

ORIGINAL
UNITED STATES
NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF:

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SHOREHAM NUCLEAR POWER STATION
(Long Island Light Company)

50-322-OL

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C O N T E N T S

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WITNESSES:	DIRECT	CROSS	REDIRECT	BOARD
Arthur Sarsten)				
Adam Henriksen.)				
By Mr. Goddard	23567			
By Mr. Ellis		23581		
By Mr. Dynner		23585		
By Mr. Goddard			23672	
By Judge Morris				23672
By Judge Ferguson				23678

EXHIBITS

RECEIVED

Staff Diesel 7 - Ricardo Report with	23579
tabulation of 7 piston skirts. (Bound in)	
8/10/84	

Morning recess	23619
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P R O C E E D I N G S

JUDGE BRENNER: On the record.

Good morning. Welcome back. As we predicted, Professor Sarsten and Mr. Henriksen, you have both been immediately previously sworn, so we don't have to do that again.

Whereupon,

ARTHUR SARSTEN

and

ADAM HENRIKSEN

resumed the stand and, having been previously duly sworn, were examined and testified further as follows:

JUDGE BRENNER: Mr. Goodard.

MR. GODDARD: The Staff witnesses are available for cross-examination on piston skirts.

JUDGE BRENNER: Do you have a few things to do first?

MR. GODDARD: Yes, your Honor.

DIRECT EXAMINATION

BY MR. GODDARD:

Q Professor Sarsten and Mr. Henriksen, do you have the Staff testimony on piston skirts, which is pages 48 through 55 inclusive of the NRC Staff prefiled testimony in this case before you at this time?

A (Witness Sarsten) Yes.

WRBeb

1 A (Witness Henriksen) Yes.

2 Q Do each of you-- Strike that.

3 To the best of each of your knowledge, is it true
4 and correct to the best of your knowledge? And do you wish
5 to sponsor it into testimony in this case?

6 A Yes.

7 A (Witness Sarsten) Yes.

8 Q And to the best of your knowledge, is Staff
9 Exhibit A-6 true and correct?

10 JUDGE BRENNER: Staff Exhibit what?

11 MR. GODDARD: Staff Exhibit A-6-- Staff Diesel
12 Exhibit 6.

13 JUDGE BRENNER: I didn't hear the prefix to the
14 6.

15 Mr. Goddard, out of prudence, maybe you should
16 tell the witnesses what Staff Exhibit 6 is, to make sure you
17 are all on the same wavelength expressly.

18 WITNESS HENRIKSEN: We have read it but we don't
19 know whether it is correct.

20 MR. GODDARD: Judge Brenner, the Staff's
21 apologies. That is Staff Exhibit 7, dealing with piston
22 skirts.

23 JUDGE BRENNER: Wait a minute. Let's back up
24 here.

25 We have already admitted into evidence, as I

WRBeb

1 recall, Staff Exhibits 1 through 5.

2 MR. GODDARD: That's correct.

3 JUDGE BRENNER: We are now up to the subject of
4 pistons, which we are using as a shorthand label to cover
5 some subissues identified in this portion of the County's
6 contention.

7 What exhibits do you have that you want to offer
8 that are pertinent to that issue?

9 MR. GODDARD: The exhibit relevant to piston
10 skirts is Staff Diesel Exhibit 7.

11 I might ask the witnesses at this time, for the
12 purposes of saving time:

13 BY MR. GODDARD:

14 Q Is that a copy of the table which was assembled
15 by Ricardo Consulting Engineers as a result of your meetings
16 with them?

17 A (Witness Henriksen) That's correct.

18 A (Witness Sarsten) Correct.

19 Q Thank you.

20 MR. GODDARD: If there are no objections, the
21 Staff would move that the testimony--

22 MR. DYNNER: Excuse me, Mr. Goddard.

23 JUDGE BRENNER: Let him finish, then I have
24 something to say.

25 MR. DYNNER: All right.

WRBeb

1 MR. GODDARD: If there are no objections at this
2 point, the Staff would move that the testimony which is
3 already bound into the record be admitted in evidence at
4 this point in the hearing.

5 JUDGE BRENNER: Let's take first things first,
6 leaving the exhibits out of it for now.

7 We will admit the direct written testimony of
8 these witnesses previously bound into the transcript of
9 September 20th, 1984, into evidence in regard to pages 48
10 through 55, is it, Mr. Goddard?

11 MR. GODDARD: That's correct.

12 JUDGE BRENNER: All right. That's admitted into
13 evidence right now.

14 In terms of the exhibits, as I recall the
15 agreement really of the Staff, based on our discussion of
16 the County's motion to strike the previously filed Staff
17 Exhibit 7, Staff Exhibit 7 now consists of a table bearing
18 the printed heading "Facsimile Message Recardo," and it says
19 page 6 of (blank) in my copy."

20 MR. GODDARD: That's correct.

21 JUDGE BRENNER: That table was to have been
22 marked up by the Staff, and we have never received the
23 marked-up copies identifying which engines the 1 through 7
24 designation stands for. And as I recall, there is one you
25 are going to have to leave undesignated, I believe Number 7,

WRBeb

1 and that has not been done. At least I haven't received a
2 copy.

3 Did you do that?

4 MR. GODDARD: I apologize, Judge Brenner. I
5 believe all the marked-up copies were delivered to
6 Mr. Bloom, the Court Reporter in this case.

7 JUDGE BRENNER: Can I see a copy of that?

8 MR. GODDARD: I believe Mr. Bloom has all the
9 copies. I think the Staff has let them get away here, and
10 the parties have not been furnished with the marked-up copy
11 either at this point in time.

12 JUDGE BRENNER: In addition, the exhibit also I
13 thought was to consist of the drawing which is difficult to
14 identify from my copy. But partially obliterated on my copy
15 it says "Ricardo Calculation" in the upper left-hand
16 corner. And it says "P-7," which I assume means page 7, in
17 the "of" box in the right-hand corner.

18 Do you wish to move that into evidence also?

19 MR. GODDARD: That is part of the exhibit,
20 Judge Brenner. Pages 6 and 7 are the only remaining
21 portions of the exhibit.

22 JUDGE BRENNER: You didn't identify page 7 in
23 your proffer a moment ago.

24 Off the record.

25 (Discussion off the record.)

WRBeb

1 JUDGE BRENNER: Back on the record.

2 Professor Sarsten or Mr. Henriksen, looking at
3 the table which we have identified as the first page of the
4 proposed Staff Exhibit 7, which is actually page 6 from a
5 larger document, could you tell us which engines those
6 numbers 1 through 7 represent, and also tell us, after you
7 do that, how you know that?

8 Let's go down the list. Let's do it on the
9 record.

10 WITNESS HENRIKSEN: From the table as I have it
11 in my exhibits I could not. I would have to refer to
12 another page.

13 JUDGE BRENNER: Fine. I did not mean to restrict
14 you to the table. Just from your knowledge tell us.

15 WITNESS HENRIKSEN: Yes. By referring to another
16 page I can tell.

17 JUDGE BRENNER: All right. Can you do that on
18 the record now, please?

19 WITNESS HENRIKSEN: The engines are, Number 1,
20 Trans-American Delaval R-4; Number 2, GMT-420; Number 3,
21 MAN-40/45; Number 4, Mirrlees "K" Major; Number 5, Pielstick
22 PC-2; Number 6,--

23 JUDGE BRENNER: Give me a moment, since we have
24 to take the time now, and I have to mark up my own exhibits.

25 Mirrlees is M-i-r-r- --

WRBeb

1 WITNESS HENRIKSEN: To the best of my
2 recollection you spell it M-i-r-r-l-e-e-s. I could be
3 incorrect.

4 JUDGE BRENNER: Okay.

5 WITNESS HENRIKSEN: There could be another "s."
6 I don't really recall that.

7 JUDGE BRENNER: And it is Mirrlees "K" Major.

8 WITNESS HENRIKSEN: Yes.

9 JUDGE BRENNER: "K" in quotation marks.

10 WITNESS HENRIKSEN: Correct.

11 JUDGE BRENNER: That's Number 4.

12 Number 5 you said was Pielstick.

13 WITNESS HENRIKSEN: PC-2.

14 JUDGE BRENNER: And that's P-i -- You better
15 spell some of these for the Reporter. That's what I'm
16 trying to tell you.

17 WITNESS HENRIKSEN: P-i-e-l-s-t-i-c-k.

18 JUDGE BRENNER: All right. Thank you.

19 Proceed, please.

20 WITNESS HENRIKSEN: Number 6 is SWD TM-413.

21 We have also received a Telex from Ricardo which
22 identifies Number 7, but it is not on that list. I can
23 identify it.

24 JUDGE BRENNER: All right. Why don't you do
25 that?

WRBeb

1

WITNESS HENRIKSEN: That's English Electric

2

Vulcan Model.

3

JUDGE BRENNER: Am I correct that the source of

4

this table as it originally appeared was from the Ricardo

5

Company?

6

WITNESS HENRIKSEN: On the piece of paper I have

7

here it says it was from George Murray of Ricardo.

8

JUDGE BRENNER: Do you know that? Are you the

9

one who obtained it from Ricardo?

10

WITNESS HENRIKSEN: I got it from another member

11

of the Staff this morning.

12

JUDGE BRENNER: The table, the table on page 6,

13

how do you know it is from Ricardo other than the fact that

14

it has their name on the page?

15

WITNESS HENRIKSEN: I'm not 100 percent sure, but

16

I do think I saw the original Telex.

17

JUDGE BRENNER: Well, are you the one who had

18

discussions with the Ricardo Company which led to the

19

obtaining of this table by the Staff from Ricardo?

20

WITNESS HENRIKSEN: Yes, I was at Ricardo when we

21

requested this table.

22

JUDGE BRENNER: All right.

23

And who supplied the separate information to you

24

as to which engines each of these engines represent on the

25

table?

WRBeb

1

WITNESS HENRIKSEN: Also Ricardo.

2

JUDGE BRENNER: That is all I have at this time

3

as a predicate to admitting the exhibit.

4

Somebody might want to ask what these initials

5

stand for, but maybe everybody knows but me so I won't

6

belabor it at this point.

7

Mr. Goddard, we took about ten minutes to do what

8

we should have done in 30 seconds, and presumably you are as

9

interested in your witnesses' time on the last day of the

10

week as I am.

11

If there are no objections, we will admit the

12

Staff's Exhibit 7 as identified, consisting of those two

13

pages, the table as has been modified, and the official copy

14

will be marked up with the modification.

15

And Mr. Goddard, you had better make sure that

16

that Number 7 modification is on there now, too.

17

MR. GODDARD: It will be, Judge Brenner. We will

18

distribute copies to the Board and the parties at the

19

earliest opportunity, in addition to the official copies.

20

I might add that the table which is designated

21

page 6 of (blank) should also have added at the bottom the

22

following language:

23

"All data taken from published data

24

and measurement. Small variations may occur.

25

Detailed dimensions and max...."

WRBeb

1 JUDGE BRENNER: Wait a minute. You can't do that
2 as Counsel.

3 MR. GODDARD: This was part of the markup that
4 you originally asked for, Judge Brenner.

5 JUDGE BRENNER: I never asked for that. I never
6 saw that language on the table. If you anything else to do
7 with these exhibits by modification, you will have to ask
8 your witnesses, who are under oath, to supply that.

9 Go ahead and ask them, and I will hold off
10 admitting it into evidence until we know. Now, in addition
11 to having to mark up the engine names, you want me to add
12 whole sentences to the exhibit.

13 Go ahead. You cannot testify to-- Ask the
14 witnesses what you think you need to ask them to obtain any
15 clarifications or explanations of the table. And if you get
16 the answers you expect, we can probably accommodate you by
17 accepting the marked-up copy.

18 BY MR. GODDARD:

19 Q Mr. Henriksen, were there any other additions to
20 these tables which were originally taken from the Telex
21 which you received from Ricardo?

22 A (Witness Henriksen) Yes.

23 Q Will you state the addition to this table?

24 A It is under heading B:

25 "All data in table on page 6 can be

WFLeb 1 taken from published data and measurement. Small
2 variations may occur. Detailed dimension and
3 maximum firing pressures due to latest source
4 variances."

5 MR. GODDARD: Thank you.

6 That's the only change that the Staff would make
7 to the exhibit.

8 JUDGE BRENNER: All right.

9 What he has done is read the third paragraph of
10 the previously proposed -- I guess it was Staff Exhibit 7
11 which is not going to be an exhibit. And you have marked up
12 the official copies with the same words that Mr. Henriksen
13 just read?

14 MR. GODDARD: That's correct, your Honor.

15 JUDGE BRENNER: Mr. Henriksen, what does that
16 last phrase mean?

17 "Detailed dimension and maximum
18 firing pressures due to latest source variances."

19 WITNESS HENRIKSEN: Well, there are publications
20 -- I can't name them right now -- which list the number of
21 engines and the detail. There used to be one published in
22 the United States--

23 JUDGE BRENNER: My question is simple. I simply
24 don't understand what those words mean as an explanation of
25 the table.

WRBeb

1 WITNESS HENRIKSEN: Well, there are publications,
2 annuals, which will give all engine builders in the world
3 and list all their models, cylinder numbers, horsepower,
4 EMEP, the speed range, just about everything you want to
5 know about these engines. They are available in
6 publications. Maybe Sarsten can--

7 JUDGE BRENNER: Let me repeat my question. I
8 understand what the first sentence you read means. I
9 understand what "Small variances may occur" means. I do not
10 understand what "Detailed dimensions and max firing pressure
11 due to latest source variances" means. And either one or
12 both of you can help me.

13 WITNESS SARSTEN: I believe that there are
14 variations in the listed firing pressures and slight
15 variations in some dimensions if you look at different
16 sources. I think that is what he's referring to, as the
17 firing pressures especially are updated regularly and may
18 vary from one application to another. They are not fixed
19 values.

20 JUDGE BRENNER: But what is that phrase saying
21 that the table represents? Do you know?

22 WITNESS SARSTEN: He is saying that there may be
23 slight variations in the table values. Those firing
24 pressures are not fixed.

25 JUDGE BRENNER: Do you know, other than by

WRBeb 1 reading this phrase, what the providers of this table meant
2 by it?

3 WITNESS SARSTEN: No.

4 WITNESS HENRIKSEN: No.

5 JUDGE BRENNER: All right.

6 We will admit it at this point, but I am becoming
7 concerned that some of the representations in the Staff's
8 answer to the motion to strike as to the extensive
9 involvement and knowledge on the part of its witnesses who
10 would take the stand, with everything that is involved in
11 this table, may have been exaggerated, at least in my own
12 mind as I read the Staff's answer. But we will save that
13 for a later time if it becomes appropriate, either to wait
14 or any renewal of any motions.

15 At this time, consistent with our previous
16 rulings, and now having a little more information on the
17 record, we will admit, as requested by the Staff, its
18 Exhibit 7, Diesel Exhibit 7, consisting of the two pages
19 identified, and with the page bearing the table as
20 modified.

21 (Whereupon, Staff Diesel Exhibit
22 7, having been previously
23 marked for identification,
24 was received in evidence.)

25 JUDGE BRENNER: And as a convenience, since it is

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only two pages, we can bind it into the transcript at this point, as well as having it as an official exhibit.

(The document follows:)

Facsimile Message

RICARDO

Fax No. 079 17 64124

From _____

Date _____

To _____

Page 6 Of _____

Fax No. _____

For The Attention of _____

Subject SUFFOLK COUNTY SUBMISSIONS (CONT)

	CYL. BORE	L/B	C/B	R/B	S/B	α/B°	MAX. FIRING P. lb/in ²	RATED BHP/CYL
T.D.I. R4 1.	432	1.36	.76	.36	.64	35/48	1750	677
G.M.T. 420 2.	420	1.56	.96	.45	.57	35/48	1710	700
MAN 40/45 3.	400	1.47	.89	.47	.53	43/48	2030	750
MIRRELES "K" MAJOR 4.	381	1.34	.81	.45	.52	42/46	1620	660
PIELSTICK PC2 5.	400	1.57	.93	.87	.65	45/52	1650	650
SWD TM 410 6.	410	1.59	.93	.49	.64	45/52	1810	765
ENGLISH ELECTRIC "WULCAN" Model 7.	438	1.6	.81	.37	.75	37/53	1600	530

(Engines corresponding to numbers are identified in Ricardo telex number 9183 dated August 20, 1984, which is enclosed as an attachment to this facsimile message)

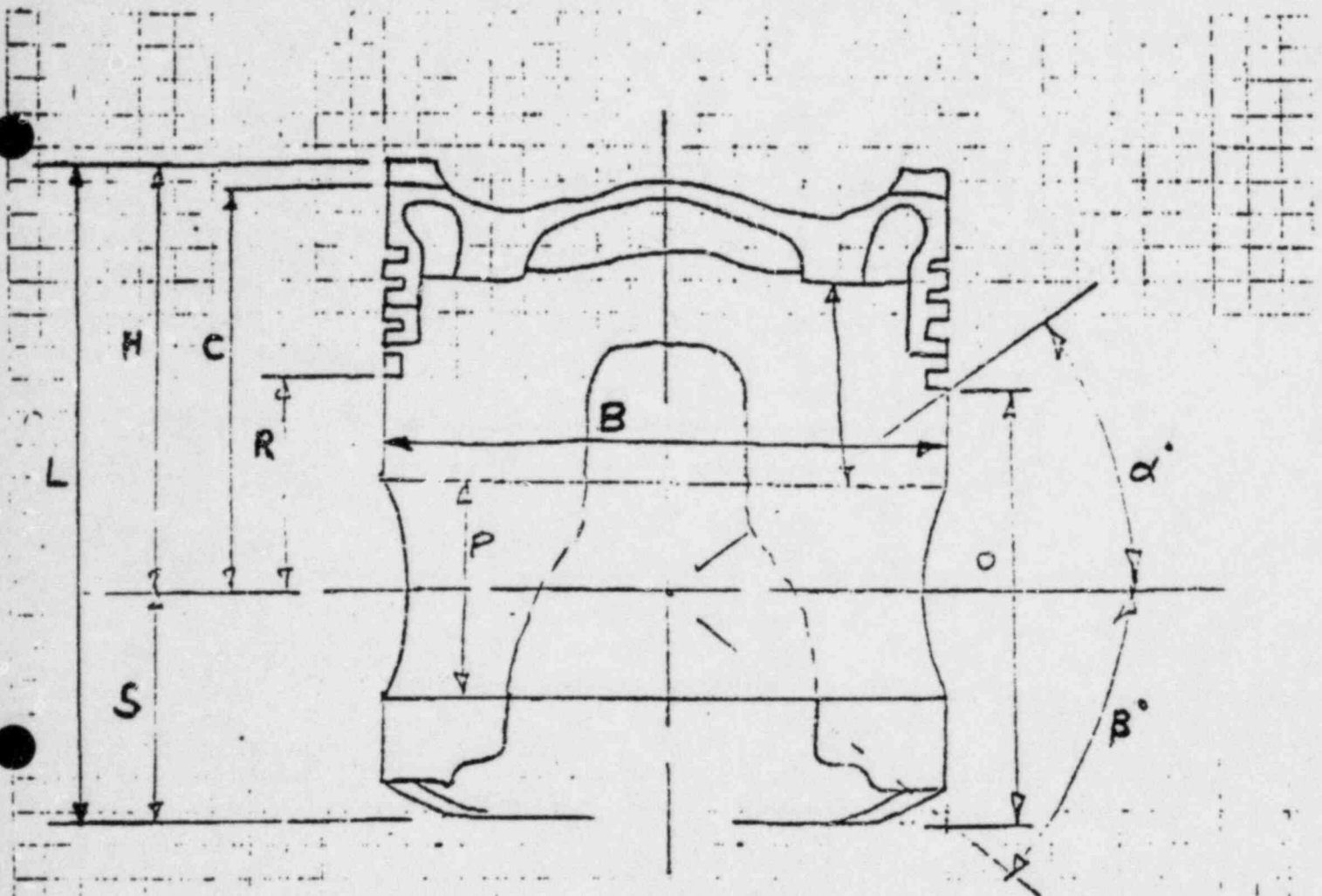
ALL DATA IN TABLE ON PAGE 6 CAN BE TAKEN FROM PUBLISHED DATA AND MEASUREMENT. SMALL VARIATIONS MAY OCCUR DUE TO LATEST SOURCE VARIANCES.

PROJECT _____

SHEET _____

OF **P 7**

SECTION _____



WRBeb

1

MR. GODDARD: Judge Brenner, the witnesses are

2

available for cross-examination.

3

JUDGE BRENNER: LILCO.

4

MR. ELLIS: Judge Brenner, I have about 15 to 20

5

minutes is all.

6

JUDGE BRENNER: Off the record.

7

(Discussion off the record.)

8

JUDGE BRENNER: Mr. Ellis.

9

MR. ELLIS: Thank you, Judge Brenner.

10

CROSS-EXAMINATION

11

BY MR. ELLIS:

12

Q Mr. Henriksen, good morning.

13

Would you look, please, at page 50 of your direct

14

testimony?

15

A (Witness Henriksen) Yes.

16

Q On page 50, Mr. Henriksen, you stated that at

17

Grand Gulf you viewed all 16 pistons of the Division 1

18

engine and no indications were evident.

19

A That is correct.

20

Q And I take it you meant no indications evident in

21

the stud boss area of the skirt?

22

A That is what I meant.

23

Q And that observation, I take it, is part of your

24

basis for your conclusions on the adequacy of the AE piston

25

for use at Shoreham?

WRBeb

1 A That is part of our conclusions.

2 Q Now you also indicated that at Shoreham, the
3 piston skirts were assembled so that the contested areas
4 could not be viewed. Am I correct that that is the skirt
5 and the boss were connected -- I mean the skirt and the
6 ground were connected so that you couldn't see the boss
7 area?

8 A This is correct.

9 Q Now are you aware that the AE pistons at Shoreham
10 were inspected after, in one engine, 100 starts and 100
11 hours of operation at 3500 kilowatts and above?

12 A This I have read.

13 Q And are you aware that those inspections by
14 liquid penetrant and eddy current of the boss areas after
15 100 starts and 100 hours of operation at 3500 kw and above
16 were witnessed by NRC inspectors?

17 A This I have also read.

18 Q And are you aware that the result of those
19 inspections that were witnessed by the NRC inspectors was
20 that there were no indications in the boss area?

21 A This I have also read a report on.

22

23

24

25

WRBpp

1 Q And does this additional evidence serve to
2 support your conclusions on the adequacy of AE pistons for
3 their intended use at Shoreham?

4 A Yes.

5 Q All right.

6 Next, Mr. Henriksen, am I correct -- you may
7 certainly consult if you wish on this question -- am I
8 correct that it is your opinion based on your inspections of
9 the AE pistons at Shoreham, that you have concluded that the
10 tin plating of the pistons will not affect adversely the
11 operation of the Shoreham engines?

12 A The inspection as such did not convince me of
13 that. I did not have an opportunity other than to look at
14 it initially.

15 Q Well, based on everything, though, that you have
16 done, am I correct that it's your opinion that the tin
17 plating of the AE pistons will not affect adversely the
18 operation of the Shoreham engines?

19 A I think this has been gone into fairly
20 extensively before. And I think it was very clear that the
21 Staff's major concern was even distribution and not to
22 exceed certain thickness of tin plating.

23 Q And I take it that that concern has now been
24 resolved, as far as you're concerned?

25 A The LILCO's testimony would indicate that, yes,

WRBpp

1 that the tin plating is, in fact, applied properly and that
2 the thickness is controlled.

3 Q You were present for the LILCO testimony by
4 Dr. Swanger and Dr. Pischinger on that?

5 A That is correct.

6 Q And is what you're saying then, that what you've
7 heard in connection with their testimony satisfies your
8 concerns that you may have had in that area?

9 A Yes.

10 Q Is that true with you as well, Professor Sarsten?

11 A (Witness Sarsten) Yes, I was also present and
12 any concerns I did have were alleviated after the testimony.

13 MR. ELLIS: We have no further questions, Judge
14 Brenner.

15 JUDGE BRENNER: The County?

16 JUDGE BRENNER: Do you know how much you have?

17 MR. DYNNER: Maybe an hour. I expect that we'll
18 have an hour, maybe less, Judge Brenner. If you could just
19 give me a few minutes, because I did anticipate that
20 Mr. Ellis might take a little longer and I'll get organized
21 in about two minutes.

22 (Pause.)

23 JUDGE BRENNER: I can give you a little more time
24 if you want.

25 MR. DYNNER: No, I only need about two minutes.

WRBpp

1 CROSS EXAMINATION

2 BY MR. DYNNER:

3 Q Gentlemen, you have concluded that subject to
4 examination by dye penetrant of the stud boss areas of all
5 the AE pistons at Shoreham, and subject to those pistons
6 being as represented in the drawing that you've seen of it,
7 that the AE piston skirts at Shoreham would be suitable for
8 nuclear service for one refueling cycle, isn't that true?

9 That's on page 55 of your testimony.

10 A (Witness Henriksen) I don't think it would be
11 based solely on the inspection at Shoreham, or the Shoreham
12 inspection, I'm sorry. I think previous testimony will
13 indicate that we also based it on the inspection of the R5,
14 the 2R5 AE pistons?

15 Q Yes, let me clarify my question. My question was
16 not what you based that conclusion on yet. We'll get to
17 that. But, rather what the conclusion is as stated on page
18 55?

19 A That is correct.

20 Q Now, could you please tell me why you limited
21 your conclusion to suitability for one refueling cycle only?

22 A The reason was that we would like to see these
23 pistons being inspected after one refueling cycle.

24 Q Is that the only reason for your limitation?

25 A Yes.

WRBpp

1 Q I'd like to explore with you now, Gentlemen, the
2 bases for your conclusion in your testimony.

3 Now it's true, isn't it Gentlemen, that your
4 conclusion is not based on the Failure Analysis Association
5 reports as to crack initiation and crack growth, as you
6 stated on page 49 of your testimony, isn't that right?

7 A That is correct.

8 Q Now, is your conclusion based in part, on the
9 experience of the 16 A E skirts at Grand Gulf, which is
10 referred to on page 50 of your testimony?

11 A Partially, yes, in part.

12 Q Thank you.

13 Now, Mr. Henriksen, you testified that you saw
14 the 16 skirts at Grand Gulf. In what manner did you inspect
15 those 16 skirts?

16 A Visual.

17 Q Visual?

18 A As well as all by inspection records.

19 Q And how many of the 16 skirts did you visually
20 inspect?

21 A All 16.

22 Q And what inspection records of those 16 skirts
23 did you review?

24 A I reviewed the record as presented by Grand Gulf
25 inspection departments.

WRBpp

1 Q Yes. Do you recall what the records pertain to,
2 that is, what they showed?

3 A They showed no indications in the contested area.

4 Q You mean in the boss area?

5 A Correct.

6 Q And what inspection process was evidenced by the
7 reports that you reviewed?

8 A To the best of my recollection, I believe there
9 were only -- they were only inspected by liquid penetrant?

10 Q So there was no eddy current inspection of those
11 piston skirts; isn't that true?

12 A I do not recollect this, whether there was or
13 not. I would not say yes, I would no say no at this point.

14 Q All right.

15 Now, Mr. Henriksen, how many hours had those
16 pistons run at Grand Gulf at the time that you visually
17 looked at them?

18 A The total hours, as I recall, was in the order of
19 11 to 1200 hours, as I recall. I'm not sure of the figure.

20 Q 11 to 1200 hours per skirt, or 11 to 1200 hours
21 total?

22 A Total.

23 Q So to get the number of hours per skirt, you
24 would have to divide 11 or 1200 by 16 --

25 A I'm talking about total hours from the engine.

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1 Q Total hours from the engine.

2 And were those 16 AE skirts in the engine for
3 that entire 11 hours or only a part of it?

4 A I believe only a part of it.

5 Q And for how many hours were the AE piston skirts
6 in the Grand Gulf engine at the time that you had inspected
7 them?

8 A Again, I go by memory. But I believe they were
9 in the order of 400 to 500 hours.

10 Q All right.

11 Mr. Henriksen, do you know what the loads were
12 that those pistons were run as while they were in the engine
13 at Grand Gulf?

14 A The loads are varying from no load up to 10
15 percent overload, over the rated load.

16 Q And can you tell me what is the rated load, the
17 rated full load of the engines at Grand Gulf?

18 A 7,000 kw.

19 Q And that is a V 16 engine, isn't it?

20 A That's correct.

21 Q And at 7,000 kw for 16 cylinders, that would be a
22 lower rating than the rating of the -- strike that.

23 Now do you know, of the 400 to 500 hours that AE
24 pistons were run at Grand Gulf, how many of those hours were
25 above full load?

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1 A I don't recall the exact figures, but the
2 percentage was fairly high.

3 Q Well, can you give us an idea? Are we talking
4 about 200 hours or 100 hours or 300 hours, at or above full
5 load?

6 A My recollection is that they were closer to 300
7 than to 100.

8 Q Gentlemen, do you have any -- or available to you
9 any -- records which would evidence the number of hours the
10 AE pistons were run in Grand Gulf at or above full load?

11 A The data is available, yes. Not here, but I will
12 take it in Richland at PNL.

13 Q Would you be willing to make that available to
14 us?

15 A Certainly.

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1 Q Now Mr. Ellis just asked you a question
2 concerning the AE skirts at Shoreham and what your knowledge
3 was about the inspection of those skirts.

4 Do you know how many skirts, AE skirts at
5 Shoreham have been inspected by -- for indications in the
6 boss area, after t' 100 starts and 100 hours at full power?

7 A I don't recall exactly the figure, but they were
8 not 100 percent in number, that's correct.

9 Q Now gentlemen, in your testimony on page 51 now,
10 you say that there is piston skirt experience that is of
11 special significance for the process of evaluating the
12 performance of the AE piston skirts and for that purpose you
13 identified the two AE skirts from the DeLaval prototype R-5
14 engine that you say were inspected by Failure Analysis
15 approximately 622 hours of operation at 2000 psi maximum
16 cylinder pressure.

17 Have you reviewed the documentation regarding
18 those inspections?

19 A No, I don't think I have.

20 Q Professor Sarsten?

21 A (Witness Sarsten) I read at least some of the
22 document as late as last night.

23 Q And it may help to refresh your recollection,
24 gentlemen, that there is some data concerning the R-5 AE
25 piston experience that is in LILCO's exhibit, diesel Exhibit

WRBagb 1 P-29. If you have it handy, you might take a look at that.

2 MR. ELLIS: Judge Brenner, I'm not sure, it
3 appeared to me that Mr. Henriksen wanted to add something.

4 JUDGE BRENNER: Well I did not see it.

5 Did you want to add something, Mr. Henriksen?

6 WITNESS HENRIKSEN: Yes. I want to correct that
7 I have also seen this document, yes. Thank you.

8 JUDGE BRENNER: Incidentally Mr. Dynner, I take
9 it we're at the point where you could be addressing
10 questions to the panel as a whole now, unless you otherwise
11 state differently.

12 MR. DYNNER: Yes. For example the last question
13 was and then I brought in Professor Sarsten when he did not
14 respond.

15 JUDGE BRENNER: Thank you. I want the panel to
16 know that also.

17 MR. DYNNER: Yes. The reasons why the questions
18 concerning the inspection of the piston skirts were directed
19 to Mr. Henriksen is because he is the only sponsor of that
20 testimony.

21 BY MR. DYNNER:

22 Q If either of you has anything to add at any time,
23 please feel free to jump in.

24 Gentlemen, I would like you for a moment to turn
25 to about the middle of this exhibit where you will find the

WRBagb 1 memorandum from Donald Johnson of Failure Analysis
2 Associates dated February 3, 1984, "Subject: Report of
3 Trips on 1/10/84 to TransAmerica DeLaval."

4 Gentlemen, were you present at the time that we
5 cross-examined the LILCO panel concerning this document?

6 A (Witness Henriksen) Yes.

7 A (Witness Sarsten) Yes.

8 Q And do you recall the testimony of that panel and
9 the information which is evident in this memorandum
10 concerning the fact that the boss area in the AE pistons
11 that were in the R-5 engine had been polished prior to the
12 time that the pistons were run in the engine for the 622
13 hours?

14 MR. ELLIS: Could we have the question read back?

15 MR. DYNNER: I can repeat it if it would make
16 things easier.

17 JUDGE BRENNER: That's fine.

18 BY MR. DYNNER:

19 Q Do you recall the testimony of the LILCO panel at
20 that time reflecting the fact, as evidenced in this
21 memorandum, that the boss area of the pistons that had been
22 run in the R-5 engine had been polished and that that was
23 different from the appearance of the boss areas in the AE
24 piston skirts at Shoreham?

25 MR. ELLIS: Judge Brenner, I object. I'm not

WRBagh 1 sure that the testimony said it had been polished. The
2 memorandum says "as if polished."

3 JUDGE BRENNER: There was testimony, Mr. Ellis.
4 I thought you were going to object to the second part of the
5 question.

6 MR. DYNNER: I asked whether they recalled that
7 testimony.

8 JUDGE BRENNER: I would not have interrupted on
9 my own, Mr. Dynner, since you have plenty of counsel around
10 here to protect their party's interest.

11 The second part of your question -- and I don't
12 remember the exact phraseology now, but you said and
13 therefore would be different than those in the AE --

14 MR. DYNNER: Yes, have a different appearance.

15 JUDGE BRENNER: There were also quite a few
16 questions of those witnesses as to what differences there
17 would be, and the word "different" has certain connotations
18 and one could interpret the testimony as whether or not
19 there is a real distinction and we'll save those sort of
20 things or the findings. Unless you need it for your
21 question, maybe you should just stay with the first fact,
22 that they had been polished. And if you have a particular
23 transcript cite, that would be helpful. I'm not going to
24 require it though.

25 MR. DYNNER: Well for further reference the part

WRBagb 1 of the transcript I'm going to be referring to would be from
2 pages 22,299 of the transcript on where there is extensive
3 testimony.

4 I will clarify the issue that you raised.

5 JUDGE BRENNER: Should I get my transcript?

6 MR. DYNNER: I don't think you need to.

7 JUDGE BRENNER: All right.

8 MR. DYNNER: I'm asking them if they recall
9 testimony to the effect that the boss area in the R-5 AE
10 piston skirts had been polished and that the appearance of
11 that polishing was different from the appearance of the AE
12 skirts in the Shoreham engines.

13 BY MR. DYNNER:

14 Q Do you recall that testimony?

15 A (Witness Henriksen) Yes, I recall the testimony,
16 not in detail but I think I have the general gist of the
17 testimony.

18 MR. ELLIS: Judge Brenner, I object asking him to
19 verify when he said that it goes for about 10 pages the
20 correctness of his summary.

21 JUDGE BRENNER: He's not verifying that. This
22 witness' answer bears nothing toward the correctness of
23 Mr. Dynner's summary. I will view it, for your information,
24 Mr. Ellis, as simply a lead-in to see if the witnesses are
25 keyed in to the subject at all. In fact, I thought the

WRBagb 1 witness was very good about emphasizing what he meant by
2 saying yes.

3 MR. ELLIS: Yes, sir.

4 JUDGE BRENNER: Mr. Dynner.

5 BY MR. DYNNER:

6 Q Yes, gentlemen, and if you could take a look for
7 a moment to LILCO's Diesel Exhibit P-29, you'll see the
8 memorandum that I have referred to by Mr. Johnson and then,
9 in subsequent pages, you will see -- in the third page over,
10 a page which shows some drawings. It states: "Side view
11 looking out from inside," and then there is a circle which
12 stated "notch side, overhead view." And there are in three
13 of those drawings in each case lines.

14 Do you see that page?

15 A (Witness Henriksen) Yes.

16 JUDGE BRENNER: Mr. Dynner, maybe LILCO can help
17 now since I don't have the official exhibits.

18 What page is that going to be in the official
19 exhibit copy?

20 MR. ELLIS: 29-14.

21 JUDGE BRENNER: Thank you.

22 BY MR. DYNNER:

23 Q And do you recall the testimony concerning the
24 fact that those diagonal lines in those drawings represented
25 crack-like indications which were disclosed by an eddy

WRBagb 1 current examination, which is referenced in the memorandum?

2 A (Witness Henriksen) Yes.

3 Q Now gentlemen, at the time that you prepared your
4 prefiled testimony, were you aware that the AE skirts in the
5 R-5 engine were different from the AE skirts in the Shoreham
6 engine, as described in Mr. Johnson's memorandum?

7 And the difference I'm talking about is not the
8 difference in the wrist pin area but rather the difference
9 in the fact that the boss area had been polished?

10 A No.

11 Q Do you recall testimony by the LILCO witness
12 panel that the polishing of the boss area in the R-5 AE
13 skirts occurred before the AE skirts were run for the
14 600-plus hours in the R-5 engine?

15 MR. ELLIS: Could we have a transcript page
16 number, please?

17 JUDGE BRENNER: All right. I know your witness
18 said that. Is that why you need it?

19 MR. ELLIS: Well my memory -- my data banks are
20 not as prodigious. Yes, I need it because I'm concerned
21 about the representation.

22 MR. DYNNER: I'm asking if they recall --

23 MR. ELLIS: I'm finding testimony that goes well
24 beyond that.

25 JUDGE BRENNER: They testified that it was

WRBagb 1 polished before the run in the R-5 engine.

2 It would be better for the record if you had the
3 references. I'm not saying you need it --

4 MR. DYNNER: Can I give him that reference later
5 on, because I'm asking them whether they recall that
6 testimony. I'll be happy to --

7 JUDGE BRENNER: All right. If you don't have it
8 handy --

9 MR. DYNNER: -- dig out the specific reference
10 later on.

11 JUDGE BRENNER: If you don't have it handy, I'll
12 let you proceed. But it would help when you know you're
13 going to be asking witnesses if they recall testimony if we
14 could have a contemporaneous reference, both so the
15 witnesses can take a look to see if there might be a
16 contextual problem and because I don't always remember
17 testimony, although I remember that point.

18 MR. DYNNER: Yes, Judge, I have given you the
19 general 10 pages about it. There was, as I recall -- and I
20 asked someone to get me another reference. There was a
21 specific statement that was made at the beginning, I think,
22 on the following day exactly on this point, which I will
23 find.

24 JUDGE BRENNER: All right.

25 What day? You have convinced me that I want to

WRBagb 1 get my transcript.

2 MR. DYNNER: This is September 12th, 1984.

3 JUDGE BRENNER: All right. Give me a moment.

4 (Pause.)

5 JUDGE BRENNER: What was the first reference you
6 gave me to the September 12 transcript?

7 MR. DYNNER: The beginning reference, I believe,
8 was to 22,300 or 22,299 where the whole discussion begins
9 and goes on for some time.

10 I'm trying to find the precise citation.

11 JUDGE BRENNER: All right. Why don't you proceed
12 with your questioning and then you can give it to us?

13 BY MR. DYNNER:

14 Q Do you recall that testimony, gentlemen?

15 A (Witness Henriksen) I believe there was that
16 testimony, yes.

17 Q Gentlemen, do those facts -- the polishing and
18 the indications that were found -- in any way affect your
19 confidence as to the experience of the two AE skirts that
20 operated in the R-5 engine?

21 A The polishing, in my estimation, would improve
22 the condition. It would reduce or limit the number of
23 possible stress risers, there is no question about that.

24 As far as the cracks, I had my original concerns
25 alleviated by Dr. Bush, who is an expert in that field and

WRBagb 1 they are of no particular concern.

2 Q Is it then your conclusion that given the
3 polishing that occurred in the AE skirts in the R-5 engine
4 that those skirts would have been less likely to have
5 indications -- or crack-like indications develop than would
6 the skirts in the Shoreham engine?

7 A At the same operational levels, yes.

8 Q Gentlemen, I now would like to explore with you
9 another area.

10 Have you gentlemen reviewed Suffolk County's
11 testimony concerning the AE piston skirts?

12 A (Witness Henriksen) Yes.

13 Q Mr. Sarsten?

14 A (Witness Sarsten) Yes. But some time ago. I
15 have reviewed it, yes.

16 Q Do you recall the testimony of the witnesses of
17 Suffolk County concerning the peak firing pressures in the
18 EDG's at Shoreham? And I mean generally, not specifically,
19 not specifically every number.

20 A I can't recall in what context they were
21 concerned. Could you lead us to a page?

22 Q Certainly.

23 I would direct you -- Do you have a copy there of
24 the testimony?

25 A Yes.

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1 Q If you could look at pages 29 and 30, you'll see
2 a discussion -- some discussion of peak firing pressure that
3 will help refresh your recollection.

4 A We have refreshed our memory.

5 Q Now gentlemen, do you have any reason to doubt
6 the County's testimony, as shown on these pages and in the
7 exhibits attached to the County's testimony, that the
8 highest peak firing pressure recorded at 100 percent of load
9 in the Shoreham engines was 1720 psi -- that figure, for
10 your information, isn't corrected in your copy, it was
11 corrected later on from 1750 to 1720 -- and that the highest
12 peak pressure at 3900 Kw was about 1800 psi?

13 A I obviously would have to see the data before I
14 could form an opinion on how the County got these figures.

15 Q Have you not had an opportunity to review this
16 testimony together with the exhibits that are referenced in
17 the footnotes concerning peak firing pressure?

18 A I have, but it was a little time ago now.

19 Q And I'm not going to ask you right now to look at
20 it but can you recall, either of you, whether you have any
21 reason to doubt those peak firing pressures?

22 A I have no particular reason to doubt them, no.

23 Q Would you please turn for a moment to two of the
24 LILCO exhibits that deal with this matter?

25 I'm going to refer you first to LILCO Diesel

WRBagb 1 Exhibit P-5, the crank angle diagram that we had some
2 discussion about previously, and also to the associated
3 LILCO Diesel Exhibit P-35 which, as you may recall, shows,
4 among other things, a digital readout pressure in psi at 1
5 percent increments beginning at top dead center.

6 MR. ELLIS: Is there a question?

7 JUDGE BRENNER: Let's give him a chance. I don't
8 let people interrupt you that much.

9 MR. ELLIS: I'm sorry, Judge.

10 JUDGE BRENNER: He gave them two documents and
11 the witnesses are in the process of gathering up the
12 documents. I assume he will ask them a question when the
13 witnesses look like they have found the documents.

14 MR. ELLIS: I apologize.

15 BY MR. DYNNER:

16 Q Do you have those documents, gentlemen, in front
17 of you?

18 Now gentlemen, can you tell me, given this
19 information on these two exhibits would it be possible to
20 calculate the BMEP of the engine at this point for this
21 cylinder?

22 MR. ELLIS: Judge Brenner, I object to the
23 question. It is beyond the scope of their direct
24 examination. I find nothing in their direct examination
25 that has anything whatever to do with these exhibits or

WRBagb 1 with peak firing pressures or with calculating BMEP, and
2 therefore I think it goes well beyond the scope of direct
3 examination and should not be permitted.

4 JUDGE BRENNER: I'll let Mr. Dynner respond
5 rather than jumping in myself.

6 MR. DYNNER: Yes.

7 I think, Judge, clearly I'm examining them in the
8 context of their review of peak firing pressure values which
9 go directly to both the County's testimony and LILCO's
10 testimony which have a bearing upon the operation of the AE
11 piston skirts because all their testimony -- both here and
12 direct testimony -- must, by necessity, relate to the loads
13 seen by the various AE skirts that they have testified to.
14 And obviously the psi -- that is to say, the peak firing
15 pressures relate to the loads. It's all one package and I
16 don't think it can be segregated out into every time we get
17 into some detail saying it's beyond the scope.

18 JUDGE BRENNER: We agree. Let's not belabor it.
19 The objection is overruled.

20 BY MR. DYNNER:

21 Q Do you recall my question, gentlemen, which was:
22 Would it be possible, with this information, to
23 calculate the BMEP for the engine, for that cylinder?

24 A (Witness Sarsten) Yes. Given this information
25 it would be possible to calculate the indicated brake mean

WRBagb 1 pressure for that cylinder.

2 Q Have you done so?

3 A No, I have not done so.

4 Q The BMEP, rated BMEP on full load for the
5 Shoreham EDG's is 225 BMEP, isn't it?

6 If you did the calculation -- I am asking you now
7 to use your experience and judgment in answering this
8 question because I know you have not done the calculation --
9 but if you did the calculation and it showed a BMEP of less
10 than 225 indicated by this data, would that then indicate
11 that this data did not reflect the peak firing pressure at
12 full load?

13 A No. not necessarily. Looking at the data points
14 I would indeed be very surprised if the BMEP did not come
15 out near -- the indicated mean effective pressure did not
16 come out near the brake mean effective pressure because I
17 would like to believe there is an obvious shift in the top
18 dead center which changes your mechanical efficiency
19 greatly. But the error need not be in the maximum firing
20 pressures, it is most probably here in the top dead center
21 location.

22 JUDGE BRENNER: Let me make sure that I heard
23 Professor Sarsten right. I thought you were going one place
24 from what you said in the beginning of your answer and then
25 you went someplace else.

WRBagb 1

2 Did you say you would be surprised if this data
3 did not result in a BMEP of very close to 225?

4 WITNESS SARSTEN: Yes. I said indicated mean
5 effective pressure, that is the work done in the cylinder.
6 I would expect almost equal the work measured on the shaft
7 because the top dead center is shifted. There is a very
8 large pressure rise here near top dead center. This shift
9 in the marking of top dead center will drastically change
10 the mechanical efficiency of the engine, so the discrepancy
11 with the calculated value here and what you would expect
12 would, in large part at least, be due to the error in the
13 top dead center. If there was also an additional pressure
14 in the pressure recordings themselves, that I cannot say.

15 JUDGE BRENNER: I am still confused because when
16 I heard your answer it meant to me that you would expect not
17 to see a discrepancy because you expect the 225 figure to be
18 the same in both cases. So I am not understanding
19 something.

20 WITNESS HENRIKSEN: What I think he's saying,
21 Judge Brenner, is he would expect to arrive at a result that
22 would indicate 100 percent efficiency and that would
23 indicate that the mean pressure and the brake mean pressure
24 would equal each other, which of course cannot be true.

25 MR. DYNNER: Perhaps I can -- If I can explore
with one more question and what I'll try to do is to give a

WRBagb 1 hypothetical and then they can respond to that. It might
2 make it a little more clear.

3 BY MR. DYNNER:

4 Q Let us assume for a moment that if you calculated
5 the indicated BMEP given this data and it came out to 215
6 BMEP instead of 225, what would that tell you about this
7 data?

8 A (Witness Henriksen) That the represented maximum
9 pressures are not correct.

10 Q Well would it tell you that they are too low or
11 too high?

12 A They are too low.

13 Q Thank you.

14 I have another question -- a couple more
15 questions in this area of firing pressure that I would like
16 to explore with you, gentlemen.

17 First can you tell me, we had some earlier
18 testimony when we were talking about the issue of firing
19 pressures and you may recall Judge Ferguson asked some
20 questions of Dr. Pischinger in this regard.

21 Can you tell me how an increase of, let's say, 60
22 or 70 degrees Fahrenheit in the environmental temperature
23 around the EDG's would affect their peak firing pressures,
24 if at all, in your judgment?

25 A By "environment," you mean the intake air

WRBagb 1 temperature?

2 Q Ambient temperature.

3 A Ambient temperature.

4 These engines are equipped with coolers between
5 turbocharged compressor discharge and the engine. These
6 coolers are normally automatically controlled and will
7 maintain a constant air temperature through the engine
8 should it should not significantly change compression -- the
9 compression process.

10 Q So is it your testimony that an increase in the
11 ambient temperature of 60 to 70 degrees Fahrenheit would
12 have no significant impact on the peak firing pressure for
13 those engines?

14 A It will somewhat change the turbocharger
15 performance but not a great deal of influence on the firing
16 pressures as I can visualize right now.

17 Q Thank you.

18 Gentlemen, you may recall also in the discussion
19 with Dr. Pischinger some discussions about the measurements
20 of firing pressures and of strains of piston pressures while
21 the piston was operating and comparing that to the strain
22 gauge that was taken in a static condition.

23 Can you tell me, do you agree -- Strike that.

24 Is it difficult, if not impossible, to do a
25 dynamic strain gauge in the cylinder while the engine is

WRBagb 1 operating?

2 A It is not exactly easy but it is very possible.

3 Q Professor Sarsten?

4 A (Witness Sarsten) I would say today -- although
5 difficult as far as the life expectancy of the leads -- the
6 wires out, I would say it is almost standard practice in the
7 development of highly rated engines, at least in the medium
8 speed range, units can be bought -- if not off the shelf,
9 for these large sizes units can be bought from specialist
10 firms such as Wellworthy in England for the linkage that is
11 necessary to lead the wires out from the reciprocating
12 motion of the piston.

13 Q Would you expect, Dr. Sarsten, that that type of
14 measurement would be more accurate than the static
15 measurement that was done by Failure Analysis in the case of
16 the AE piston skirt study?

17 A Yes, as the static measurements performed on the
18 piston skirts also were without the benefit of the thermal
19 distortion of the crown, such as you see in true operating
20 condition of the piston. I would have more faith in dynamic
21 measurements on a running engine.

22 Q If one were to use a static measurement such as
23 used by FaAA -- Strike that.

24 It is true, isn't it, that FaAA's static tests
25 were done with a dry piston, isn't that correct?

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1 A (Witness Henriksen) I believe so.

2 Q Wouldn't more accurate results have occurred had
3 FaAA, given the use of a static test, used a lubricated
4 piston pin because the hoop stress would be increased by the
5 oil film?

6 A (Witness Sarsten) It's hard to say.

7 And another question is: you, I believe, are
8 referring to a lubricated or non-lubricated piston pin, is
9 that correct?

10 Q Yes.

11 That is to say, to clarify it for you, if there
12 were oil -- if oil had been used in the piston to show, in
13 effect -- that more closely approximated the actual piston,
14 which does, after all, operate in a lubricated environment,
15 wouldn't that have given you more accurate results?

16 MR. ELLIS: Objection, asked and answered.

17 JUDGE BRENNER: No, it wasn't answered.

18 Objection overruled.

19 WITNESS SARSTEN: This is purely speculative. It
20 depends also upon the type of oil used and if there had been
21 some other additives present in the oil or not.

22 I do not feel that a pressure lubricated or a
23 well lubricated pin and a pin that has just been oiled prior
24 to the test makes a great deal of difference here.

25 JUDGE BRENNER: Professor Sarsten, you'll forgive

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1 my ignorance, I hope, I don't know what a piston pin is when
2 you refer to it just as a pin. With some work I learned
3 what a wrist pin was but I don't know what a piston pin is.

4 WITNESS SARSTEN: Identical, the same
5 terminology, both are used.

6 JUDGE BRENNER: All right. Thank you.

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1 BY MR. DYNNER:

2 Q Gentlemen, I want to ask you a few questions now
3 about tinplating.

4 It's true, isn't it, that tinplating used on the
5 piston skirt can serve as a place for material to become
6 embedded in the soft tin coat, isn't it?

7 A (Witness Henriksen) It can.

8 Q And in fact, Mr. Henriksen you, yourself, saw
9 that condition in some of the piston skirts at Shoreham that
10 you inspected, didn't you?

11 A Yes.

12 Q Now, isn't it true that if large enough pieces of
13 material became embedded in the tinplated skirt and remain
14 there, that the scoring of the liner could result, and
15 scoring of the skirt?

16 My question is not whether this did happen, but
17 could it happen?

18 A In my estimation it can happen, and it probably
19 has happened on occasion.

20 Q And you did, in fact, see some scoring of the AE
21 skirts when you inspected them at Shoreham, didn't you?j

22 A I hesitate to use the term scoring, because I
23 would have to view the cylinder liners in order to make a
24 proper evaluation of that term. I saw scratches, yes.

25 Q Scratching, thank you.

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1 JUDGE BRENNER: To make sure it's clear in my
2 mind, the scratches you saw were on the piston, is that
3 right?

4 MR. DYNNER: Piston skirt.

5 WITNESS HENRIKSEN: That's correct.

6 JUDGE BRENNER: All right, on the piston skirt.

7 WITNESS HENRIKSEN: But we did not have occasion
8 to see the liners. They were not in the plant when we were
9 there.

10 JUDGE BRENNER: Mr. Dynner was trying to make my
11 question better, and I agree with him. Were the scratches
12 you saw on the piston skirt?

13 WITNESS HENRIKSEN: Yes.

14 BY MR. DYNNER:

15 Q Now it's true, isn't it, that if you had material
16 embedded in the tinplating and it caused scoring, that that
17 scoring could reach a point, given sufficient operation of
18 the engine in that condition, that gas blow-by could occur;
19 isn't that true?

20 A That could be one consequence, yes.

21 Q You said that could be one consequence. Could
22 you tell me what other consequences, in your experience and
23 knowledge, might also occur; if any?

24 A In my experience when excessive scoring for some
25 reason, not necessarily tinplating but for some reason,

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1 occurs, it usually is more likely to happen to have a seized
2 piston because of piston growth.

3 Q Result in a seized piston?

4 A Yes, this would be more likely.

5 Q Yes, thank you.

6 Gentlemen, I'm going to hand you copies newly off
7 the press of Suffolk County Exhibit 71, which has already, I
8 believe, been given to the reporter. We have some copies
9 here.

10 JUDGE BRENNER: Let's go off the record.

11 (Off the record.)

12 JUDGE BRENNER: My records are that this exhibit
13 was only one for identification; is that correct?

14 MR. GODDARD: That's correct, your Honor.

15 JUDGE BRENNER: All right.

16 BY MR. DYNNER:

17 Q Mr. Henriksen, if you'll take a look at page 54
18 of your testimony for a minute, at the bottom of the page?

19 Do you see where you say you "found signs of
20 scuffing on most pistons that you inspected at Shoreham on
21 May 23, 1984"? I would like to ask you, Mr. Henriksen,
22 whether you can identify this photo as appearing to be, in
23 appearance, one of the piston skirts that you inspected at
24 Shoreham at that time?

25 A (Witness Henriksen) It looks like one of the

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1 pistons I looked at slightly dramatized by color.

2 Q I'm not going to comment on the quality of the
3 photograph, but it is -- if you can tell me by looking at
4 this photograph -- can you tell me which part of the photo
5 is the top part of the piston skirt, and which is the
6 bottom?

7 A Which part is the top and which part is the
8 bottom?

9 Q Yes, in other words, is the photograph properly
10 oriented so that the top of the photograph is the top of the
11 piston, the top portion of the skirt?

12 A It's properly oriented.

13 Q Thank you.

14 Now, do you recall in inspecting the skirt, which
15 you say resembles this photo, whether this part that looks
16 like a U-shaped area, was on only one side of that piston or
17 was it on the other side, or other portions of the skirt as
18 well of each single skirt?

19 A As I recall, this was only on one side.

20 Q And it's blue, isn't it Mr. Henriksen, that in
21 the area which appears on this photo as a darkened area,
22 that I recall a sort of U-shaped area, that in that area you
23 noted that the tinplating was no longer there?

24 A That is correct.

25 Q And in the areas surrounding that U-shaped area,

WRBpp 1 that appears darker in the photograph, the tinplating was,
2 in fact, still on the piston skirt; isn't that true?

3 A The tinplating was still in place in the
4 surrounding area.

5 Q Now, based upon your inspection, do you believe
6 that the lack of tinplating in that area that appears
7 darker, resulted from the rubbing of that area of the skirt
8 against the liner?

9 A This would definitely be the first impression you
10 have, yes.

11 Q Now, can you tell me, Mr. Henriksen, whether this
12 is what is sometimes called scuffing and whether, when you
13 use the term scuffing, this was the type of marking that you
14 had in mind?

15 A It could be very well. It very well could be,
16 yes.

17 Q When you say it could be, you testified that you
18 found signs of scuffing, and I just wanted to identify, was
19 this type of mark that you were referring to as scuffing?

20 A Yes, but it definitely -- like I said before -- I
21 also would have to look at the liner to make a firm
22 conclusion on that. Looking at only one side, I cannot tell
23 that.

24 Q Yes. In your testimony you said that you found
25 signs of scuffing on most pistons. And what I'm trying to

WRBpp 1 get at is whether the representation in this photo is what
2 you were referring to in your testimony?

3 A Looking at the pistons only, it would appear that
4 scuffing took place.

5 Q Thank you.

6 Now, Mr. Henriksen, do you believe that a piston
7 -- that a piston in this condition should simply be put back
8 into the EDG for further operation?

9 A Not without a full investigation as to what
10 caused this.

11 Q All right. But wouldn't this be a questionable
12 piston to put back into an EDG?

13 A I would question it, yes.

14 MR. DYNNER: If you would give me a moment, I'm
15 going to move onto a different area.

16 JUDGE BRENNER: I thought you really, wanting a
17 full record as we all do, you would ask him what it is he
18 would question before deciding what to do with the piston.

19 MR. DYNNER: I will take that cue, yes, sir.

20 BY MR. DYNNER:

21 Q Would you tell me what else you would investigate
22 in order to make this questionable piston into an acceptable
23 piston for further operation?

24 A (Witness Henriksen) Like I said, I would have to
25 look at the cylinder liner to see if there were

WRBpp 1 corresponding marks there, or if this was simply the tin
2 evacuating through normal wear. Tinsplating on a piston I
3 would expect it, in the course of normal operation, to
4 finally disappear in the loaded area.

5 Q And approximately how many hours, in your
6 experience, would a piston skirt have to operate before the
7 tinsplating disappeared? And I'm talking about operation in
8 the Shoreham engine, so that we've got a specific situation
9 in mind.

10 A I'm sure I cannot give you a quantitative answer
11 to that, because it depends on a lot of operational
12 conditions, like what type of lube oil they use. The load
13 level, obviously, has a great deal to do with it. So, I
14 cannot give you a quantitative answer on that point.
15 Also the thickness of the plating, obviously, is also a
16 factor.

17 JUDGE BRENNER: Mr. Henriksen, do you know what
18 the hours were at full load or above on the Shoreham
19 diesels with the AE piston in June, 1984, when some of these
20 pistons were looked at -- strike that, I don't know when
21 they were looked at -- when some of these pistons were
22 looked at and still extant in June, 1984.

23 WITNESS HENRIKSEN: As I recall, they had in
24 excess over 100 hours.

25 JUDGE BRENNER: And that was approximately

WRBpp 1 accurate for all three engines? Well, let me talk about
2 the 103 engine.

3 WITNESS HENRIKSEN: Yes, I believe it was a
4 little over 100 hours, at/or about 3500 kw.

5 JUDGE BRENNER: All right. And what would you
6 expect to occur with respect to the tinplating on the
7 Shoreham pistons at that many hours, at full load or above.
8 Assuming that LILCO did all the right things with respect to
9 lubrication?

10 WITNESS HENRIKSEN: If properly applied, I would
11 not expect that this might show the tinplating to have
12 already disappeared.

13 JUDGE BRENNER: Just to make sure I ask the
14 question correctly in terms of taking the factors in, would
15 you also have to know whether there were additional hours at
16 which the particular piston was run at less than full load?
17 Would that be a factor?

18 WITNESS HENRIKSEN: Normally it would be a factor
19 if you viewed all pistons, but this was the only piston. So
20 there obviously was something different in this particular
21 piston from the others, because this condition was not
22 evident in the other pistons.

23 JUDGE BRENNER: Do you know what the total hours
24 were in the 103 engine for the AE pistons at the time the
25 pistons were removed, and when they were still extant in the

WRBpp

1 June timeframe? I think they may have been removed in May,
2 that's why I'm hedging on the timeframe.

3 WITNESS HENRIKSEN: No, I don't, Judge Brenner.

4 JUDGE BRENNER: Okay.

5 I had the place in your testimony, Mr. Henriksen,
6 and lost it -- maybe you can help me -- in which you mention
7 the scuffing.

8 MR. DYNNER: It's page 54, Judge Brenner, at the
9 bottom of the page.

10 JUDGE BRENNER: In reading your testimony it
11 says, as already discussed, "I found signs of scuffing on
12 most pistons." In your answer here to me a few moments ago
13 you said, this was the only piston that looked like it
14 looks, in the picture in Suffolk County Exhibit 71 for
15 identification. Can you explain to me, then, what you meant
16 by your testimony, if only this piston looked like this?

17 WITNESS HENRIKSEN: All pistons had vertical
18 scratches, which could be interpreted as signs of scuffing.
19 This was the only piston that looked like this, with the
20 tinplating gone. The others had their full coverage.

21 JUDGE BRENNER: Okay, thank you.

22 I'm sorry for the interruption, Mr. Dynner. I
23 wanted some clarification.

24 MR. DYNNER: I'll just follow up with one more
25 question about the skirts.

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BY MR. DYNNER:

Q Mr. Henriksen, if this had been normal wear, wouldn't you expect to find that at least some, if not all, of the other piston skirts would show the same kind of wear?

A (Witness Henriksen) I think that's what I indicated to Judge Brenner.

Q Yes, thank you.

MR. DYNNER: Do you want me to continue, Judge Brenner, or is this a convenient time for a break? I think I'm going to be going on for about another 15 minutes, probably. Maybe not more than that.

JUDGE BRENNER: If you want to take a break now, we can. It would be convenient. Let's come back at 10:55.

(Recess.)

WRBeb 1

JUDGE BRENNER: Back on the record.

2

Will you continue, Mr. Dynner?

3

BY MR. DYNNER:

4

Q Gentlemen, I am going to ask you some questions now about your testimony concerning piston side thrust, which begins on the bottom of page 52 of your testimony.

7

Gentlemen, you say that in your experience, piston skirt side thrust has never been a problem in piston skirt design with medium-speed, high-break, mean effective pressure four-cycle engines.

11

What experience are you specifically basing that statement on?

13

A (Witness Henriksen) My experience of about 25 years with Nordberg Manufacturing Company.

14

Q Can you tell me specifically what engines you had in mind in connection with the statement about your experience, if any?

17

18

A Yes. To the best of my knowledge, side thrust was never a concern in the design of the 13-1/2x16-1/2 Nordberg four-cycle engines, nor the 9x11-1/2 Nordberg engines. Those are the four-cycle engines we did have.

22

Q Yes.

23

Any other engines?

24

A We had two-cycle engines.

25

Q I'm sorry, I meant any other four-cycle

WRBeb 1 medium-speed, high break, mean effective pressure engines.

2 A No, those were the Nordberg line of four-cycle
3 engines.

4 Q Professor Sarsten, did you have any particular
5 engines in mind when you gave this testimony?

6 A (Witness Sarsten) I was thinking of the ALCO-251
7 engines which I had experience with from around 1958 to '61,
8 roughly.

9 Q Now your testimony is that the piston side thrust
10 was never a problem in the design of those engines. Is that
11 correct?

12 A (Witness Henriksen) To the best of my knowledge,
13 no.

14 Q What was the piston side thrust measured in
15 pounds per square inch for each of those engines?

16 A I haven't calculated them but I can inform you
17 that the 13-1/2x16-1/2 -- there the engines operate in the
18 range of 2250 BMBP and approximately, as I recall, about
19 1900 to 2000 maximum pressure.

20 Q I'm sorry, my question-- Maybe you weren't
21 finished. My question was not the firing pressure in the
22 cylinder but the calculation of the side thrust of the
23 piston in pounds per square inch for those engines.

24 A Since it was not a problem we never had any
25 occasion to calculate it.

WRBeb 1 Q So you don't know.

2 Do you know, Professor Sarsten, what the side
3 thrust calculation in pounds per square inch was for the
4 ALCO-251?

5 A (Witness Sarsten) No. I worked in the
6 Calculation Department. I never even saw a calculation for
7 side thrust. However, I have seen calculations of side
8 thrust on the Salzer engines, but that was on the cross-head
9 engines, something completely different. They did not
10 calculate the side thrust on four-stroke engines as far as I
11 remember.

12 Q Are you familiar with the Salzer engines?

13 A I worked on Salzer for a year.

14 Q Yes.

15 Are you familiar with the Salzer rotating piston
16 engine?

17 A I am.

18 Q Does the rotating piston design have any impact
19 on the likelihood of or unlikelihood of piston seizure in
20 that engine?

21 A Salzer claims that the rotating piston evens out
22 the wear, gives better lubrication, and so on, but no other
23 manufacturer has seen fit to go to the complexity of this
24 piston. They are the only ones really that push it, for
25 some designs, I might add, not all.

WRBeb 1 Q Well, my question perhaps wasn't clear, Professor
2 Sarsten. It is whether, in your judgment, the rotating
3 piston design has an effect on the likelihood or
4 unlikelihood of piston seizure in that engine.

5 A It should-- In conditions where piston seizure
6 or extreme scoring or wear is a problem, it should tend to
7 be beneficial, yes.

8 Q Do you recall, in connection with the examination
9 of the LILCO witnesses, that there was distributed a copy of
10 an article concerning the Salzer rotating piston engine,
11 that is, Suffolk County Diesel Exhibit 69, marked for
12 identification?

13 Did you review that document?

14 A I do recall that a copy of some pages from an
15 issue of The Motorship was passed around and, among other
16 things, this also covered the rotating piston design of
17 Salzer.

18 A Well, that design in fact does show a concern
19 with the design of the engine in terms of the effects or
20 potential effects of excessive piston side thrust, doesn't
21 it?

22 A I do not know if excess piston side thrust was
23 the reason for going to this piston design. There has never
24 been any problem, as I stated, with this, and I don't
25 remember its being calculated for four-stroke engines where

WRBeb 1 I worked.

2 Q Well, I'm not sure that you really addressed my
3 question. Let me try to repeat it.

4 It is true, isn't it, that the rotating piston
5 design addresses the issue of potential -- of the effects of
6 potential excessive piston side thrust which could result,
7 as the article stated, in distortion of the piston and
8 eventually seizure. Isn't that true?

9 MR. ELLIS: I object to the question. It's been
10 asked and answered.

11 JUDGE BRENNER: I think it has been asked and
12 answered. You changed your immediately preceding question
13 to which you thought you did not get an answer. In my
14 opinion you got an answer, and now the question just asked
15 was asked even before that. And I am going to sustain the
16 objection.

17 Also on my own, I don't like the form of the
18 question in terms of pulling a conclusion out of the article
19 without any other context. But Mr. Ellis' reason is reason
20 enough to sustain it.

21 BY MR. DYNNER:

22 Q Gentlemen, if you will turn the page now to page
23 53 of your testimony, I want to direct your attention to the
24 Staff's exhibit--

25 MR. DYNNER: I'm sorry, I have this exhibit now.

WRBeb 1 It has been distributed but it doesn't have a number on it.
2 It is Staff Exhibit Number 7?

3 JUDGE BRENNER: Yes.

4 It is not your fault the copy given to you by the
5 Staff doesn't have a number on it.

6 Go ahead.

7 BY MR. DYNNER:

8 Q Now can you tell me, gentlemen, this information
9 on this Staff Exhibit 7 was obtained, I think you said
10 earlier in your testimony, from Ricardo Consulting
11 Engineers. Is the information on this first sheet, a table
12 of numbers, true and correct in every respect?

13 A (Witness Henriksen) I don't know that.

14 Q Did you ask Ricardo to substantiate or verify in
15 any way the data that appears on this table after you
16 received the table?

17 A This may have been done by PNL.

18 Q Do you know whether it was done, sir?

19 A I do not now that.

20 Q Now at the bottom of this table there are two
21 sentences. One says:

22 "All data in table on page 6...."

23 I suppose it means this table.

24 "....can be taken from published data and
25 measurements."

WRBeb 1 What is the published data that that refers to?

2 A I have no knowledge of the specific published
3 data referred to.

4 Q Do you know who took the measurements that are
5 referred to there?

6 A No.

7 Q Do you know what the variations are that might
8 occur that are referred to in the second sentence?

9 A I have no specific knowledge of that.

10 Q Now given the data that appears on this table
11 that you have identified, I would ask you:

12 There is data identified for seven engines;
13 isn't that true?

14 A Correct.

15 Q Have you calculated the piston side thrust for
16 any of those engines?

17 A No.

18 Q Can you tell me what information you would need
19 about each of these pistons in order to calculate the piston
20 side thrust of each one of these pistons?

21 A I would need the center-to-center distance
22 between the wrist pin or piston pin, and the con rod.

23 JUDGE BRENNER: I didn't hear that.

24 WITNESS HENRIKSEN: The con rod bearing, the
25 center-to-center distance between the wrist pin bushing or

WRBeb

1 wrist pin and the con rod or crankshaft.

2 JUDGE BRENNER: You mean the connecting rod?

3 WITNESS HENRIKSEN: I need the con rod length.

4 JUDGE BRENNER: I want to dissuade you from using
5 jargon. What is a con rod?

6 WITNESS HENRIKSEN: A connecting rod.

7 JUDGE BRENNER: Thank you.

8 WITNESS HENRIKSEN: And I need a diagram so that
9 I can get the pressures at the different crank angles.

10 BY MR. DYNNER:

11 Q By "diagram" you mean you would need a pressure
12 volume diagram or a pressure time diagram. Isn't that true?

13 A (Witness Henriksen) Pressure volume.

14 Q Yes.

15 You don't have that, do you not?

16 A No, I do not.

17 Q So you cannot calculate the piston side thrust of
18 any of these engines based upon material set forth in the
19 Staff's Exhibit 7, can you?

20 A No.

21 Q And you don't know the shape, if any, of these
22 pistons, do you, because you haven't seen the drawings.
23 Correct?

24 A That is correct.

25 Q You have seen the drawing-- I'm sorry, you have

WRBeb 1 seen the drawing for the TDI engine, which is the first one
2 listed. I wanted to clarify that.

3 A That's correct.

4 Q Yes.

5 Can you tell me what analysis and calculations
6 you made, if any, of this data which enabled you to reach
7 the conclusion that there is no drastic difference in the
8 design criteria and operating conditions between the AE
9 piston skirts and the other six piston skirts represented in
10 the tabulation?

11 That last portion was a quotation from your
12 testimony on page 53.

13 A You can compare cylinder bores. You can compare
14 brake mean effective -- brake horsepower per cylinder. And
15 you can compare firing pressures. And you can compare
16 general geometry such as locating the pin, the piston.

17 Q But you can't compare piston side thrust, can
18 you?

19 A Not without the additional data I indicated.

20 MR. DYNNER: Judge Brenner, I am going to renew
21 the County's motion, as you might have anticipated,--

22 JUDGE BRENNER: I'm shocked.

23 (Laughter.)

24 MR. DYNNER: -- to strike Staff Exhibit 7. The
25 grounds I think are fairly obvious. The witnesses have no

WRBeb

1 real knowledge of this information, of its source, of its
2 accuracy or completeness. They can, in fact, and have
3 testified they are unable from this material to make
4 calculations of side thrust in any of these engines and,
5 therefore, cannot make the relevant comparisons.

6 Furthermore, they have testified earlier to your
7 questions that they obtained this information from Ricardo.
8 They have not made any analyses or calculations of side
9 thrust from this material and therefore, it is hearsay of
10 the rank sort that you referred to the other day.

11 It is also unreliable testimony which should be
12 stricken under the regulations, and I would move to strike
13 their testimony which refers to this exhibit as well.

14 JUDGE BRENNER: Let me isolate a few factors
15 because you had several factors in your renewed motion to
16 strike.

17 To the extent that some of the factors in your
18 renewed motion to strike are of the nature that these
19 witnesses have not personally verified data in the table
20 because they obtained it from Ricardo Engineers, that would
21 not be grounds to strike it. We passed over that ground in
22 ruling on your initial motion to strike, and nothing has
23 occurred that changes that.

24 The very essence, in my view, of the Federal Rule
25 of Evidence 703 is that experts can rely on material which

WRBeb

1 it would be reasonable for an expert to rely on without
2 having to personally be involved in gathering up all the
3 data. So we will put that ground aside.

4 I am ruling that that does not support your
5 motion.

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1 However you have other grounds based on the
2 testimony you have adduced here before us today and which I
3 will characterize for your comment to agree or disagree with
4 as being that nothing in this table stands for what somebody
5 reading the testimony initially might have believed it to
6 stand for, namely information by which piston side thrust
7 can be compared to support the conclusion reached in the
8 testimony that there would be -- that the side thrust load
9 likely to be experienced by the AE piston skirt presumably
10 at Shoreham will be representative of what is demanded of
11 piston skirts in medium speed high-BMEP diesel engines today
12 based on these other engines.

13 Did I characterize the other part of your motion
14 correctly?

15 MR. DYNNER: Yes, sir.

16 JUDGE BRENNER: Let me ask the witnesses another
17 question, if I could.

18 Mr. Dynner asked you questions as to what the
19 support was for a sentence in your testimony -- well let me
20 ask my own question.

21 Look at the last sentence of your first answer on
22 page 53, which is in essence what I almost quoted in its
23 entirety just a moment ago, beginning "Furthermore in the
24 data..." have you read that, both of you?

25 (Witness indications of assent.)

WRBagb 1 JUDGE BRENNER: What is the basis for that
2 conclusion?

3 WITNESS HENRIKSEN: Mostly I based mine on my
4 experience with Nordberg where we did not -- we were not
5 concerned about this problem. I do not have data as to side
6 thrust, but our engines were operating at 250 BMRP as early
7 as 1973. I cannot calculate that because I cannot obtain
8 the necessary data, this is usually not data that engine
9 builders will part with and our data at Norberg -- at
10 Cooper-Bessemer, who took over our parts and service
11 business when Nordberg ceased to manufacture engines.

12 JUDGE BRENNER: All right.

13 Professor Sarsten, how about you?

14 WITNESS SARSTEN: I based my conclusion on the
15 geometrical.... Let's see the figure again -- on the
16 geometrical dimensions. The gas pressure is generally equal
17 -- similar, rather, for engines of this type. The peak
18 firing pressures, of course, vary more but they are at or
19 near top dead center. There is not much piston side thrust
20 then.

21 In order to get significant deviations, the
22 piston of the TDI R-4 engine had to deviate substantially
23 from the typical figures shown here. I did not see any
24 significant deviation. The connecting rod ratio is roughly
25 the same for all engines of this type, that's given by

WRBagb 1 design considerations.

2 So I don't see from this table that there should
3 be any significant differences in the side thrust between
4 the TDI and the other six engines in the table.

5 JUDGE BRENNER: Well how about -- the fact that
6 you cannot calculate the piston side thrust from the data in
7 this table, doesn't that undercut almost totally a
8 conclusion based on the data in this table that the piston
9 side thrust would be approximately the same or
10 representative, comparing all the engines in the table?

11 WITNESS SARSTEN: In order to get the exact
12 figures, of course, you would have to have the exact
13 digitized information similar to that which was shown
14 previously this morning. But there is not very much
15 difference in the PV diagrams of these engines. The maximum
16 piston side thrust will appear at approximately the same
17 position in these engines.

18 All I can say is that there will be no
19 substantial difference. I cannot give the exact figures.

20 JUDGE BRENNER: Okay.

21 Can you tell me what a PV diagram is?

22 WITNESS SARSTEN: I'm sorry, that's a
23 pressure-volume diagram, it gives the pressure inside the
24 cylinder along the stroke length.

25 JUDGE BRENNER: While I am at it -- I think I

WRBagb 1 know what most of the terms mean, but can you tell me what
2 the terms mean through the tops of the columns in this
3 table, the ones that are not obvious, starting with L/B?

4 WITNESS SARSTEN: All right. L/B is the ratio
5 length to bore.

6 The C/V is the ratio -- these are dimensional
7 numbers -- of the distance to the top of the piston, or, to
8 be more specific here, to the effective top of the piston.
9 They then subtracted the valve pockets. The ratio of this
10 height, C, to the cylinder bore.

11 The R to B is the height to the lower end of the
12 upper scraper ring, which then shows how much of this C
13 height is really effective as a bearing area.

14 The S/B is the same ratio applied to the lower
15 part of the piston, from the center line of the wrist pin to
16 the bottom of the piston.

17 The ratio alpha/beta refers to the right-hand
18 side, the angle to the top of the effective side thrust
19 bearing area to the bottom of the piston or the bottom of
20 the effective side thrust area.

21 The maximum firing is the maximum firing
22 pressure --

23 JUDGE BRENNER: I think those two are obvious.

24 WITNESS SARSTEN: All right.

25 JUDGE BRENNER: Give me a moment and, if

WRBagb 1 necessary, we will get responses.

2 (The Board conferring.)

3 JUDGE MORRIS: Professor Sarsten, I had a couple
4 of more questions. I note that in this tabulation one
5 cannot determine the length of the connecting rod, nor can
6 one determine the maximum angle that the connecting rod sees
7 during rotation.

8 With those two things missing, are you still able
9 to draw the conclusion that you have stated?

10 WITNESS SARSTEN: Yes. The connecting rod ratio,
11 lambda it is called, is a relatively fixed diameter. It
12 varies roughly for engines of this type from .22 to .25, so
13 it does not change very much.

14 JUDGE MORRIS: So that in your conclusion you
15 are making the assumption that the geometry that I have just
16 referred to is approximately the same for the TDI R-4 engine
17 as it is for these other engines?

18 WITNESS SARSTEN: Yes, that is true.

19 JUDGE BRENNER: Professor Sarsten, following up
20 on that, do you have any knowledge that any of these engines
21 fit within that range that you just gave? I know you don't
22 know about all of them.

23 WITNESS SARSTEN: No, I have not measured on any
24 of these engines. It is not one of the things that is
25 specified for an engine usually. You get it from -- if you

2 WRBagh

1 wish to have it, from looking at the drawings or
2 cross-section view.

3 JUDGE BRENNER: Let me be clear. I didn't ask
4 you if you personally measured it, I just asked you if you
5 knew.

6 WITNESS SARSTEN: No, I did not know for any of
7 these engines, apart from the TDI engine.

8 JUDGE BRENNER: That was going to be my next
9 question.

10 You said between .22 and .24.

11 WITNESS SARSTEN: .25, I said.

12 Let me see, I made some calculations of the
13 pressure volume diagram for the TDI engines. I believe the
14 figure was .22-something, around .23 specified input with
15 four digits. I cannot recall them now but it is sort of in
16 the middle of the ballpark.

17 JUDGE BRENNER: Mr. Goddard, do you want to
18 respond to the motion to strike at this time?

19 MR. GODDARD: Yes, Judge Brenner.

20 JUDGE BRENNER: And if you want to ask any of
21 your own questions at this time we will allow that also.
22 we will allow that also.

23 MR. GODDARD: Thank you, Judge Brenner.

24 Dr. Sarsten, when designing a medium-speed
25 high-BMEP four-cycle engine in modern practice, is piston

2 WRBagb 1 side thrust considered a significant consideration in
2 formulacing piston design?

3 JUDGE BRENNER: Wait a minute. The questions I
4 was gcing to allow you to ask now --

5 MR. GODDARD: I understand.

6 JUDGE BRENNER: -- was not your entire redirect.
7 Well I don't think... Your question doesn't lead
8 me to believe I made that clear.

9 That's not the kind of question I would allow
10 now.

11 It would be questions going to the use of this
12 table in support of the conclusion which is the remaining
13 ground supporting the County's motion to strike which we
14 have not yet ruled upon.

15 MR. GODDARD: Fine.

16 Dr. Sarsten, are you aware of whether the pistons
17 set forth in -- or the engines set forth in Staff Exhibit 7
18 are in common use today?

19 JUDGE BRENNER: Mr. Goddard, forgive me, I don't
20 mean to keep interrupting you.

21 Mr. Dynner, am I correct that you have never
22 argued in support of your motion to strike that these
23 engines are not in common use?

24 MR. DYNNER: That's correct, sir.

25 JUDGE BRENNER: So that is not in controversy.

WRBagb 1 If you don't have any questions you can respond to the
2 motion.

3 MR. GODDARD: I will drop the line of
4 questioning, Judge Brenner.

5 In response to the motion, I believe the
6 witnesses have testified that it is not -- or Dr. Sarsten
7 has testified that he can make comparisons from Exhibit 7
8 without knowing specific values of side thrust and that
9 these figures would put the TDI engines in approximately the
10 same range as the other engines. The data was provided to
11 them by Ricardo as indicated as a result of discussions
12 which were held there.

13 I would state that the arguments made by Suffolk
14 County, if anything, may go to the weight to be attributed
15 to this exhibit based upon lack of some personal knowledge
16 of the witnesses as to certain characteristics rather than
17 the admissibility of the table.

18 JUDGE BRENNER: Mr. Ellis, did you have anything
19 to add?

20 Don't repeat any arguments, only if you have
21 anything to add.

22 MR. ELLIS: Judge Brenner, I'm not sure that I
23 do, but I do feel compelled to say something.

24 As I understand the argument --

25 JUDGE BRENNER: Don't bother to repeat. Just

WRB:agb 1 tell me what your position is on the motion, I do want to
2 know that.

3 MR. ELLIS: We are opposed to the motion.

4 JUDGE BRENNER: All right.

5 Now do you have anything to add?

6 MR. ELLIS: Yes, I think I do, but I have been
7 mistaken in the past.

8 JUDGE BRENNER: If you think you do that's good
9 enough.

10 Go ahead.

11 MR. ELLIS: I believe that the thrust of the
12 argument now being considered by the Board is that the
13 information that is contained in the exhibit does not
14 support the opinion that is given in the testimony.

15 And the only question that I would add -- I'm not
16 sure that it has been clearly asked is the question -- May I
17 address it to Professor Sarsten?

18 Professor Sarsten, is the data contained in
19 Exhibit 7 adequate to enable you to form an opinion with
20 respect to whether side thrust will adversely affect the
21 operation of the AE pistons at Shoreham?

22 WITNESS SARSTEN: The table, to be very specific,
23 only allows me to say that the side thrust on the TDI piston
24 is not substantially different from the side thrust of other
25 engines in use today.

2 WRBagb

1 MR. ELLIS: And the data allows you to make that
2 relative comparison?

3 JUDGE BRENNER: Now that has been asked and
4 answered.

5 MR. ELLIS: Well I think based on that answer,
6 Judge Brenner, that it should be admitted for that purpose.

7 JUDGE BRENNER: Okay.

8 Mr. Johnson, did you have any position different
9 than the County?

10 MR. JOHNSON: No, your Honor.

11 JUDGE BRENNER: We are going to deny the motion
12 to strike. We believe the further answers of the witnesses
13 in response to the Board's questions primarily show the
14 bases for their conclusion and, given the bases as explained
15 by the witness, we do not now conclude that that conclusion
16 is entitled to no weight.

17 The questions of the County filled in part of the
18 picture and then our questions filled in the rest of the
19 picture. And together we now better understand the basis
20 for the conclusion and the record has been helped in that
21 regard and we will evaluate it all when we write our
22 findings.

23 BY MR. DYNNER:

24 Q Professor Sarsten, you testified in answer to one
25 of the questions that there is not much difference in the

WRBagb 1 pressure volume diagrams for these seven engines.

2 Have you inspected or seen the pressure volume
3 diagrams for any of these particular engines listed?

4 A (Witness Sarsten) Apart from number one,
5 obviously I have not seen any of the pressure diagrams from
6 the engines. I based my testimony on the fact that all the
7 engines today operate roughly under the same conditions; the
8 expansion stroke does not differ too much.

9 Q What's the basis for that statement? Have you
10 conducted an analysis or survey of each of these engines
11 that supports that statement?

12 A I have not conducted any analysis or any survey
13 of these engines which supports this analysis.

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WRBpp

1 Q Now in answer to a question from Judge Morris
2 concerning the length of the connecting rod, is it correct
3 that, in order to calculate piston side thrust, one of the
4 elements you need to know is the length of the connecting
5 rod to stroke?

6 A That's correct. The ratio is one of the factors
7 you have to know.

8 Q Well it's true, isn't it, that you have merely
9 made an assumption that the length of the connecting rod of
10 these six other engines on the table is approximately the
11 same as the length of the connecting rod to stroke on the
12 EDG's, isn't that true?

13 A That is true. I assume that the lambda ratio, as
14 it is called, is roughly the same for all these engines.

15 Q And you haven't made any analysis or survey to
16 determine whether or not that is a fact, have you?

17 A No, I have not. But I know from experience that
18 they do not deviate very much.

19 Q What's the basis of that experience if you
20 haven't conducted any surveys to each of these engines?

21 A Design considerations limit you to a relatively
22 small band of ratios. You don't want the engine to be too
23 tall, too expensive, but, on the other hand, you cannot
24 make the piston too short. It has to go -- I'm sorry -- the
25 connecting rod too short. It has to clear the piston. And

WRBpp

1 there are geometrical considerations also in the crank throw
2 mechanism, which limits you downwards, so you are pretty
3 well fixed between two limits.

4 Q What are those limits?

5 A As I testified previously, the lambda ratio
6 generally lies around .25 down to .21, .22, or something of
7 that nature.

8 Q Okay, you say generally. You don't know that
9 for a fact, with respect to any of these engines, other than
10 the Delaval engine; isn't that true?

11 A I have not measured it or calculated it for any
12 of these engines, that is true.

13 Q Now, in order to calculate what the effects of
14 side thrust might be, you would have to know the weight of a
15 piston, wouldn't you?

16 A The weight of the piston would also enter into
17 the picture, that is correct. But at this speed, this is a
18 relatively minor consideration. But it would have to be
19 added, yes.

20 I must add that the weight of the piston has its
21 major effect at top dead center. And it falls off down
22 along the stroke. So if you look at the calculation of the
23 TDI piston, the forces employed by FaAA in analyzing the
24 piston, you would see that the inertia force is a relatively
25 insignificant force at top dead center. But then, of

WRBpp

1 course, the gas pressure is higher. But the same, roughly,
2 holds for the down stroke.

3 Q Professor Sarsten, have you ever heard the term
4 maximum thrust pressure on a piston in terms of the pounds
5 per square inch, as a way of indicating the side thrust?
6 That term is -- I will repeat it for you -- maximum thrust
7 pressure on a piston.

8 A Yes.

9 Q And that term means the side thrust; doesn't it?

10 A Per unit projected.

11 Q Yes.

12 Now, I'm wondering if it would change your mind
13 -- strike that.

14 It's fair to say, isn't it Professor Sarsten,
15 that what you have said and the conclusions you have reached
16 concerning this table of Staff's Diesel Exhibit No. 7, is a
17 rough approximation based upon certain assumptions; isn't
18 that right?

19 A Perhaps I would strike the word rough
20 approximation. It's an approximation based upon certain
21 assumptions, yes.

22 But the connecting rod ratio, to refer to that,
23 is less -- doesn't vary as much as some of the other
24 parameters in this figure. And that's probably why Ricardo
25 has not included that. The other ratios, which are here,

WRBpp 1 vary more and are, perhaps, more important to the
2 consideration than the connecting rod ratios.

3 Q Now, it's true, isn't it Professor Sarsten, that
4 you have calculated that you would not expect -- or you have
5 testified that you would not expect to find any measurable
6 differences in side thrust for any of these seven engines
7 listed; isn't that true?

8 A That is not true. I would not say any
9 measurable. I used the word significant.

10 Q Significant, I'm very sorry.

11 Now, do you recall -- because you testified you
12 didn't make the calculation yourself -- do you recall what
13 the calculation in pounds per square inch was for the side
14 thrust on the AE piston in the EDG's?

15 A I do not recall the figure.

16 Q Well, let me try to refresh your recollection.
17 If you looked in Suffolk County testimony you would find, I
18 believe, that the side thrust in pounds per square inch,
19 given by Professor Christensen, was 123. And that the
20 number, that, I believe, testified to by the LILCO panel
21 was somewhere around 80 psi, does that refresh your
22 recollection? Do you recall that?

23 A Yes, but as I recollect also, the County's
24 testimony looked at what, to me, appeared to be the area of
25 the piston over an arc of 90 degrees, while it is customary

WRBpp

1 to specify this over the projected piston area.

2 Q Now, Professor Sarsten, do you know --

3 Did you want to add something?

4 A (Witness Henriksen) I think LILCO's figure at
5 around 80 was based on using the diameter for the projected
6 area.

7 Q But you remember those two figures, about 80 and
8 about 123, right?

9 A (Witness Sarsten) Roughly.

10 Q Now, do you know what the side thrust in pounds
11 per square inch for the Mirrlees "K" major, that's the
12 engine that's number 4 on your list here?

13 A No, I do not know what that is.

14 Q Now, in comparing the engines on this list, in
15 terms of side thrust, what would you consider to be a
16 significant difference?

17 A As we are not speaking as anything that is
18 critical and, based upon calculations using the same rules
19 for determining area and so on, I would say a significant
20 difference here would be a 50 to 60 percent difference.

21 Q A 50 percent difference?

22 A A 50 to 60 percent difference, I said.

23 Q So, do I understand your testimony now that, on
24 the basis of your review of this data, on Staff's Diesel
25 Exhibit 7, that you would not expect to find the side

WRBpp 1 thrust, on any of these seven engines to vary by more than
2 50 to 60 percent?

3 A No, I did not say that. If the side thrust --
4 let me see.

5 Some of these with large piston lengths like, for
6 example -- well, they're all slightly different in their
7 configuration -- but if referred to the same method of
8 calculation, I would not expect a difference of more than 50
9 to 60 percent between the TDI engine and other of these
10 engines.

11 Q You mean any of the others, sir?

12 A Let me see. If we had the rating -- the ones
13 that run at very, very low power may lie at the low end of
14 this.

15 Q Well, by very, very low power, what are you
16 referring to?

17 A All right. Let's rephrase that.

18 There may be difference, of course, according to
19 the rating of the engines. But I would be surprised if the
20 difference between the TDI and any of the other engines were
21 more than 60 percent. But it is not a significant figure, I
22 wouldn't attach great importance to it. As long as side
23 thrust isn't very significant, I would not attach a very
24 great importance to the figure. That's what I meant to say.

25 JUDGE BRENNER: To which figure? To your 50 to

WRBpp 1 60 percent figure, you mean?

2 WITNESS SARSTEN: Well, I'll try to rephrase
3 this. I'm not being quite clear.

4 Strike that whole sentence.

5 JUDGE BRENNER: No problem. Start again.

6 WITNESS SARSTEN: What I'm saying is that I would
7 not expect a difference of more than, say, 60 percent
8 between the TDI engines and the other engines. And even if
9 there were a greater deviation, I would not consider it
10 extremely important, because the side thrust, in my opinion,
11 has not been an issue in the design of such engines.

12 BY MR. DYNNER:

13 Q I'm trying to understand your last statement for
14 a minute, Professor Sarsten, and maybe you can help me.

15 You say that even if there were differences of
16 100 percent or more between the side thrust of the Delaval
17 engine and any of these other engines, that that would not
18 affect your conclusion that the data indicates that side
19 thrust load likely to be experienced -- the data indicates
20 that the side thrust load likely to be experienced by the AE
21 piston skirt will be representative of what is demanded of
22 piston skirts in medium speed high BMEP diesel engines
23 today? That's your written testimony on page 53?

24 A (Witness Sarsten) Right.

25 Q So 100 percent difference, you would still say

WRBpp

1 that's representative?

2 A No. What I was trying to say is that even if
3 some of these figures, or other engines for that matter,
4 should come up with large differences of the side thrust, it
5 would not change my conclusion as to the effect of the side
6 thrust on the adequacy of the pistons.

7 Q I understand your conclusion but, what I'm trying
8 to explore with you, sir, is what you conclude on the basis
9 of this particular data?

10 A All right.

11 Q That's what we have a discussion in the context
12 of the question and answer on the top of page 53. What I'm
13 getting at is, what are you -- what conclusions are you
14 basing on the data that is on this Exhibit 7?

15 A All right. The data indicates to me, as I would
16 anticipate before without seeing it, that there is not any
17 substantial difference in the geometrical ratios of the
18 pistons on medium speed four-stroke engines. And that the
19 piston side thrust there, of necessity, will not deviate
20 substantially between the engines.

21 Q Now, when you say will not deviate substantially
22 between the engines, is that different from saying that it
23 won't -- there won't be any significant difference, i. e, 50
24 to 60 percent? Or do you mean another figure now?

25 A No, I would be surprised if the differences here

WRBpp

1 if, when calculated, were more than 50 to 60 percent.

2 Q And if the differences were more than 50 to 60
3 percent, then this wouldn't be representative and it
4 wouldn't show, by this data, that your conclusion is
5 correct; isn't that true?

6 A The conclusion about the side thrust is not
7 altered. You're not referring to --

8 Q No, I'm talking about the question and answer on
9 the top of page 53 of your written testimony, where you are
10 asked about a question and then you refer to this exhibit
11 and the data in this exhibit. And that's all I'm talking
12 about.

13 A And your question was -- please rephrase it -- or
14 please repeat it, I'm sorry. I'm not implying that it was
15 not clear.

16 MR. DYNNER: Will you re-read the question
17 please?

18 (The reporter read the record as requested.)

19 MR. ELLIS: I object. The question is compound.

20 JUDGE BRENNER: My ruling on this substance is
21 going to overrule the objection. We will let the witness
22 answer. My ruling on procedure is that having a question
23 re-read is not an opportunity to object to the question
24 late, when the original question was not objected to.
25 And I hope the witness has not forgotten the question now,

WRBpp

1 which was the point of having it re-read.

2 WITNESS SARSTEN: Well, almost so.

3 I think my answer would be affirmative, as I
4 remember the question.

5 JUDGE BRENNER: You cannot stay with that,
6 Mr. Dynner. Given that answer by the witness, I want you to
7 know that I won't assume it is a correct answer. I am
8 worried about --

9 MR. DYNNER: I'm worried about what affirmative
10 means now. j

11 JUDGE BRENNER: You are with me. You had better
12 put the question again.

13 MR. DYNNER: Let me try again. I'm sorry for the
14 confusion, Professor.

15 BY MR. DYNNER:

16 Q If you look at your answer on page 53, that
17 answer is talking about the conclusions that you base on the
18 data, which is in Staff's Diesel Exhibit 7, isn't that
19 right?

20 A (Witness Sarsten) Right.

21 Q Now if you found, contrary to your current
22 belief, that there were differences between the side thrust
23 of the TDI R48 engine and any of these other engines on this
24 list of greater than 50 to 60 percent, then it's true that
25 this data would not support your conclusions; isn't that

WRBpp

1 correct?

2 A I would like to refer to the average of the
3 engines shown. There may be some having extremely low
4 values for some reason or other, if you got all the data
5 there, and the pressure diagrams.

6 Q What is the average, Professor Sarsten?

7 A Of all these? You would have to calculate them,
8 of course.

9 Q Well, you haven't done that, have you?

10 A No, and no one has done that.

11 Q So you're saying some of these engines might have
12 a side thrust of 100 percent or even greater, less than or
13 more than the Delaval diesel, right? And that still would
14 not -- you would look to the average then; is that what
15 you're saying?

16 A No. I'm not saying that any of these have 100
17 percent above or below what the TDI engine has. But in
18 order to offer a fair comparison, if you wanted to do that,
19 you would have to calculate all these side thrusts and then
20 view the TDI side thrust in comparison to that.

21 I still contend that the TDI engine has a side
22 thrust based upon this table, which does not deviate
23 considerably or substantially from the side thrust of other
24 engines which you would be likely to compare it with. You
25 might find some engines in this table which are lowly rated

WKBpp

1 and have very low side thrusts, for all I know. But I would
2 be very surprised if the TDI engine has a substantially
3 greater side thrust than the highest figure you find in this
4 table.

5 I would like to believe that-- Looking at the
6 figure here, I do not think that the TDI engine has a side
7 thrust which is substantially above the largest of the side
8 thrusts shown here.

9 In fact, it probably -- it's hard to say on the
10 basis of this figure, let's face that. We're speculating,
11 all of us.

12 Q Thank you

13 Gentlemen, I want to cover just one other area
14 for a moment, and it involves your conclusion on page 55. I
15 would like to read this and your conclusion with you now for
16 a moment, based upon the testimony that you have given
17 today. And particularly on the effects of the experience of
18 the R5 AE pistons that you saw that we talked about, and ask
19 you whether it is still your conclusion that, based upon
20 that information and other things we have talked about here
21 today, that your conclusion remains that the AE piston
22 skirts are suitable for nuclear service for one refueling
23 cycle?

24 A (Witness Henriksen) I do.

25 A (Witness Sarsten) I do.

1 WRBeb

1 Q And since you are not taking into consideration,
2 as you have testified, FaAA reports but only the experience
3 of Grand Gulf, -- two things in your testimony, Grand Gulf
4 and the two R-5 pistons, is it your belief that that
5 experience is sufficient, in and of itself, to justify the
6 suitability for nuclear service of the AE pistons in
7 Shoreham?

8 A (Witness Henriksen) As stated in the testimony,
9 the major weight in this decision was put on the R-5 two
10 piston experiences.

11 And let me add that one of the reasons for
12 wanting a full inspection after one refueling or before --
13 even before going into nuclear service we would like all
14 pistons to be inspected, would be that we certainly welcome
15 more data on the subject.

16 Q Gentlemen, the date your testimony was filed
17 appears to be August 30th, 1984. Isn't that correct? It is
18 on the first page where there is a cover letter from
19 Mr. Goddard to the Administrative Judges.

20 A As I recall, that is correct.

21 Q Now also entered into evidence by the Board was
22 the Safety Evaluation Report that was prepared by the
23 Staff. That is also in evidence, and it's dated August
24 13th, 1984.

25 Do you have that document handy?

1 WRBeb

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JUDGE BRENNER: Just refresh my recollection. We

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admitted that into evidence?

3

MR. DYNNER: Yes, sir, you did.

4

JUDGE BRENNER: I'm totally blank on it. I will

5

be candid with you, I don't recall our ruling admitting any

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Staff testimony into evidence, that we admitted that into

7

evidence.

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MR. DYNNER: We can have somebody check the

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transcript but I'm quite certain that it was admitted into

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evidence at the request of the Staff, I think the first day.

11

JUDGE BRENNER: Well, the day we bound all the

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Staff testimony in was September 20th.

13

MR. DYNNER: I don't remember the exact date, but

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I'm quite sure that it was admitted into evidence. And we

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certainly can check that.

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JUDGE BRENNER: I would like to see the

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transcript on our ruling.

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MR. DYNNER: Would you like to see that now or—

19

JUDGE BRENNER: I don't recall that it is in

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evidence. I want to be honest with you. I have no

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recollection now that at the time we were admitting that SER

22

into evidence. It is not an exhibit. Am I correct?

23

MR. DYNNER: It is my recollection that it was

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admitted at the time that the Staff's testimony was admitted

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into evidence. And I would be happy to have that checked,

1 WRBeb

1 either now or later on, or I can go ahead and complete my
2 questions concerning it if the witnesses have it handy, and
3 we can check it later, whatever you prefer, sir.

4 JUDGE BRENNER: If you are going to proceed on
5 it, I just did not realize that we were admitting it into
6 evidence. I remind you that we admitted nothing into
7 evidence on that particular day other than the particular
8 shot-peening pages identified.

9 We allowed the Staff to bind its entire testimony
10 in for convenience, but I did not realize I included the
11 SER. At least I don't presently realize that that included
12 the SER.

13 MR. DYNNER: You are getting me afraid that I
14 might be mistaken, so we can certainly check that point.

15 JUDGE BRENNER: I can do it in a moment.

16 MR. DYNNER: All right, fine.

17 (Pause.)

18 JUDGE BRENNER: The transcript was here all
19 along, as it turns out.

20 The Staff testimony follows transcript page
21 23,128, using the old transcript. Hopefully the pagination
22 won't change when the new one is issued. And let me back up
23 to where we discussed what would be admitted. I don't know
24 whether it was bound in or not, but that is not the
25 controlling factor anyway.

1 WRBeb

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2 I am sorry for the interruption, but it is just
3 that I did not remember, and if you are going to proceed on
4 a certain assumption, I want to check myself on it.

5 On page 23,125, I granted the Staff's motion to
6 admit the portion of testimony just identified as being
7 sponsored by Dr. Bush into evidence, and it was just the
8 shot-peening and the two questions on forging. And I said
9 for convenience we will bind in the entire joint testimony
10 of the other Staff witnesses which consists of 55 pages,
11 plus attachments, which contain the witnesses' professional
12 qualifications.

13 And I did that in anticipation of the very thing
14 that has occurred this week. As we get to each subpart, we
15 are admitting it into evidence, relating back to the fact
16 that it is bound in. But those 55 pages is just the joint
17 testimony and the professional qualifications. And that is
18 all I had in mind at the time.

19 Now if Mr. Goddard identified more than that at
20 the time, I didn't realize that or incorporate it in my
21 ruling at 125 and 126. And frankly, I would have had to
22 stop and consider at that time whether that document should
23 be admitted into evidence in its entirety, although maybe I
24 would not have if there were no objections. But that is
25 where it stands.

25

Mr. Goddard, you did not at any time move that

WRBeb

1 Safety Evaluation into evidence, did you?

2 MR. GODDARD: Not at this time. At such time as
3 we plan to use it, we would of course move to the
4 appropriate parties that the SER be admitted into evidence,
5 as normally is the case in a licensing proceeding.

6 JUDGE BRENNER: No, it is not normally the case
7 in an operating license proceeding, at least not in this
8 case. I won't go into it because a lot of reasons may not
9 apply here because this was the Safety Evaluation
10 particularly for the diesels.

11 MR. GODDARD:

12 JUDGE BRENNER: We only admit that into evidence
13 which is material to the issues in controversy. There are a
14 lot of things in general licensing SERs that are not
15 material to the issues in controversy.

16 That precept is what would give me trouble with
17 respect to the Safety Evaluation here. I don't want to
18 admit anything into evidence other than that which is
19 relevant to the issue in controversy before us, which has
20 several subissues involving, as you know, the crankshafts
21 and pistons and so on.

22 MR. GODDARD: The Staff did not move for its
23 admission on the 20th.

24 JUDGE BRENNER: It is not in evidence.

MR. DYNNER: I am going to--

1 WRBeb

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JUDGE BRENNER: If you want to ask about it, feel

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free.

3

MR. DYNNER: I recall specifically your Honor responded to Mr. Goddard's request concerning the SER which he had made in writing, as you will recall, somewhere in this testimony. I am going to find it, and it is not going to be today, right now, because we all want to get home, but I will certainly conduct a search.

9

It may be that I'm mistaken, that it was identified for the record and not admitted into evidence. I thought it was admitted into evidence, but anyway I'll find the spot somewhere.

13

JUDGE BRENNER: Anyhow, at the point of admission of the testimony and even at the point of binding in testimony for convenience, I did not mean to include that, and now as I read 23,125 and 126, I did not include that. I tried to be careful. That is why I go through the routine about the number of pages sometimes, and so on. I have been in cases where there were problems in that regard.

20

In any event, you may find a place where we talked about it on the transcript. I am not telling you you won't find it. All I am telling you is I don't remember it. I certainly remember something in Mr. Goddard's letter involving — that he might intend to move that in, but we didn't act on it.

24

25

1 MR. DYNNER: All right. I will just, if I may,
2 proceed to ask some questions about the SER and we will try
3 to clear up the misunderstanding. And if I misspoke about
4 its having been admitted, it was due to my own lapse of
5 memory rather than through anything, obviously, that was
6 intentional.

7 JUDGE BRENNER: The only reason I stopped you is
8 I want you to ask your questions as if it is not in
9 evidence.

10 MR. DYNNER: All right.

11 JUDGE BRENNER: And that may change the way you
12 ask questions about it, as you can imagine. And if it later
13 becomes necessary to mark something for identification or
14 admit portions of something into evidence, we can deal with
15 it.

16 MR. DYNNER: Thank you, sir.

17 BY MR. DYNNER:

18 Q Gentlemen, if you have the document....

19 MR. DYNNER: Mr. Goddard, can you help your
20 witnesses with a copy of the SER, please?

21 (Document handed to the witnesses.)

22 JUDGE BRENNER: Are you going to finish soon,
23 Mr. Dynner?

24 MR. DYNNER: Yes, sir, I am. This is the last
25 area, and it will be relatively brief, I believe.

WRBeb

1 BY MR. DYNNER:

2 Q Gentlemen, as you can see by the first page,
3 which is a letter from Mr. Eisenhut of the Staff dated
4 August 13th, 1984, that has attached to it the Safety
5 Evaluation Report that I'm referring to by the Staff.

6 Will you please turn to page 15 of that document?

7 Now, gentlemen, let me ask you preliminarily,
8 have you reviewed this document previous to today?

9 A (Witness Henriksen) I may have read through it
10 but I cannot really say that for sure.

11 Q You are both consultants to Pacific Northwest
12 Laboratories who, in turn, are working with the Staff on the
13 issue of the EDGs, aren't you?

14 A Correct.

15 Q Now you see what it says in the first full
16 paragraph on page 15:

17 "The Staff and PNL have not yet made
18 conclusions regarding the applicability of the R-5
19 engine experience with AE pistons. However, if the
20 Staff finds that the R-5 experience verifies the
21 adequacy of AE pistons at full rated load, the
22 185 psig BMEP criterion above will remain
23 operative in view of concerns regarding other key
24 components, particularly the crankshaft."

25 Do you know gentlemen, whether you were

1 WRBeb

1 involved at all in the deliberations that are referred to,
2 or the conclusions of the Staff and PNL in this regard?

3 A I was.

4 Q Professor Sarsten?

5 A (Witness Sarsten) I was, at least in part, on
6 some of the components, yes.

7 Q Now if you take that statement and you look back
8 — and I would ask you to turn for a moment back to page 13,
9 to see what criterion refers to.

10 There is a sentence that says, and I quote:

11 "For engines where emergency service
12 load requirements involved a BMEP greater than
13 185 psig, the utility shall provide information
14 demonstrating that crankshafts, pistons, and other
15 T-engine components as identified below, which are
16 of the same design as those in the subject engines,
17 have operated successfully for at least 10 to the
18 seventh loading cycles under loading conditions
19 which meet or exceed the severity of the maximum
20 emergency service load requirements for the
21 subject engines."

22 Then it goes on to suggest that:

23 "Where appropriate operating experience
24 does not already exist relative to this qualified
25 load, a test of an engine with the same design of

1 WRBeb

1 these key elements for 10 to the seventh cycles
2 will be required to establish an adequate qualified
3 load for the subject engines."

4 So this document reflects, doesn't it, a
5 conclusion that until experience of 10 to the seventh
6 loading cycles at the qualified load is accumulated that the
7 AE pistons should not be used in engines operating at more
8 than 185 BMEP. Isn't that correct?

9 MR. ELLIS: Judge Brenner, I object to that
10 because it is taken out of context, and the witnesses ought
11 to be given an opportunity to read the entire document. The
12 one whom he asked said he could not remember whether he had
13 reviewed it before or not.

14 JUDGE BRENNER: I am going to overrule the
15 objection and we'll see what they know about it. At times
16 in this proceeding I was tempted to ask the very question
17 Mr. Dynner asked before he got into this, and that is you
18 are the same people who are also working for PNL who also
19 work for the Staff who put some of the documents together,
20 aren't you? And I will leave that at that.

21 We will allow the question.

22 WITNESS HENRIKSEN: It may not appear here to be
23 this way but as I recall — and I don't recall this exact
24 document, but I recall the reason for establishing 185 BMEP
25 as the upper limit at that point was a particular concern

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1 about the crankshaft on 16 cylinder engines where we did not
2 have any experience data sufficient to allow the engines to
3 be run at a higher load.

4 This was primarily written during the
5 certification of the Grand Gulf and Duke Power engines.

6 The pistons— We did have some concerns about
7 pistons at that time. We had not yet looked at any more
8 pistons. We feel, after having looked at the pistons, and
9 having also assured ourselves that the AE pistons at
10 Shoreham, in our estimation, is an improved design over the
11 R-5, we gained a little more confidence in this area.

12 BY MR. DYNNER:

13 Q Mr. Henriksen, let me ask you, to help you
14 refresh your recollection, to look at the bottom of page
15 14. There is specifically says:

16 "The 185 psig BMEP criterion above
17 reflects existing PNL and Staff concerns regarding
18 the limited design margin available to certain key
19 engine components, particularly the piston skirts
20 and crankshaft, while the engine is operated at
21 full rated load."

22 That indicates, doesn't it, that there was
23 particular concern with the AE piston skirts, doesn't it?

24 MR. ELLIS: I object to the question because he
25 stopped at the very sentence that goes on to explain it.

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JUDGE BRENNER: I am going to allow the question,
2 and maybe a further explanation would help you, Mr. Ellis.
3 He is not pulling the document out of left field here and
4 asking the witnesses what they know about it, unlike some of
5 my comments on the Salzer article and more particularly, the
6 other British Engine article the other week.

7

This is a Safety Evaluation prepared by and/or on
8 behalf of the Staff who, after all, is a sponsoring party of
9 these witnesses. And if they don't know they can say so,
10 and we'll draw some conclusions from that also.

11

MR. ELLIS: My objection just went to the fact
12 that the next sentence—

13

JUDGE BRENNER: I understand. But I made my
14 statement and I think it applies to some of the
15 considerations involved. I'm sure you don't realize it;
16 it's late in the week and I don't want to end on this note
17 with you, so I will just say it as a gentle reminder:

18

I appreciate zealous representation of a client,
19 and it is to be commended, but when you get a ruling, that's
20 the ruling and I don't want to have to keep repeating it or
21 rearguing a ruling.

22

Do you recall the question?

23

WITNESS HENRIKSEN: I would like to have it
24 reread, please.

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BY MR. DYNNER:

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Q The question was very simple. I was referring you to the sentence at the bottom of page 14 to refresh your recollection that the piston skirt was in fact of particular concern when the engines operated at full rated load. And that is true, isn't it?

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1 A (Witness Henriksen) At that particular time it
2 was, yes.

3 Q Now to go on, the next sentences which were
4 alluded to by Mr. Ellis, why don't you take a look at those
5 for a minute, because they have reference to the two AE
6 piston skirts in the R-5 engine — I'm sorry, to the....
7 Well it's not clear. Let me rephrase the question.

8 In the next two sentences it says:

9 "With regard to the piston
10 skirts, however, AE piston skirts have
11 accumulated in excess of 6000 hours
12 without failure."

13 What is that experience referring to, gentlemen,
14 the 6000 hours?

15 A I will have to assume that this is experience
16 accumulated on the Kodiak engine.

17 Q Yes, and we have already seen in prior testimony
18 that those engines were run at firing pressures of
19 approximately 900 to 1300 psi, isn't that true?

20 A That is correct.

21 Q And that's substantially less than the firing
22 pressures and peak at full load for the Shoreham EDG's,
23 isn't it?

24 A Correct.

25 Q And in fact you didn't even refer to those hours

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1 in your direct testimony as being supportive of your
2 conclusion, did you?

3 A I did state, I think, that all experience is
4 important.

5 Q All right.

6 Now it's true, isn't it, gentlemen, that as this
7 document states as of its date -- which presumably was
8 August 13, 1984 -- no conclusions had been made about the
9 applicability of the R-5 engine; that the Staff was saying
10 through the SER that even if it had conclusions in that
11 regard it would still have concerns about the 185 psig BMEP
12 criterion until concerns about other components, including
13 the crankshaft, were made.

14 Given that, I'm very interested as to what
15 evidence occurred or what happened so that between August 13
16 and August 30 of 1984 when you filed your testimony the
17 conclusion that you stated in the SER was changed to the
18 conclusion that is stated in your testimony on page 55.

19 MR. ELLIS: I object to the question. There was
20 a long predicate which I believe mischaracterized the second
21 paragraph on the top of page 15.

22 JUDGE BRENNER: I'm going to allow the question.
23 I have made this speech many times: they are expert
24 witnesses, they can handle a question like that. And if
25 they don't know because of lack of familiarity with the

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1 document, we can hear about it in the answer.

2 WITNESS HENRIKSEN: Answering for myself, the
3 difference between my opinion at that time and at the time
4 we wrote our testimony was that at the time we wrote the
5 testimony we had occasion to look at the piston drawings of
6 both the R-5 AE version and the Shoreham version. Up to
7 that time we had nothing but a verbal assurance that the two
8 pistons were identical or interchangeable.

9 In fact, looking at the piston drawings it was
10 fairly clear that, if anything, the Shoreham pistons were
11 superior in strength to the R-5 pistons and not necessarily
12 in the contested area but as a piston as such it was
13 stronger.

14 BY MR. DYNNER:

15 Q In the contested area you're saying, as you
16 testified earlier, that the R-5 engine would tend to show
17 less stress or less — or that there would be, because of
18 the polishing of the boss area of the R-5 engine, there
19 would be a difference between that and the Shoreham?

20 A (Witness Henriksen) I am not now talking about
21 surface conditions. I'm talking about design.

22 Q And on that basis you determined that the two R-5
23 pistons or the two AE piston skirts in the R-5 engine would
24 be sufficient to change your opinion, is that correct?

25 A Yes.

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1 Q Professor Sarsten, is that also your testimony?

2 A (Witness Sarsten) That is also my testimony.

3 I must also add that I think we reviewed this
4 slightly earlier than the date referred to there. There is
5 a time lag here and my memory may be wrong.

6 I personally was also concerned with what I
7 believed to be a difference in the piston crown between the
8 R-5 version and the Shoreham AE pistons. I suspected that
9 there was a dishing of the mating surfaces which changes the
10 stress level in the piston crown and skirt. Later, when we
11 got the drawings, I also verified with the plant and we
12 found there was no dishing, that the mating surfaces were
13 indeed flat, both in the R-5 pistons and in the AE pistons
14 at Shoreham. So that changed my view on the piston skirts.

15 Q But gentlemen, if you look at page 15 that we
16 alluded to previously of the SER, it says that:

17 "Even if the Staff finds that
18 the R-5 experience verifies the adequacy
19 of the AE piston skirts at full rated
20 load, the 185 psig BMEP criterion above
21 would remain operative in view of concerns
22 regarding other key components, particularly
23 the crankshaft."

24 Why doesn't your conclusion in your testimony on
25 page 55 reflect that fact, or was there a change in the

2 WRBagb

1 Staff's position?

2 A (Witness Henriksen) Reading the sentence it
3 seems clear that we were more concerned with the crankshaft
4 at this point than the pistons.

5 Q One last question.

6 Is it your position that in fact you do not
7 believe that the AE piston skirts will be suitable for
8 nuclear service for one refueling cycle in the Shoreham
9 EDG's until after at least one Shoreham EDG has been run for
10 ten to the seven cycles in order to alleviate your concerns
11 about the crankshaft?

12 A This certainly would improve our confidence
13 level.

14 Q Isn't that, in fact, your conclusion?

15 A No, our conclusion was that all pistons should be
16 inspected prior to — obviously my inspection verified that
17 they are free of any faults. Our general conclusions in the
18 pre-text obviously referred to ten to the seven. That would
19 be the Staff's preference.

20 MR. DYNNER: The County has no further questions
21 at this time.

22 JUDGE BRENNER: I don't know if we are going to
23 complete this today or not, I have my doubts.

24 How much do you have, Mr. Goddard?

25 MR. GODDARD: Probably 10 to 15 minutes of

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1 questions for these witnesses.

2 JUDGE BRENNER: Mr. Ellis, how about you?

3 MR. ELLIS: I would say 30 to 45 as a minimum.

4 JUDGE BRENNER: The Board has questions also.

5 Why don't we see if we can complete the redirect at least?

6 REDIRECT EXAMINATION

7 BY MR. GODDARD:

8 Q Gentlemen, on page 52 of your testimony you
9 stated the conclusion that "...the piston skirts
10 installed in the Shoreham engines appear to
11 be superior to those installed in the R-5 engine.'

12 At the time that this testimony was written, did
13 you know that the insides of the wrist pin boss area on the
14 R-5 engines had in fact been polished?

15 A (Witness Henriksen) No.

16 Q Knowing now that that area has been polished on
17 the R-5 piston skirts, does that affect your conclusion as
18 stated in that paragraph I read?

19 A No.

20 JUDGE BRENNER: Mr. Goddard, can I interject for
21 a moment?

22 MR. GODDARD: Please.

23 JUDGE BRENNER: Gentlemen, is it your belief that
24 the wrist pin boss area — the term used by Mr. Goddard in
25 his question to you — is the area that was polished for

1 WRBagb

1 the R-5 engine?

2 WITNESS HENRIKSEN: No. I think we were
3 referring to the area around the bolting, the stressed area.

4 JUDGE BRENNER: You mean the stud boss area?

5 WITNESS HENRIKSEN: Yes.

6 JUDGE BRENNER: And that's what you had in mind
7 when you answered Mr. Goddard's question?

8 WITNESS HENRIKSEN: Yes.

9 JUDGE BRENNER: All right. You have to listen to
10 the question.

11 Go ahead, Mr. Goddard.

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1 MR. GODDARD: Thank you.

2 BY MR. GODDARD:

3 Q Mr. Henriksen, you stated this morning that you
4 had observed the piston which is shown in Suffolk County's
5 Exhibit 71 for identification, the photograph that was
6 presented to you this morning.

7 A (Witness Henriksen) I stated I believed that's
8 the piston, yes.

9 Q And I believe you also testified that you were
10 unable to inspect the cylinder liners at the time that
11 you inspected this and the other pistons from Engine 103, is
12 that also correct?

13 A That is correct.

14 Q In your opinion is the piston portrayed in
15 Exhibit 71 presently suitable for nuclear standby service in
16 one of the diesel generators at Shoreham?

17 A I think I also stated that in order to make a
18 full evaluation of this piston I would have to also see the
19 corresponding liner.

20 Q In the absence of being able to observe the liner
21 in which this piston was operated, are you capable of
22 drawing any conclusions about the present condition of this
23 piston?

24 A I cannot quite visualize being able to see the
25 piston without seeing the liner and then draw a conclusion.

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1 but I will try.

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1 but I will try.

2 I would have to assume this was abnormal and I
3 think I would ---

4 JUDGE BRENNER: I can't hear you, Mr. Henriksen.

5 WITNESS HENRIKSEN: I believe I would remove the
6 piston and replace it, if this was the only evidence I could
7 look at.

8 BY MR. GODDARD:

9 Q Mr. Henriksen, you testified this morning that
10 you concluded that the pistons are suitable for one
11 refueling cycle because you believe all should be inspected
12 after the first refueling cycle.13 Can you elaborate on the basis for your
14 conclusion that the pistons should be inspected after the
15 completion of one cycle?16 A (Witness Henriksen) Yes. It obviously would be
17 beneficial to see more pistons to support the position that
18 the pistons are suitable. This affects a lot of other power
19 stations. The longer the history you can get the more
20 valuable the information becomes.21 Q Professor Sarsten, in modern engineering practice
22 is excessive piston side thrust a significant concern in
23 designing medium-speed diesel engines of the size we are
24 considering?

25 JUDGE BRENNER: Mr. Goddard, that has been asked

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1 and answered.

2 MR. GODDARD: Very well. The Staff has no
3 further questions.

4 JUDGE MORRIS: In view of the time I think the
5 Board will ask a few questions and probably not get to LILCO
6 today.

7 MR. ELLIS: Thank you, Judge Morris. I have an
8 airline reservation I would rather not change. Thank you.

9 EXAMINATION BY THE BOARD

10 BY JUDGE MORRIS:

11 Q Mr. Henriksen, with respect to the tin coating on
12 the cylinder, there was some discussion in prior sessions of
13 making measurement to assure that the coating was not too
14 thick.

15 Is your opinion today that such measurements
16 prior to operation of those piston skirts is not necessary?

17 A (Witness Henriksen) No. They should not be
18 necessary.

19 We had a long dissertation by Dr. Schwanger how
20 to control it. If this is the procedure used, I am
21 satisfied with the tin coating.

22 Q Professor Sarsten, do you agree?

23 A (Witness Sarsten) Yes, I was satisfied with that
24 explanation.

25 Q Mr. Henriksen, with respect to the scuffing, am I

1 WRBagb

1 correct that there was only one skirt at Shoreham that
2 showed the scuffing?

3 A (Witness Henriksen) No, there were scratches and
4 streaking in all of the other pistons, too, but not very
5 markedly so.

6 Q With respect to the scratching, how many skirts
7 did you observe with that scratching?

8 A Eight.

9 Q And was there any preferred orientation of the
10 scratching with respect to the orientation of the cylinder
11 within the engine?

12 A They were all on one side of the piston.

13 Q Which side was that?

14 A I would have to assume it would have to be the
15 piston that was most heavily -- the side that was most
16 heavily loaded during the firing stroke.

17 Q You would assume it, but --

18 A The pistons are not marked front and back.

19 Q You cannot tell from the orientation of the wrist
20 pin?

21 A Not the way the pistons were positioned.
22 Geometrically the pistons are even on both sides.

23 Q As a matter of clarification, did you look at the
24 skirts from all three engines or just one engine?

25 A No, only one engine was available at that time.

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JUDGE BRENNER: Let me see if I understand.

2

You found scratches on eight out of the eight

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piston skirts you looked at?

4

WITNESS HENRIKSEN: That's correct.

5

JUDGE BRENNER: Thank you.

6

BY JUDGE MORRIS:

7

Q On the skirt where the pin was missing, were you

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able to identify the orientation of that cylinder with

9

respect to the missing pin?

10

A (Witness Henriksen) No, I just assumed it was

11

the most heavily loaded side.

12

JUDGE MORRIS: That's all I have for now. Thank

13

you.

14

BY JUDGE FERGUSON:

15

Q Let me start with just a few basics and then I

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have one or two other matters I would like to ask you about.

17

This goes back to a question that Mr. Dynner

18

asked you about, I believe, Professor Sarsten, and I simply

19

want a definition in the record and perhaps the definition

20

may help the record.

21

There was a discussion about brake mean effective

22

pressure and there was also the word indicated mean

23

effective pressures.

24

Would you define both of those for us and

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indicate the distinction?

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1 A (Witness Sarsten) I would first like to define
2 mean indicated pressure without the "effective."

3 That is the average, to put it in laymen's terms,
4 the average height of the pressure volume diagram or the
5 average magnitude of the driving force on the piston
6 throughout one cycle -- to put it that way, one power
7 stroke.

8 However, if you look at the output shaft, you
9 will there register a certain number of kilowatts or
10 horsepower or brake horsepower. You can convert this to an
11 equivalent brake mean effective pressure which will be less
12 than that indicated or measured in the cylinder due to the
13 mechanical efficiency of the engine or the pumps, et cetera,
14 driven off the crankshaft.

15 Q Is there any situation that you can envision
16 where the two will be of equal magnitude?

17 A No, that would be the so called perpetuum mobile,
18 an engine which runs without friction and I cannot envision
19 such an engine ever being designed, unfortunately.

20 Q Thank you very much.

21 Now I would like to turn to a question that has
22 to do with the conclusions that you were not able to draw on
23 page 49 of your testimony. There is a question in the
24 middle of the page on 49 -- there is a question at the
25 middle of page 49 of your testimony and the question says:

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1 "Have you drawn any conclusions from your
2 review of the FaAA analysis with regard to crack initiation
3 in the piston skirts?" And your answer is, "No." You go on
4 to say that, "The area in question is of intricate design
5 and some of the determining values, although claimed to be
6 conservative are admittedly assumed. As stated in the
7 conclusions, the FaAA report, page 8-1, the analysis is
8 inconclusive as to whether cracks were initiated or not."

9 There is a further question on that same page.
10 It says, "Have you drawn any conclusions from your review of
11 the FaAA analysis with regard to crack growth if cracks are
12 initiated in the piston skirts?" And again your answer is,
13 "No."

14 You have an additional part to your answer which
15 simply says, "Since the analysis of crack growth is based
16 largely on the same input data as was the crack initiation
17 analysis, we have been unable to draw a firm conclusion
18 regarding whether or not cracks that might initiate will
19 grow."

20 In each of the answers that I have read, you
21 refer to the FaAA analysis.

22 Now, I turn to the FaAA analysis, and I ask you:
23 Based on the conclusions of that analysis -- and
24 incidentally, a copy of that analysis is in the Suffolk
25 County Exhibit No. 8, and the part that I want to ask you
26 about is on page 8-1 of that exhibit.

1 WRBeb

1 I believe you have that document in front of
2 you. Is that correct?

3 A (Witness Sarsten) That's correct.

4 Q I would like to call your attention to the first
5 of the conclusions that are listed there, and in particular
6 I would like to call your attention to the part of the first
7 conclusion that says:

8 "Based on experimentally measured
9 stresses, fatigue cracks are predicted neither
10 to initiate nor to propagate in the AE skirt."

11 Now I emphasize that that is based on
12 experimentally measured stresses.

13 Then the next part of that conclusion says:

14 "Finite element stress analysis
15 combined with fatigue analysis predicts that
16 cracks may or may not initiate in the AE skirt...."
17 and so forth.

18 Am I correct in understanding these conclusions
19 to say that the experimentally measured stresses will
20 indicate that -- or indicate that cracks will not propagate
21 whereas the analysis indicate that they may or may not? Is
22 that correct?

23 A (Witness Henriksen) This would be our
24 interpretation.

25 Q Is that the interpretation that you--

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2 MR. ELLIS: Judge Ferguson, I am most reluctant
3 to interrupt your questioning but I thought you asked him a
4 question about whether or not the cracks would propagate and
5 it says very clearly that even if they initiate on the
6 analysis they will not propagate.

6

JUDGE FERGUSON: I thought I made that clear.

7

BY JUDGE FERGUSON:

8

Q Did you have an understanding also--

9

MR. ELLIS: I don't believe it was in your
10 question as I heard it, but I may have been mistaken.

11

BY JUDGE FERGUSON:

12

Q What was your understanding?

13

A (Witness Henriksen) My understanding of your

14

15 question was that, based on the experimental values, the
16 piston would not crack, number one; based on the analytical
17 calculations it may crack.

17

Q It may or it may not?

18

A It may or it may not.

19

MR. ELLIS: And I think he used the word that it
20 would propagate, and that's what the conclusion does not say
21 that it would do.

22

BY JUDGE FERGUSON:

23

Q Did you say that?

24

A (Witness Henriksen) I didn't say that.

25

JUDGE BRENNER: It is more leeway than I would

1 WRBeb

1 normally give you, Mr. Ellis, because there is such a thing
2 as follow-up questions. I have been quiet for the major
3 part of the dialogue. Don't abuse it. We are going to
4 adjourn in a minute or two, and then you can put it all
5 together with the transcript. You will have that added
6 advantage.

7 BY JUDGE FERGUSON:

8 Q I guess I can get immediately to the point that
9 I'm concerned about.

10 It seems to me that there are two statements, one
11 having to do with an analysis and one having to do with
12 experimentally measured stresses. And my question simply
13 put to you is:

14 Are you able at this time to form any opinion as
15 to whether or not cracks will either initiate or propagate
16 in the piston skirts?

17 A (Witness Henriksen) No, I don't think we are in
18 a position to say whether they will or will not. I think
19 that is what our testimony is trying to say.

20 Q Thank you.

21 JUDGE FERGUSON: We will stop at this point.

22 JUDGE BRENNER: We will recess until 10:30 Monday
23 morning. As soon as we complete these witnesses, we will go
24 immediately to the County's panel for the crankshaft
25 subject, and we have already discussed how the County's

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1 exhibits should be re-put together, if you will.

2 Mr. Goddard, I may ask you on Monday why you did
3 not offer the portions of the Safety Evaluation into
4 evidence. I had a chance to look back at the transcript
5 this morning and you did not. So you can think about that
6 and maybe have some copies here in case we mark it for
7 identification.

8 MR. GODDARD: Judge Brenner, I just wanted to
9 make one brief--

10 JUDGE BRENNER: The witnesses are excused.

11 (Witness panel excused.)

12 MR. GODDARD: -- comment for the advantage of
13 everyone.

14 The County will be withdrawing Mr. Aneesh Bakshi
15 as a witness. None of the testimony of the County is
16 supported by Mr. Bakshi alone. Therefore his withdrawal
17 will not have an impact on the cross-examination of the
18 County's testimony.

19 JUDGE BRENNER: All right.

20 There being nothing else, we will close the
21 record today.

22 (Whereupon, at 12:44 p.m., the hearing in the
23 above-entitled matter was recessed to reconvene at
24 10:30 a.m., Monday, October 1, 1984.)
25

CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceedings before the
UNITED STATES NUCLEAR REGULATORY COMMISSION in the matter of:

NAME OF PROCEEDING:

LONG ISLAND LIGHTING COMPANY

(Shoreham Nuclear Station)

DOCKET NO.: 50-322-1 OL

PLACE: HAUPPAUGE, NEW YORK

DATE: WEDNESDAY, SEPTEMBER 26, 1984

were held as herein appears, and that this is the original
transcript thereof for the file of the United States Nuclear
Regulatory Commission.

(Sigt) William R. Bloom

(TYPED)

William R. Bloom

Official Reporter

Reporter's Affiliation