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August 30, 1984

FILE NO. 24566.3

DIRECT DIAL NO. 202 955-1564

In the Matter Of
LONG ISLAND LIGHTING COMPANY
(Shoreham Nuclear Power Station, Unit 1)
Docket No. 50-322-1 (OL)

BY HAND

Hon. Lawrence Brenner, Esq.
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Hon. Dr. Peter A. Morris
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Hon. Dr. George A. Ferguson
Administrative Judge
School of Engineering
Howard University
2300 - 6th Street, N.W.
Washington, D.C. 20059

50-322 OL

Dear Administrative Judges:

I sincerely regret that the attachments to LILCO's Supplemental Motion To Strike were omitted yesterday. Here is a set for each of you and service is being made today on everyone else. I apologize for this inconvenience.

Very truly yours,

E. Milton Farley, III, Esq.

EMF/jlf

cc: Alan Roy Dynner, Esq. (By Hand)
Richard J. Goddard, Esq. (By Hand)
Entire Service List

add'l from TOCA

DS03

ATTACHMENT 1

OFFICIAL TRANSCRIPT
PROCEEDINGS BEFORE

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	
	)	
LONG ISLAND LIGHTING COMPANY	)	Docket No. 50-322-OL
	)	
(Shoreham Nuclear Power Station	)	
	)	
Unit 1)	)	

DEPOSITION OF ROBERT N. ANDERSON

Washington, D. C.

Wednesday, May 16, 1984

ALDERSON REPORTING

(202) 628-9300
440 FIRST STREET, N.W.

A It may be one of them. I don't know.

Q Do you consider yourself an expert or qualified in the mechanics of finite dynamics?

A Finite dynamics. No, I seldom work in that area.

Q Who did you talk to at ANAMET?

A Gordon Laxell, and the other name escapes me at the moment, but he is the President of ANAMET.

Q Did you observe any shot peening of any of the components or parts that you observed at the TDI facility?

A No, I saw no shot peening operation, nor did I see, though necessarily you wouldn't be able to recognize it without careful inspection, any shot-penned parts.

Q You don't know whether or not they do in fact have a shot peening capability, process or facility at TDI?

A I did not see one. It was not inspected.

Q Now, did Bohaugi focus solely on connecting rods?

A The bearings, yes.

ATTACHMENT 2

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of : Docket No.

LONG ISLAND LIGHTING COMPANY : 50-322 O.C.

(SHOREHAM NUCLEAR POWER STATION, UNIT 1) :

Deposition of DENNIS ELEY, held at the Shoreham Nuclear Power Plant, Shoreham, New York, on the 3rd day of May, 1984, at 9:50 o'clock a.m., before Thomas R. Nichols and John Ianno, Jr., Notaries Public of the State of New York.

Q. Is that the only -- is what you have read about the Holzer method in the FaAA report, again, the only knowledge you have about the Holzer method?

A. That is correct.

Q. Do you know anything, Mr. Eley, about finite element analysis?

A. I do not.

Q. Have you read anything about the finite element analysis?

A. I have read the finite element analysis reports.

Q. Where did you read that, sir?

A. In various reports that are being made available to me.

Q. Do you understand finite element analysis?

A. I would not have the capability of completing a finite element analysis myself.

Q. Why is that, sir?

A. I do not have that capability. I have not done this task before.

Q. Is it because you have some limitation in mathematics or physics or solid mechanics or --

A. I don't --

Q. That makes that impossible?

A. I don't really know. I have not investigated it. I have not researched it far enough.

Q. You are not saying you couldn't do it if you spent the time to research it?

A. That's right.

Q. You are saying you just can't do it today?

A. That's right.

Q. Because you don't have a full understanding of it?

A. That's correct.

Q. Do you know what a torsiograph is?

A. Yes.

Q. Have you ever seen a torsiograph?

A. Yes.

Q. What is it?

A. Things that measure torsion.

Q. Have you ever had occasion to do a torsiograph yourself?

A. I have not done one myself.

Q. Did you ever have occasion to have someone do one for you?

A. I have seen the results of torsiograph

ATTACHMENT 3

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	:	
LONG ISLAND LIGHTING COMPANY	:	Docket No.
(Shoreham Nuclear Power Station	:	50-322-OI
Unit 1)	:	

Washington, D.C.

Tuesday, May 15, 1984

Deposition of RICHARD B. HUBBARD, called for examination by counsel for Long Island Lighting Company in the above-entitled action, pursuant to notice, at the offices of Hunton and Williams, 2000 Pennsylvania Avenue, N.W., Washington, D.C., commencing at 10:08 a.m., on Tuesday, May 15, 1984, the witness being first duly sworn by SUSAN HARRIS, a Notary Public in and for the District of Columbia, and the proceedings being taken down by Stenomask by SUSAN HARRIS, and transcribed under her direction.

defect, based on a report?

A In general, that would be the case. But also working with Dr. Anderson to analyze the various service reports.

Q What qualifications do you have in terms of casting? Have you ever worked in a foundry?

A No, I have not.

Q Have you ever studied the foundry process, the casting process?

A No.

Q Do you have any background in metalurgy?

A I've taken courses in metalurgy?

Q Do you have a degree in metalurgy?

A No, I don't.

Q A bachelor's degree in metalurgy?

A No.

Q We have identified two areas in which you have -- I'm not going to use the words "preliminary opinion" every more, because every time I ask you that you say it's not really a preliminary opinion -- but areas that you're going to examine further. You indicated one was the DRQR and the second was the manufacturing process.

A I don't have an opinion on that.

Q Do you know how to do a finite element analysis, Mr. Hubbard?

A No.

Q I'd like you to look at page 5-8 of the report, please. Section 5-3 discusses fatigue crack growth analysis. The first paragraph in Section in 5-3, in the middle of the paragraph states, "The presence of a crack in the piston skirt does not necessarily lead to unsatisfactory performance of the piston because the initated cracks may not grow. Even if they do grow, they may arrest as they grow out the localized region of high stress. The behavior of any cracks that do not initiate can be analyzed by use of" -- I'm sorry -- "The behavior of any cracks that do initiate can be analyzed by use of fracture mechanics principles."

Do you agree with the statements that I just read, sir? And we can take them one by one if you want.

A Well, we ought to go through them one by one. I would agree that the cracks may not grow. You have to get into a time period and in an environment and lots of other things, and really, you know, what caused the

cracks, whether they are a manufacturing defect or as a result of operation. So the word "may" there, you know, it's conceivable that they might not grow. They also may stop growing. The "may" there is also true. That may happen. It also may not happen, and again, it has to do, you know, with all the things I mentioned before, what caused the cracks initially.

Q Are you familiar with fracture mechanics?

A No. I would rely on Dr. Anderson for that.

Q So then you would not be prepared to comment on a conclusion that was reached in this report based on the application of fracture mechanics analysis?

A Yes. Other than that the behavior of any cracks -- I mean it seems to me that it is an infinite number of types of cracks and locations, so one of the first questions I would have of Dr. Anderson is is it true that this analysis would really go to any cracks or just some cracks.

Q Mr. Hubbard, have you done any work on push rods that are in the TDI emergency diesel generators at Shoreham?

A No, other than the general gathering of field

ATTACHMENT 4

BEFORE THE ATOMIC SAFETY AND AND LICENSING BOARD

---o0o---

In the matter of LONG ISLAND LIGHTING COMPANY, (Shoreham Nuclear Power Station, Unit 1)	DOCKET NO. 50-322-OL

COPY

DEPOSITION OF STANLEY G. CHRISTENSEN

MAY 9, 1984

VOLUME IV, Afternoon Session

REPORTED BY:
DANUTA WARNOCK, C.S.R. NO 4782

TOOKER & ANTZ
CERTIFIED SHORTHAND REPORTERS
681 MARKET STREET, SUITE 925
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415/392-0650

COMPUTERIZED TRANSCRIPT

torsiographs in connection with your analysis of replacement crankshafts?

A. I did look at them, yes.

Q. Do you recall what you determined, if anything, from looking at them?

A. No, I just looked at them. It was some time ago now since I looked at them and as I had come up with these values and as they had shown what they had come up with later on, I didn't take that thing any further. I can't exactly say how I would view that now because I am going back now to the early days of the receipt of the first report or second report on the crankshaft.

Q. Did you have occasion, Professor Christensen, to review the FAA finite element analysis of the replacement crankshafts?

A. I did look at that, yes.

Q. What if anything, sir, did you determine after you had looked at that?

A. We will, I will be quite frank. I went back to my textbooks on finite element analysis because it is not an area in which I would consider myself as an expert, not in any way.

Q. When you went back to your textbooks on finite element analysis were you able to gain an understanding so that you could analyze the methodology --

A. Yes.

Q. Let me finish the question.

A. I thought you had finished.

MR. DYNNER: The record should show Professor Christensen is not attempting to interupt but because of the phraseology of the questions from time to time it's difficult to tell whether Mr. Stroupe has finished phrasing the question.

MR. STROUPE: Thank you.

If Professor Christensen would give me ten seconds or so after I start a question I don't think we will have that problem.

MR. DYNNER: There is, of course, no intention here to interrupt you, Mr. Stroupe, and it's important that be on the transcript because someone reading the transcript cannot listen to the phrasing of your questions.

MR. STROUPE: Let me see if I can repeat the question.

Q. Professor Christensen, after going back to your textbooks on finite element analysis, were you able to gain an understanding as to the methodology utilized by PoAA in applying finite element analysis to replacement crankshafts?

A. Yes. I wondered -- we will, the first thing we had in the book -- I can't quote the book but it's from the McGraw Hill Engineers' Section, library books on engineering, Mecnanical Engineering Series, I think the first thing that hit me there was finite -- I'm not condemning finite element analysis when I say this, please let me get that straight.

First thing it said there was it was an art and not a science, and this is obvious to any engineer because the locations of the various points around the system would require a considerable amount of knowledge to locate correctly.

The next thing I would comment on would be that if you are using a standard computer program for this analysis, then you would have to see that the dimensions of the crankshaft coincided with the basic parts on what that computer program was based on. This is relative to size.

The next thing that would be required is a knowledge of the various stresses that a crankshaft is subjected to during its 720 degrees of rotation. As I mentioned earlier, I'm not an expert on finite element analysis, three dimensional finite element analysis, but I think I know enough of it to be very cautious in its usage. And where I would comment further is it could be an ideal thing perhaps to be used as a comparitive, but not something to be used to find the definite figure for a stress value.

Q. Do you recall, Professor Christensen, the title of the publications, or if they were in fact plural in number, the publications that you looked at to gain an understanding of finite element analysis?

A. I again --

MR. DYNNER: Let's not characterize his testimony. It wasn't to gain an understanding, was it?

If you want to ask him which books he was referring to, if he remembers the title, fine. Let's not characterize incorrectly his testimony.

MR. STROUPE: I did not mean to characterize your testimony. Mr. Dynner obviously has a photographic memory. So I do the best I can based on the memory I have.

MR. DYNNER: Thank you.

MR. STROUPE: And I will ask the questions based on the memory that I have and not Mr. Dynner's memory.

Q. And I will ask you if you can recall the name of those textbooks.

A. I think the name of the series was McGraw Hill Mechanical Engineers' Series of books. We might call them textbooks because that is virtually what they are. The name of the book within the series, I think, was Introduction to Finite Element Analysis. The preface of the book, which is the reason that I bought the book, it is not a methodology to be able to carry out a finite element analysis of calculations, it is a book which is more or less telling you the whys and wherefores of it, as the book says in the introduction.

I wanted this to review certain ideas that I had about this from reading stuff earlier in technical journals, mathematical journals and various place where one acquires knowledge. Here I had most of the things together in one book, that is why I went to that book.

Q. Do you know the author of that book, Professor Christensen?

MR. DYNNER: Personally?

MR. STROUPE: No.

Q. Sir, are you acquainted with his name?

MR. DYNNER: Thank you.

THE WITNESS: I'm not acquainted with anybody's name. I cannot remember the name of the man, but I will certainly give it to the lawyer here if you desire me to give it to him.

MR. STROUPE: Q. Do you recall, Professor Christensen, the year of publication of that book?

A. It's a very, very recent publication. I couldn't give you the exact year. I think finite element analysis has only been out over the last ten or 15 years, and then it was only used in very limited areas in the first instances.

Q. Did you have occasion, Professor Christensen, to, in reviewing the FaAA report, to compare the finite element analysis of torsional stress upon the crankshaft with the experimentally obtained data?

A. I don't quite understand your question. I'm sorry.

Q. Do you recall, Professor Christensen, a reference in the FaAA report to strain gauge testing of the replacement crankshafts?

A. I remember reading about the strain gauge testing, yes.

Q. Do you recall having made any comparison between the results produced by the strain gauge testing, e.g., experimental testing as opposed to the figures obtained through the use of finite element analysis?

A. Yes. There was some inaccuracy there, I believe, because if my memory serves me correctly there was a correlation factor used which I thought introduced some further doubt about one or the other sets of figures. What the correlation factor was, I cannot remember now. I got a feeling it was in the order of maybe seven percent, but again, I am using my memory which may be playing tricks with me.

MR. STROUPE: Let's take a break.

(short break from 5:00 until 5:20.)

MR. STROUPE: Q. Professor Christensen, are you aware of any requirement that the Nuclear Regulatory Commission has which says that either Lloyd's rules, ABS's rules or DEMA's rules have to be complied with?

A. I am not aware of anything in their rules that says that.

Q. Are you generally familiar with the NRC regulations as they apply to emergency diesel generators in nuclear service?

A. I won't say I know those regulations down to the last cross on the "T" and dot on the "I," but I think I have a broad idea of them. One of the things that I have noted is that most of those regulations are directed to safety, and I thought that they were good regulations

ATTACHMENT 5

COPY

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

--oOo--

In the Matter of	)	
	)	
LONG ISLAND LIGHTING COMPANY	)	
	)	Docket No. 50-322-OL
(Shoreham Nuclear Power Station, Unit 1)	)	
	)	
	)	

DEPOSITION OF ROBERT NEIL ANDERSON

MAY 10, 1984

Reported by:

KEMBLE ANTZ, CSR 669

Q. What type of work did you do for them?

A. In the past, I have worked in the nuclear area, principally availability of uranium. Some problems on extraction of uranium. New techniques for extraction of uranium.

Q. Extraction of material is your principal expertise in the field of metallurgy, isn't it?

A. Chemical, temperature, chemical thermodynamics of metals.

Q. Were any of these publications that you list in your Exhibit 3 submitted for review prior to publication or were they just sent to particular magazines?

A. Most of those that are there were sent for professional review and were accepted.

Q. What else had you done in connection with the diesel generators at Shoreham prior to the end of 1983 that you haven't already told me about?

A. I can't think of anything else.

Q. How did 1984 start out?

A. It was a good year. I got an invitation to go to India and work on the Taj Mahal. And then came back and I had more boxes of material on this case to read.

Q. When did you come back?

A. Toward the end of February.

Q. Okay. And you received this material from either Mr. Dynner or Mr. Miller?

A. Or Mr. Scheidt.

Q. Have you reviewed all that material?

ATTACHMENT 6

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

---o0o---

In the Matter of

LONG ISLAND LIGHTING COMPANY
(SHOREHAM NUCLEAR POWER STATION, UNIT 1.) No. 50-322 O.C.

Deposition of
ROBERT N. ANDERSON

August 4, 1983

Reported by ADELE I. NOLAN, CSR No. 1641

received, approximately July 19th, do you know how many hours you spent reviewing that package?

You said you received it in Hawaii?

A. Yes, I did.

Again, without the notes that I have made, I may not be exact, but it would be on the order of three or four hours.

Q. And with respect to the final package of documents that you received from Mr. Avery, can you just estimate how much time you spent on that?

A. Okay. Now this presumes that I have only -- I only stay with the documents once and never reread them, or refresh my memory, so that I would say on the package I received from Mr. Avery, I believe there was about two, two and a half hours in that package, in the initial reading.

Q. Professor, would you consider yourself an expert in foundry practices?

A. No.

Q. Have you ever been employed by a foundry?

A. No.

Q. Have you ever done any consulting work for a foundry?

A. Yes.

Q. And could you describe that work, please?

A. Well, let's see.

There was one business that had a small casting operation -- I mean small compared to what you have. I believe they were in belt buckles, and I straightened up their procedures, developed mold washes, and extended the life of the molds that they were using.

I have had -- let's see -- I have had a number of casting problems, and it's not clear to me that I was working for the plaintiff or the defendant in those cases.

If it was the plaintiff, I was clearly working for the company as a consultant.

I can recall one -- there's a neat little casting firm back East that makes the Harley-Davidson handles -- brake handles -- and they had a problem, and one of them broke, and when it breaks, there's no way you can put a brake on, and it was a fatal accident, and I had to go through their casting procedures and characterize what they were doing compared to all the other motorcycle castings that are currently on the market, and that was for the manufacturer.

[Mr. Pratt entered the deposition room.]

MR. EARLEY: Q So let me review.

You have done consulting work for a foundry that dealt in small castings, and you have indicated that you have been involved in a number of casting problems.

Could you estimate the number of times you have had -- given consulting services dealing with casting problems?

A That's difficult.

I would say I have had over 500 cases, independently consulting for corporations, and I just don't keep track of it.

There have been a number of casting problems.

There have been some spring hangers on trucks, White Truck -- Trucking Company -- there was some failures there that I had to look at, and examine the casting procedures.

Q Well, would you estimate that it is more or less than

10 percent of those 500 cases?

A. You must be reading my mind.

I was going to say it would probably, if I had to make an estimate, not going back through my files, 10 percent might be reasonable of the 10 percent of the metallurgical consulting work associated with the casting failures.

This would be ferrous base and nonferrous, too.

Q. So have you dealt with casting problems relating to steel castings?

A. Yes.

Q. Have you ever dealt with a case involving steel castings of cylinder heads?

A. As represented in this case here?

Q. This case is the limit of your experience in dealing with steel casting -- steel cylinder heads?

A. No. I can't recall any similar case.

MR. DYNNER: Off the record.

[Discussion off the record.]

MR. EARLEY: Q. Professor, have you ever conducted a failure analysis?

A. Failure analysis?

Q. Yes.

A. Yes, I have -- lots of them.

Q. And have you conducted failure analysis on a steel casting?

A. Yes.

Q. Can you estimate how many failure analyses on steel castings you have performed?

A. Well, let's see.

If I had about 500 metallurgical cases, roughly 10 percent, my most honest guess, were castings, and if you'll look at the market, most of the castings are, I'm afraid, nonferrous, that have problems.

Ferrous is fairly reliable.

I would say that I would have to say -- I would say about a third of those castings would be of ferrous material.

Q. Do you remember the precise subject matter of any of that -- the number of steel casting failure analyses you have done?

A. I can tell you wonderful war stories --

Q. Just -- due to the lateness of the hour, can you give me a list of those you can remember?

A. I can remember Bigfoot. [phonetic]

I think I had developed a hernia carrying that casting around.

There was a truck that was working, I believe it was a logging truck, and it was working up in the hills, and apparently went out of control.

It was a brake failure or something. The driver said his brakes didn't work, but this big truck went out of control, and I believe hit another car, innocent car, and big truck, small car. Small car had severe injuries.

There was a failure in a very large casting associated with the rear end of that vehicle, and there was a question, because of its location so close to the stress point.

In other words, there is curvature problems --

Q. If I could -- if you could just give me a list, for example, a large casting in the rear of the truck, so we can expedite -- can you recall the -- just the general subject without going into the description of any others?

A. Okay. There has been some -- there is a cast part which is associated with spring hangers on large trucks, and that failed, dropped the truck down so it went out of control, went across the road, killed somebody.

That was ferrous base.

There has been some really -- and I believe those are the two most recent. I just can't recall.

I do extensive aircraft, automobile investigation, and also some nonmetallic investigation, like breast implants.

Q. Professor, have you -- are you familiar with hot tears in a casting?

A. Yes.

Q. Have you ever seen a hot tear?

A. Yes.

Q. Would it be fair to say that someone who is familiar with hot tears and has seen a number of hot tears can recognize a hot tear in a casting when they see one?

A. Yes. I think that's a fair statement, as long -- in order to keep it totally fair, we say that it's a clean -- it's close to -- it has been used, in other words, it's close to the time of manufacture, so that there is nothing obscuring the surface.

No corrosion products, no debris of any type. If it's on the casting floor, then certainly you should have a clear