	ou find there is a distinction between the	28 ê

	Dunn-cross 218
Ä	two concepts.
2	A In my own opinion they could be very, very
3	similar but not identical.
4	Q They could be similar. Are they necessarily
5	similar?
5	A I don't know. I think the answer would be
7	different for almost any person you asked. It is an opinion
S	type question.
9	Q Is it possible that the state of the art
1.0	in a given area might be different from the industrial
11	practice in a given area?
12	A There may be a lag between the state of the
13	art and industry practice, a time lag.
24	Q What way would that lag run?
15	A The state of the art may be leading the
16	practices.
17	Q So that, for example, when you say that there
18	were numerous nuclear plants that were designed using an
19	algebraic summation method in a given period of time, while
20	you may argue that that is the industrial practice, that may
21	not be the state of the art, is that correct?
22	A That is true because as one of these exhibits
23	shows, Stone & Webster was using techniques involving the
24	square root of the sum of the squares even in 1972, 1973.
25	But the state of the art, at least in terms of
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i practice, and the standards which were used for the design of 2 Beaver Valley, was the technique involving the algebraic 3 summation.

So again I guess this reflects the typical example where the industry practice may be lagging the state of the art because the state of the art is something which is always in a state of dynamic change.

8 Q Is it correct that you do not know what the 9 state of the art was at the time the Beaver Valley design was 10 made?

A Only in a very, very general context, based upon information which I have read, and basically the opinion I form, based upon what I have read, the state of the art was A rather dynamic type motion, things were changing, new techniques were being developed.

We had greater computer capability to solve these problems, so to speak, at least to simulate the problems. So as your computer techniques in terms of hardware expanded, then your computer techniques in terms of the software, that is the programs, could follow along.

Q Then you don't know that in 1974, which is the date on which certain analyses were done using the Shock II method, according to your Exhibit C, you don't know whether that was the state of the art at the time? A Would you repeat the question?

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	Dum-crost 220
1	(Question read.)
2	THE WITNESS: Thatwas at least the industry
3	practice at the time, based upon the fact of roughly 29
4	plants, four of them under construction, had used the
5	algebraic technique in some part or perhaps the entire part
5	of the design of the nuclear station.
7	BY MR. POPOWSKY:
8	Q Do you know whether they were using that in
9	1.974?
10	A Using what in 1974?
\$1	Q What you just described, the algebraic
12	summation technique.
13	A There is an exhibit which indicates Stone &
14	Webster was using the square root of the sum of the squares
15	technique in 1972, 1973. But again, I don't know whether
16	Stone & Webster was merely using this in terms of development,
17	limited applications, or how they were using it. It is not
20	clear.
19	Industry practice, based upon information 1
20	read, was for most stations, not necessarily all stations.
21	but most stations, to use the computer code which in one way
22	or another uses the algebraic summation technique.
23	Q De you know why in October 1978 when Stone &
24	Webster was asked to reanalyze the piping system, because of
25	the change in the valve weights, they used the NUFIPE method?
	The second state of the se

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1	A Because it was one of the programs which
2	apparently was available to them at that particular point in
3	time. It was a program they were using. It was a program
4	which I assume in their opinion was at least as conservative
5	as other techniques which they may have used.
6	They could have gone back and used the
8	original program upon which the Beaver Valley plant was
8	designed. Why they made that determination, I don't know.
9	It may have been simply convenience.
10	Q It is at that time that the discrepancies were
11	discovered between the two codes, to your knowledge, is that
12	correct?
13	A That is correct.
3.4	Q Do you know whether the algebraic summation
15	method produces a result, leaving aside whether or not it is
16	equally or more less conservative than the other methods is
17	it a result which is an accurate reflection of the summation
18	of the load, to your knowledge?
19	A I don't know.
20	Q Can you tell us approximately when the piping
21	of the Beaver Valley plant I realize that is a large term,
22	piping but in general can you give us the dates viping was
23	installed in the Beaver Valley plant?
24	A I can give you a rough estimate. The piping
25	was installed in Beaver Valley probably starting sometime

	Dunn-cross 222
2	early 1972, 1973, and is still being installed today.
2	Q In general would piping be among the latter
3	projects in construction?
4	A It is more in the mid-term from the standpoint
5	of construction of a station. You start with your
6	foundations, get your foundations up, your walls up, and
7	enclose the building, so to speak, and then you bring in your
8	larger components in terms of size and get those set; finish
9	off the major parts of your building; and then begin to tie
10	together your components with piping, control, electrical
1.7.	cable, et cetera.
1.2	You essentially need the walls of the building
13	to support the piping.
14	Q What about piping hangers and supports, they
1.5	would be built after the actual pipes would be installed, is
16	that correct?
17	A No, you would do that as the pipe is being
:.3	installed. You just can't hang a piece of pipe from a sky-
1.9	hook.
20	Q I had asked you yesterday I'm not sure if
21	you answered do you know when the piping design was
22	established, when it was actually designed?
23	A It would have been designed over some period
24	of time. I don't know precisely.
25	MR. THOMAS: This is repetition, Mr. Popowsty,
1111	MONTDACH & MARDIAL, INC 27 N. LOOKVILLOW AVE MARMIEURS, PA. 1711E

	Dunn-cross 223
	from yesterday.
2	MR. POPOWSKY: I'm corry. Can I go off the
3	record for a minute?
4	THE ADMINISTRATIVE LAW JUDGE: Yes.
5	
6	(Discussion off the record.)
7	THE ADMINISTRATIVE LAW JUDGE: Concerning the
8	off the record discussion, the contract between Stone &
9	Webster and Duquesne Light which was made available at the
1.0	last proceeding under a protective order, it is my under-
11	standing that counsel for Duquesne Light has no objections
1.2	to my making that contract available to you, Mr. Popowsky.
13	MR. THOMAS: Subject to the same protective
14	order.
15	MR. POPOWSKY: Thank you. That is all I have.
16	THE ADMINISTRATIVE LAW JUIGE: Is there any
1.7	further cross examination of this witness at this time?
i.8	MR. THOMAS: We reserve our right to redirect.
1.9	THE ADMINISTRATIVE LAW JUDGE: The sitness is
2.0	excused. Now let's go off the record.
24	(Discussion off the record.)
22	THE ADMINICOURAGETED FALL THREE IS A LONG TO THE
13	artensive discussion off the movent of the the mave had an
29 5	we should present with this matter. We have discussed
d-140	ME GROULD PROCEED WITH THIS MADDER. WE HAVE DISCUSSED

witnesses, we have discussed issues, we have discussed an 1 apparent upcoming rate case of Duquesne and how that may 2 affect this proceeding. 3 It has been decided that as the Administrative 4 Law Judge I am going to review the various filings of the 3 parties concerning their concepts as to the issues, and then 6 hold a meeting with counsel to arrive at a decision as to the 7 8 best way to proceed. In lieu of this, I will not set any further 9 hearing dates in this matter, having in wind that within the 10 next week or ten days we will be getting together, and at 11 12 that point in time we will set hearing dates. 13 It is my understanding that this is satisfactory to the parties concerned. 14 15 MR. THOMAS: That is satisfactory to me. MR. LEVIN: The Trial Staff as well. 16 THE ADMINISTRATIVE LAW JUDGE: The hearings 17 are recessed until a date that will be set at a later time. 18 19 20 (The hearing was adjourned at 1:05 o'clock p.m.) 31 22 23 24 25 MARSEAL, INC. - IT M. LOCIOVIT LOW AVE. - HARRISDHIPS, PA.

1.	
2	I hereby certify that the proceedings and
3	evidence are contained fully and accurately in the notes
4	taken by me on the hearing of the within cause before the
5	Pennsylvania Public Utility Commission, and that this is a
6	eorect transcript of the same.
8	
. 8	MOHRBACH & MARSHAL, INC.
9	ante
10	By Officiel Reporter
Å	4-21-80
12	REPORTED BY:
13	JAMES P. O'HARA
14	Northach & Marshal, Inc. 27 North Lockwillow Avenue
13	Harrisburg, Pennsylvanie 17112
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