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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of:

LONG ISLAND LIGHTING COMPANY

(Shoreham Nuclear Generating Plant, Unit 1)

Docket No. 50-322-OL-4
Low Power

Location: Hauppauge, New York

Pages: 714 - 1027

Date: Monday, July 30, 1984

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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In the Matter of: :
LONG ISLAND LIGHTING COMPANY :
(Shoreham Nuclear Generating : Docket No. 50-322-OL-4
Plant, Unit 1) : (Low Power)
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Court of Claims
State of New York
State Office Building
Veterans Memorial Highway
Hauppauge, New York 11787

Monday, July 30, 1984

The hearing in the above-entitled matter reconvened, pursuant to recess, at 9:00 a.m.

BEFORE:

MARSHALL E. MILLER, ESQ., Chairman
Atomic Safety and Licensing Board
Nuclear Regulatory Commission
Washington, D. C. 20555

GLENN O. BRIGHT, Member
Atomic Safety and Licensing Board
Nuclear Regulatory Commission
Washington, D. C. 20555

ELIZABETH JOHNSON, Member
Atomic Safety and Licensing Board
Nuclear Regulatory Commission
Washington, D. C. 20555

APPEARANCES:

On Behalf of the Applicant:

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C O N T E N T S

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E X H I B I T S

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P R O C E E D I N G S

JUDGE MILLER: Good morning, ladies and gentlemen.

As you know, this is a resumed hearing in the matter of Long Island Lighting Company, Shoreham Nuclear Generating Plant Unit No. 1, Docket No. 50-322-OL-4, which is the low power proceeding, and this resumed hearing is held pursuant to notice duly published in the Federal Register to consider the matters and things resulting from the order of May 16, 1984 of the NRC Commission, which is CLI-84-8, 19 NRC, and the page number has not yet been established.

We ask first that counsel identify themselves and their associates for the record, please.

MR. ROLFE: Judge Miller, on behalf of LILCO I am Robert M. Rolfe. To my left and to the Board's right is Anthony F. Earley, Jr., and to my right and to the Board's left is Jessine Monaghan.

JUDGE MILLER: Thank you. The staff.

MR. PERLIS: Your Honor, my name is Robert Perlis. I represent the NRC Staff in this proceeding. To my right is Edwin Reis. He will be here for the first few days of the proceeding.

MS. LETSCHE: My name is Karla Letsche and to my right is John Birkenheier. We are with the law firm of Kirpatrick, Lockhart, Hill, Christopher and Phillips. We

Sim 1-2

represent Suffolk County.

MR. PALOMINO: My name is Fabian Palomino, and I represent the State of New York.

JUDGE MILLER: Thank you.

Are there any preliminary matters before we resume the taking of evidence? I see there has been handed up two documents. One is the Response of Suffolk County and New York State of LILCO's motion for partial reconsideration of the July 18th security proceedings order, and the other that has been handed up, and we will see who the winner is, if I can get this thing opened, that is denominated LILCO's Response to Suffolk County "Notice of Execution of Affidavits of Nondisclosure."

This is the first time we have seen this document and we will have to take a look at it at the recess.

Are we ready to proceed?

MR. ROLFE: Judge Miller, there are a couple of logistical things.

First of all, in the transcript from the beginning of these hearings there were two matters with respect to the testimony of William G. Schiffmacher which ought to be brought to the Board's attention.

First of all, somehow Mr. Schiffmacher's prefiled testimony got shuffled when it was bound into the record so that the pages are out of order. And, secondly, in the transcript we received at least the attachments to that testimony were not there.

I have an extra set of those attachments, and with the Board's permission, I would ask that the reporters bind that into the transcript from last time.

JUDGE MILLER: All right. Do you have copies with you for other counsel?

MR. ROLFE: Yes, sir, they got copies the last time when the testimony was filed, as did the Board.

JUDGE MILLER: Okay. You may have leave to do so. It will be incorporated with the balance of that direct testimony.

MR. ROLFE: Thank you.

JUDGE MILLER: You are starting with the last page number, aren't you?

THE REPORTER: Yes, sir.

JUDGE MILLER: Ckay.

MR. ROLFE: The other thing, Judge Miller, is that last Friday afternoon LILCO filed several motions to strike. It was filed late on Friday afternoon, and I am not sure whether the Board received copies of those. They were served on the parties.

JUDGE MILLER: Well, this Board didn't. In the first place, you recall you are supposed to get everything

Sim 1-4

into our office in Bethesda by 3:30, and I left at 3:35 and they weren't there. So we have had no notice or knowledge of whatever it is you are talking about.

MR. ROLFE: In that case, Your Honor, we have additional copies to give to the Board this morning. They have been served on the parties last Friday.

JUDGE MILLER: What are they?

MR. ROLFE: They are notions to strike some of the County and State's testimony. So they won't actually become pertinent until we come to that portion of the hearing.

JUDGE MILLER: Okay.

Anything else that has been filed tardily?

MR. PERLIS: Mr. Chairman?

JUDGE MILLER: Yes.

MR. PERLIS: The NRC Staff did issue a Supplement No. 6 to the Shoreham Safety Evaluation Report.

JUDGE MILLER: When?

MR. PERLIS: That was issued with our testimony on July 16th.

JUDGE MILLER: We got that along with the prepared testimony.

MR. PERLIS: I believe at the first hearing the Staff moved the SER into evidence at the beginning of the hearing and we would like to do likewise with the Supplement.

JUDGE MILLER: No. 5 I think it was.

Sim 1-5

MR. PERLIS: That is correct, and we would like to do the same here with Supplement No. 6.

JUDGE MILLER: Any objections?

(No response.)

JUDGE MILLER: There being no objection, the Staff's SSE No. 6 previously filed July 16 was it ---

MR. PERLIS: Yes.

JUDGE MILLER: 1984 will be received into evidence.

(The NRC Staff's Supplement No. 6 received into evidence follows:)

Supplement No. 6

Safety Evaluation Report
related to the operation of Shoreham Nuclear Power Station, Unit No. 1

Docket No. 50-322

Long Island Lighting Company

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

JULY 1984

ABSTRACT

Supplement 6 (SSER 6) to the Safety Evaluation Report on Long Island Lighting Company's application for a license to operate the Shoreham Nuclear Power Station, Unit 1, located in Suffolk County, New York, has been prepared by the Office of Nuclear Reactor Regulation of the U.S. Nuclear Regulatory Commission. This supplement addresses several items that have been reviewed by the staff since the previous supplement was issued.

TABLE OF CONTENTS

1 INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

The Nuclear Regulatory Commission's Safety Evaluation Report (SER) (NUREG-0420) on the application by Long Island Lighting Company (LILCO or applicant) to operate the Shoreham Nuclear Power Station was issued by the Nuclear Regulatory Commission staff (NRC staff) on April 10, 1981. Supplement 1 (SSER 1) to the Shoreham SER was issued in September 1981; SSER 2 was issued in February 1982; SSER 3 was issued in February 1983; SSER 4 was issued in September 1983; and SSER 5 was issued in April 1984.

Each of the sections in this SSER 6 is numbered the same as the section of the SER that is being updated. The discussions in this report are supplementary to and not in lieu of the discussions in the SER, except where specifically noted.

Copies of this report are available for public inspection at the Commission's Public Document Room, 1717 H Street, NW, Washington, D.C. 20555 and at the Shoreham-Wading River Public Library, Route 25A, Shoreham, New York 11786. Copies are also available for purchase from the sources indicated on the inside front cover.

The NRC Project Manager assigned to the operating license application for Shoreham is Ralph Caruso. He may be contacted by calling (301) 492-7000 or writing to the following address:

Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, DC 20555

This supplement is a product of the NRC staff. The following NRC staff members and consultants contributed to this report:

W. Hodges - Section Leader, Reactor Systems Branch
J. Knox - Senior Electrical Engineer
T. Quay - Section Leader, Accident Evaluation Branch
E. Tomlinson - Mechanical Engineer
J. Clifford - Operational Safety Engineer

1.7 Outstanding Issues

In Section 1.7 of the SER, the NRC staff identified 61 outstanding issues that were not resolved at the time of issuance of the SER. This report discusses subsequent supplementary information that has been received regarding the applicant's March 20, 1984 supplemental motion for that low-power license and the staff's evaluation of that motion. The items identified in Section 1.7 of the SER are listed below with status of each item. If the item is discussed in this supplement, the section where the item is discussed is identified. The this supplement, the section where the item is discussed is identified. The resolution of the remaining outstanding issues will be discussed in future supplements to the SER.

Item	Status	Section
(1) Pool Dynamic Loads	Resolved	
(2) Masonry Walls	Resolved	
(3) Piping Vibration Test Program - Small Bore Piping/Instrumentation Lines	Resolved	
(4) Piping Vibration Test Program - Safety-Related Snubbers	Resolved	
(5) LOCA Loadings on Reactor Vessel Supports and Internals	Resolved	
(6) Downcomer Fatigue Analysis	Resolved	
(7) Piping Functional Capability Criteria	Resolved	
(8) Dynamic Qualification	Partially resolved, awaiting further information	
(9) Environmental Qualification	Partially resolved, awaiting further information	
(10) Seismic and LOCA Loadings	Resolved pending confirmation	
(11) Supplemental ECCS Calculations with NUREG-0630 Model	Resolved with license condition	
(12) ODYN, Generic Letter 81-08	Resolved	
(13) NUREG-0619, Feedwater Nozzle and Control Rod Return Line Cracking Generic Letter 81-11	Resolved	
(14) Jet Pump Holddown Beam	Resolved	
(15) Inservice Testing of Pumps and Valves	Resolved	
(16) Leak Testing of Pressure Isolation Valves	Resolved	
(17) SRV Surveillance Program	Resolved	
(18) NUREG-0313, Revision 1	Resolved	

Item	Status	Section
(19) Preservice Inspection	Resolved	
(20) Appendix G - IV.A.2.a	Resolved	
(21) Appendix G - IV.A.2.c	Resolved	
(22) Appendix G - IV.A.3	Resolved	
(23) Appendix G - IV.B	Resolved	
(24) Appendix H - II.C.3b	Resolved	
(25) RCIC	Resolved	
(26) Suppression Pool Bypass	Resolved	
(27) Steam Condensation Downcomer Lateral Loads	Resolved	
(28) Steam Condensation Oscillation and Chugging Loads	Resolved	
(29) Quencher Air Clearing Load	Resolved	
(30) Drywell Pressure History	Resolved	
(31) Impact Loads on Grating	Resolved	
(32) Steam Condensation Submerged Drag Loads	Resolved	
(33) Pool Temperature Limit	Resolved	
(34) Quencher Arm and Tie-Down Loads	Resolved	
(35) Containment Isolation	Resolved	
(36) Containment Purge System	Resolved	
(37) Secondary Containment Bypass Leakage	Resolved	
(38) Fracture Prevention of Containment Pressure Boundary	Resolved	
(39) Emergency Procedures	Resolved	
(40) LOCA Analyses	Resolved	
(41) LPCI Diversion	Resolved	

Item	Status	Section
(42) Flow Meter	Resolved	
(43) Loss of Safety Function After Reset	Resolved	
(44) Level Measurement Errors	Resolved	
(45) Fire Protection	Resolved	
(46) IE Bulletin 79-27	Resolved	
(47) Control System Failures	Resolved	
(48) High Energy Line Breaks	Resolved	
(49) DC System Monitoring	Resolved	
(50) Low and/or Degraded Grid Voltage Condition	Resolved	
(51) Fracture Toughness of Steam and Feedwater Line Materials	Resolved	
(52) Management Organization	Resolved	
(53) Emergency Planning	Under review	
(54) Security	Awaiting further information	
(55) Q-List	Resolved	
(56) Financial Qualification	Resolved	
(57) TMI-2 Requirements		
Shift Technical Advisor	Resolved with license condition	
Shift Supervisor Administrative Duties	Resolved	
Shift Manning	Resolved	
Upgrade Operator Training	Resolved	
Training Programs - Operators	Resolved pending confirmation	
Revise Licensing Examinations	Resolved	
Organization and Management	Resolved	

Item	Status	Section
Procedures for Transients and Accidents	Resolved	
Shift Relief and Turnover Procedures	Resolved	
Control Room Access	Resolved	
Dissemination of Operating Experiences	Resolved	
Verify Correct Performance of Operating Activities	Resolved	
Vendor Review of Procedures	Resolved	
Emergency Procedures	Resolved	
Control Room Design Review	Resolved pending confirmation	
Training During Low-Power Testing	Resolved	
Reactor Coolant System Vents	Resolved	
Plant Shielding	Resolved	
Post-Accident Sampling	Resolved with license condition	
Degraded Core Training	Resolved	
Hydrogen Control	Resolved	
Relief and Safety Valves	Resolved pending confirmation	
Valve Position Indication	Resolved	
Dedicated Hydrogen Penetrations	Resolved	
Containment Isolation Dependability	Resolved with license condition	
Accident-Monitoring Instrumentation		
Attachment 1	Resolved with post-implementation review	
Attachment 2	Resolved	
Attachment 3	Resolved	

Item	Status	Section
Attachment 4	Resolved	
Attachment 5	Resolved	
Attachment 6	Resolved	
Inadequate Core Cooling	License condition	
IE Bulletins		
Item 5	Resolved pending confirmation	
Item 10	Resolved pending confirmation	
Item 22	Resolved	
Item 23	Resolved	
Bulletins and Order Task Force		
Item 3	Resolved	
Item 13	Resolved pending confirmation	
Item 16	Resolved	
Item 17	Resolved	
Item 18	Resolved	
Item 21	Resolved	
Item 22	Resolved	
Item 24	Resolved	
Item 25	Resolved	
Item 27	Resolved	
Item 28	Resolved	
Item 30	Resolved	
Item 31	Resolved	
Item 44	Resolved	

Item	Status	Section
Item 45	Resolved	
Item 46	Resolved	
Emergency Preparedness - Short Term	Under review	
Upgrade Emergency Support Facilities	Under review	
Emergency Preparedness - Long Term	Under review	
Primary Coolant Outside Containment	Resolved	
Improved Iodine Monitoring	Resolved	
Control Room Habitability	Resolved pending confirmation	
(58) Reactor Vessel Materials Toughness	Resolved	
(59) Control of Heavy Loads - Generic Letter 81-07	Resolved	
(60) Station Blackout - Generic Letter 81-04	Resolved pending confirmation	
(61) Scram System Piping	Resolved	
(62) Remote Shutdown System	Resolved with license condition	
(63) Design Verification	Under review	
(64) Loose Parts Monitoring System	Resolved	
(65) Low-Power License Motion	Resolved with license condition	1.10, 8.5, 13.5, 15, 23

1.10 Motion for a Low-Power License

On March 20, 1984, the applicant made a supplemental motion (the motion) for a low-power operating license before the Atomic Safety and Licensing Board Panel. The objective of this supplemental motion is to show that pending diesel generator issues need not be resolved to support the issuance of a low-power license. In support of this objective, the applicant has provided design information and analysis to demonstrate that even if one assumes the unavailability of all three onsite diesel generators, with a single design-basis event and the concurrent (normally postulated) loss of offsite power, there is reasonable assurance that an alternate ac power source can be made available in sufficient time to ensure that structures, systems, and components important to safety perform as intended at 5% power.

The staff published its evaluation of the motion in SSER 5, dated April 1984. However, on May 16, 1984, the Commission ruled that the applicant must file an application for an exemption from the applicable requirements of GDC-17. The applicant filed such a request with the Atomic Safety and Licensing Board on May 22, 1984. Additional information was provided to the staff in letters from the applicant dated June 6, 1984 (SNRC-1047) and June 28, 1984 (SNRC-1060).

The evaluations contained in this SSER update those in SSER 5 (when appropriate) and provide the staff's technical basis for granting an exemption from GDC-17.

8 ELECTRIC POWER

8.5 Alternating Current Power System for Low Power Operation

The objective of the staff review in this area is to determine whether the alternate ac power sources meet the intended safety function and review objectives that are defined in the SER for the onsite diesel generator ac power sources. The safety function of the alternate ac power sources (assuming neither the offsite power system nor the onsite diesel generators are functioning) is to provide sufficient capacity and capability to ensure that the structures, systems, and components important to safety perform as intended for low-power operation. Thus, the objective of the review is to determine whether the alternate ac power sources have the required redundancy, meet the single failure criterion, and have the capacity, capability, and reliability to supply power to all required safety loads. It is also the objective of the staff review to determine whether the alternate ac power sources will provide reasonable assurance that ac power will be available in sufficient time after postulated design-basis events.

The applicant has proposed to use two portable "peaking units" as alternate ac power sources. These peaking units are rated at 20 MW and 10 MW, respectively.

The 20-MW unit consists of a single gas-turbine-powered generator. The generator, gas turbine, and all electrical and mechanical controls are contained within a weather-resistant enclosure. The gas turbine is designed for "dead-line" start capability: i.e., the gas turbine is capable of starting, accelerating to rated speed and voltage, and connecting to a power distribution system using only self-contained control systems and power sources, following an appropriate loss of voltage signal. The turbine starts using compressed air to drive an air start motor. Starting air is stored at 400 to 500 psig in pressurized receivers of sufficient capacity to allow three starting attempts without recharging. An automatically controlled air compressor within the enclosure is cycled on and off, as required, to maintain the compressed air supply. The distribution system has a 150-ampere-hour, 125-volt dc battery. A 50-amp battery charger maintains the battery charged at required levels. Power for the air compressor and battery charger comes from an auxiliary transformer that is powered from the associated distribution system (69-kV) during standby, and from the gas turbine generator during operation. Fuel is from an onsite, 1,000,000gallon storage tank. Two fuel pumps deliver fuel under pressure to the gas turbine. One pump is powered from the 125-volt dc battery and starts automatically when the gas turbine starts. The dc pump operates until the gas turbine generator is producing power, when the ac-operated pump starts and the dc pump automatically stops. Power for the ac fuel pump is from the same source used by the air compressor and battery charger.

The 10-MW unit consists of four diesel-engine-powered generators, each rated at 2.5 MW. Each generator--with its associated diesel engine, electrical and mechanical components, and controls--is in an independent, weather-resistant enclosure. Each diesel generator is designed for "dead-line" start capability. Each starts using two 125-volt dc electric starting motors. A single, 420-ampere-hour, 125-volt dc, lead acid battery provides power for the starting motors on all four diesel engines. This battery is in the enclosure of one of the four diesel generator power units. The diesel generators start in sequence, with the start cycle for one ending before the start cycle for another begins. A start cycle lasts 15 seconds. The starting battery has capacity for 7 diesel engine start cycles. The battery is maintained at full charge by a battery charger. Power for the battery charger is from an auxiliary transformer that is powered from the associated distribution system (4 kV) during standby, and from the diesel generators when they are on line. The diesel generators are designed to automatically synchronize with each other after they reach rated speed and voltage; they are connected to the load as one unit. The controls are designed to allow stable parallel operation of the four diesel generators. Connection to the load will be by manual operation.

The following areas were considered in the staff review of these alternate ac power sources:

Capacity and Capability of 20-MW Gas Turbine

The applicant (by item 20 of the Schiffmacher affidavit, contained in the motion) stated that the 20-MW gas turbine has the ability to carry all plant emergency loads together with some selected plant nonemergency loads. To demonstrate this capacity, the applicant (by item 8 of the Museler affidavit) stated that on a biweekly basis through actual test the 20-MW gas turbine will be loaded to at least 13 MW. The 13-MW test load is slightly greater than the total of all plant loads that can be connected to safety buses, as shown on FSAR Table 8.3.1-1. The 13-MW test load does not, however, consider selected nonemergency loads. The nonemergency load is about 20% of the 20-MW capacity of the gas turbine, or 4 MW, as stated by the applicant (line 7, page 22 of the March 29, 1984 meeting transcript). The staff will require, as part of the Shoreham Technical Specification, that this 4-MW nonemergency load be included in the test load so that the gas turbine will be loaded to 20 MW as part of an operational test prior to plant operation beyond criticality testing, and to 13 MW every 2 weeks. With the imposition of this requirement, the staff concludes that the 20-MW gas turbine has sufficient capacity and is acceptable.

In regard to the capability of the gas turbine to be connected to safety loads, the applicant (pages 18, 19, and 20 of the March 29, 1984 meeting transcript) stated

(1) On loss of voltage on the 69-MW offsite power system bus, the gas turbine automatically starts; breaker number 640, shown on FSAR Figure 8.2.1-1, automatically opens, isolating the 69-kV switchyard from the LILCO offsite grid system, and motor mechanical switches 616 and 617 on FSAR Figure 8.2.1-1 automatically open to strip off load normally connected to the 69-kV switchyard bus.

(2) All loads connected to nonsafety buses 1B and 12 on FSAR Figure 8.2.1-1 are automatically disconnected on loss of voltage except the 4-MW nonemergency load discussed above.

(3) The gas turbine is automatically connected to the 69-kV bus after it attains the correct speed.

(4) All other loads or power supplies that may be connected to (but are not automatically disconnected from) the 69-kV switchyard bus are administratively kept disconnected.

Thus, on loss of the normal 69-kV offsite circuit, a source of power is automatically reestablished in 2 to 3 minutes so that the control room operator need only, by procedure, close breakers 424, 444, or 464 shown on FSAR Figure 8.2.1-1 to resupply power to safety loads (lines 7 to 13, page 26 of the March 29, 1984 meeting transcript). To demonstrate this capability, the applicant (lines 19, 20 and 21, page 24 of the March 29, 1984 meeting transcript) stated that a test would be performed once a month to ensure that the gas turbine will start automatically on loss of grid voltage and isolate from the grid.

As part of the Shoreham Technical Specifications, the staff will require that this monthly test be performed with the following functions verified:

(1) that loads normally connected to the 69-kV and 4.16-kV buses are automatically disconnected

(2) that the gas turbine automatically connects to the 69-kV bus within 2 to 3 minutes

The staff will also require, as part of the Technical Specifications, the periodic verification, once every 12 hours, that loads or power supplies normally disconnected from the 69-kV bus are in fact disconnected.

With respect to the capability to close breakers numbered 424, 444, or 464 so that power can be supplied to actual loads, the applicant (lines 15 through 20, page 25, and lines 1 through 7, page 29 of the March 29, 1984 meeting transcript) indicated that this capability would be demonstrated by operational testing before plant operation in Phases III and IV and will require 5 to 10 minutes for the control room operator to complete. In addition to this operational test, the staff will require that proper operation of the gas turbine be demonstrated by loading it to its design load requirement (which includes safety loads as well as nonsafety loads on 480-V busses 12A, 12B, 12C, and 12D), with verification that voltage and frequency are maintained within required limits. The staff also will require, as part of the Shoreham Technical Specifications, that the capability to connect to actual safety loads also be demonstrated once every 6 months while the unit is shut down. With the imposition of these requirements, the staff concludes that there is sufficient capability to ensure that the gas turbine can be connected to safety loads and can supply power to permit functioning of required safety loads and that it is acceptable.

Capacity and Capability of the Four Mobile Diesel Generators

In regard to the capacity of the four mobile diesel generators, the applicant (lines 7 through 10, page 10 of the March 29, 1984 meeting transcript) stated that one of the four 2.5-MW mobile diesel generators has adequate power to mitigate the worst case accident. To demonstrate this capacity, the applicant, by letter dated April 3, 1984 (SNRC-1033), stated that on a biweekly basis through actual test the four 2.5-MW diesel generators will be loaded to a minimum of 50% of rated load or to at least 1.25 MW per diesel generator. Because this minimum test load of 1.25 MW does not equal the minimum required capacity of 2.5 MW to mitigate the worst case accident, the staff will require, as part of the Shoreham Technical Specifications, that each diesel generator be loaded to 2.5 MW or that all four mobile diesel generators be loaded to 10 MW every 2 weeks. With the imposition of this requirement, the staff concludes that each of the four mobile diesel generators has sufficient capacity and is acceptable.

In regard to the capability of the four mobile diesel generators to be connected to safety loads, the applicant (pages 11 through 18 of the March 29, 1984 meeting transcript) indicated that

(1) On loss of power the diesel generators would automatically start.

(2) A field operator would be dispatched to establish the availability and status of the diesel generators.

(3) The field operator in coordination with the control room operator, by procedure, would manually open disconnect switches to isolate the offsite power grid system from the four mobile diesel generators.

(4) All loads connected to non-safety bus 11 shown on FSAR Figure 8.2.1-1 are automatically disconnected except for nonemergency loads on buses 11A, 11B, 11C, and 11D.

(5) The control room operator, by procedure, will ensure that these nonemergency loads connected to bus 11 are in fact disconnected by manually opening their supply breaker.

(6) The field operator, by procedure, manually closes a breaker so that ac power from the four mobile diesel generators is connected to 4.16-kV bus 11 shown on FSAR Figure 8.2.1-1.

(7) The control room operator, by procedure, closes breakers numbered 415, 435, or 455 shown on FSAR Figure 8.2.1-1 to resupply power to safety loads.

With respect to the capability of the four mobile diesel generators to be connected to safety loads, the applicant (lines 9 through 22, page 31 of the March 29, 1984 meeting transcript) indicated that the capability would be demonstrated as part of operational testing before Phases III and IV and will require 30 minutes for the control room and field operators to complete. As part of this test, the staff will require that the applicant demonstrate proper operation of the four mobile diesel generators by loading each diesel generator to its design load requirements for 1 hour and verifying that voltage and frequency are maintained within required limits. In addition to these preoperational tests, the staff will require, as part of the Shoreham Technical Specifications, that the above described capability to connect the four mobile diesel generators to safety loads be demonstrated once every 6 months while the unit is shut down. With respect to the capability of the diesel generators to automatically start on loss of voltage, the applicant (by item 8e of the Museler affidavit) stated that the generators would be tested (on a biweekly basis) to demonstrate that at least three of the four mobile diesel generators can be manually started and operated at rated speed. As part of this periodic test, the staff will require, as part of the Shoreham Technical Specifications, (1) that the diesel generators be started on a simulated loss of offsite power signal with ac power disconnected from all diesel generator auxiliary equipment (such as ac power to the starting battery through the battery charger) and (2) that each of the four diesel generators can be manually reconnected to their common bus following disconnection for any reason. Also as part of these preoperational and 6-month periodic tests, the staff will require that:

(1) the battery charger be demonstrated capable of recharging the battery to at least 95% of full charge within 8 hours.

(2) a battery service test be performed in accordance with the guidelines of Standard 450-1980 of the Institute of Electrical and Electronics Engineers (IEEE) to a load test profile equal to 7 full 15 second engine start cycles. With the imposition of these requirements, the staff concludes that there is sufficient capability and capacity to ensure that the four mobile diesel generators can be connected to safety loads and can supply power to permit functioning of required safety loads and are acceptable.

Independence and Compliance with the Single Failure Criterion

With regard to electrical independence of the 20-MW gas turbine from the four mobile alternate power supplies and their circuits, the staff was concerned that the electrical cross connections (shown on FSAR Figure 8.2.1-1) between the two alternate sources could cause their common failure. Concerning the interconnections through 4.16-kV buses 1A, 1B, 11, and 12, the applicant (line 25 of page 20, and lines 1 through 7 of page 26 of the March 29, 1984 meeting transcript) stated that breakers numbered 420, 430, 460, and 470 on FSAR Figure 8.2.1-1 are normally open. Regarding the interconnection between 480-V buses 11A and 12A, 11B and 12B, 11C and 12C, and 11D and 12D shown on FSAR Figure 8.2.1-1, the applicant (lines 21 and 23 of page 22 of the transcript) also stated that the breaker interconnecting each of these buses is normally open. As part of the Technical Specifications for Shoreham, the staff will require verification, once every 12 hours, that each of these normally open breakers remains open. As to the remaining interconnections through the 4.16-kV emergency buses numbered 101, 102, and 103, the applicant (lines 13 through 16 of page 36 of the March 29, 1984 meeting transcript) indicated that plant procedures would prevent such interconnection. Procedure directs that one of the two supply breakers to each of these buses normally would be kept open, while the other breaker normally is kept closed. During the March 29, 1984 meeting, the staff (pages 36 through 41 of the transcript) expressed the concern that because these breakers included an automatic transfer capability between the two breakers, some event or single failure could cause failure of both sources of alternate power. To preclude this occurrence, the staff will require that the transfer capability be removed, and the staff will so condition the low-power license. With the imposition of this requirement, the staff considers this item resolved. The Shoreham Technical Specifications will be changed to reflect that testing of this automatic transfer will not be required during low-power operation but will be required for the full-power license.

In regard to the physical independence between the 20-MW gas turbine and the four mobile diesel generators alternate power supplies and their circuits, the applicant (page 82 of the March 29, 1984 meeting transcript) provided a description of the physical separation of these circuits. This description indicated that the gas turbine is located in the 69-kV switchyard, with its circuits entering the switchgear room as shown on FSAR Figures 8.2.1-3A and 8.2.1-8A. These circuits are part of the circuits associated with the reserve station transformer. The four mobile diesel generators are in a physically separate location next to the southwest corner of the reactor building with the circuits entering the same switchgear room shown on FSAR Figure 8.2.1-8A. These circuits enter approximately 40 feet east on the same side of the switchgear room (as those circuits associated with the gas turbine).

On the basis of this description, the staff concludes

(1) The gas turbine and mobile diesel generators are separated by approximately 300 feet.

(2) The four mobile diesel generators are separated from the reserve station service transformer by approximately 150 feet and the control and auxiliary boiler building.

(3) The circuits associated with the gas turbine are routed in underground concrete enclosed raceway approximately 75 feet from the location of the four mobile diesel generators.

(4) The circuits associated with each of the alternate ac sources located in the 69-kV switchgear room shown on FSAR Figure 8.2.1-8A are routed in physically separate cable bus duct, raceway, or switchgear.

(5) The circuits associated with each alternate ac source are routed between the switchgear room and the safety buses in raceways encased in the concrete floor, as shown on FSAR Figure 8.2.1-8B.

The preceding separation provides sufficient independence so that failure of one alternate source will not cause loss of the other source, and is acceptable with the following exception: because the staff is concerned that failure of either the reserve station service transformer or the normal station service transformer as a result of fire may cause failure of the circuits associated with the four mobile diesel generators, the staff will require that these circuits be located no closer than 50 feet from either transformer, or adequate fire barrier separation must be provided. The staff will so condition the low-power license. With the imposition of this requirement, the staff considers this item resolved.

The applicant has not provided any information regarding the quality and design standards to which the alternate ac power supplies and their associated circuits were designed. Because of the importance of these items to the safe operation of the plant during low-power operation, the staff will require they be subject to a quality assurance program commensurate with their importance to safety for 5% rated power operation. This program shall include all pertinent and past history (inspection reports, mill certifications, manufacturer certification, etc.) as available. Current and future documentation shall be all inclusive and be available at the site. With the imposition of this requirement as a condition to the Shoreham low-power license, the staff considers this item resolved.

In regard to protection from natural phenomena and postulated accidents the staff has concluded

(1) Environmental conditions associated with postulated loss-of-coolant or pipe break accidents are confined to the reactor containment or plant

auxiliary building. Thus, the alternate ac power system is sufficiently isolated or removed so that the accident environment will have no effect on the capability of the alternate ac power system to perform its safety function. The staff concludes that there is reasonable assurance that ac power will be available for these environmental conditions, and that it is acceptable in this regard.

(2) For low-power operation, the main turbine generator is not operating. Thus, the only source of missiles that need to be considered would be from outside the plant building and that would be from a tornado. For tornados, the applicant, by letter dated April 3, 1984, stated that the plant would be immediately shut down if the NWS issues a tornado watch for the Shoreham area. The staff will require, as part of the Shoreham Technical Specifications, the immediate shut down of the plant given this condition. With the imposition of this requirement, the staff concludes that more than 30 days will be available before ac power is needed; thus, there is reasonable assurance that ac power will be available and that it is acceptable in this regard.

(3) In regard to hurricanes, the applicant (item 7a of the Museler affidavit) stated that the plant would be immediately shut down if NWS issues a hurricane warning for the Shoreham area. The staff will require, as part of the Shoreham Technical Specifications, the immediate shut down of the plant given this condition. With the imposition of this requirement, the staff concludes that more than 30 days will be available before ac power is needed. Thus, the staff concludes that there is reasonable assurance that ac power will be available and that it is acceptable in this regard.

(4) In regard to a seismic event, the applicant (item 7e of the Museler affidavit) stated that the plant would be immediately shut down if there is an indication of seismic activity of 0.01g on the Shoreham seismic monitors.

In addition, the applicant (item 23 of the Schiffmacher affidavit) provided the manufacturer's assurance that the gas turbine would remain structurally sound during a design-basis seismic event at Shoreham and would be available after the event to perform its design function. As part of the Shoreham Technical Specifications, the staff will require the immediate shut down of the plant if there should be such an indication of seismic activity.

In case of a seismic event, it is the staff's opinion that the alternate ac sources will be available after the event because

(a) A period of 30 days is available before the alternate ac power sources are needed for any mitigating function.

(b) The manufacturer has provided assurance that the gas turbine will be structurally sound after a seismic event.

(c) Diesel generators similar to those being used at Shoreham have been used in marine and locomotive applications.

(d) Operating experience during seismic events has demonstrated the capability of equipment similar to that being used at Shoreham to survive a seismic event and to perform its design function after the seismic event.

The staff, therefore, concludes that there is reasonable assurance that ac power will be available following a seismic event and that it is acceptable in this regard.

(5) Concerning other natural phenomena, the applicant (item 7 of the Museler affidavit and by letter dated April 3, 1984) stated that the plant would be immediately shut down in case of (1) a severe storm watch for the Shoreham area issued by NWS, (2) a prediction by NWS for the Shoreham area of abnormally high tides greater than 5 feet above mean high water within 24 hours, (3) the outage of two of the four LILCO interconnections to Consolidated Edison and to the New England Power Grid, and (4) a low electrical frequency condition that causes an alarm on the LILCO transmission system. The staff will require, as part of the Shoreham Technical Specifications, that the plant be immediately shut down for each of these conditions. With the imposition of this requirement, the staff concludes that more than 30 days will be available before ac power is needed. Thus, there is reasonable assurance that ac power will be available when required and that it is acceptable in this regard.

(6) The applicant has provided no evaluation of a design-basis event fire in the nonsafety switchgear room through which both alternate ac power circuits pass. The staff will, therefore, require--and so condition the low-power license--that these circuits either be protected in accordance with the requirements of Appendix R to 10 CFR 50 or that a procedure be developed so that ac power can be re-established around the switchgear room from one of the alternate ac power sources to the safety loads within 30 days. With the imposition of this requirement, the staff concludes that the design is acceptable.

Thus, for the long term, following these design basis events, there is reasonable assurance that ac power will be available for event mitigation. However, for plant operation at 5 percent of rated power, ac power is not required immediately following these design basis events, since steam driven pumps that are ac independent are available for event mitigation.

Reliability

The gas turbine generator is powered by a P·att and Whitney gas turbine. This turbine generator is designed so that the power section of the turbine is not connected to the compressor section. In this design, the starting motor does not have to turn the mass of the generator during starting, thereby making starting faster, easier, and more reliable. Operating history for gas turbine generator identical to that used at Shoreham (as presented by the applicant in a letter dated April 11, 1984) shows 2 failures out of 84 start attempts or 97.6% reliability. The staff concludes that this reliability is well within the 92 to 99% reliability currently being demonstrated by typical onsite power system diesel generators located at operating nuclear power plants and is acceptable.

Each of the four mobile diesel generators is powered by 20-cylinder, EMD series 645 turbocharged diesel engines. These engines have widespread application in power generation, marine systems, and locomotives, and miscellaneous other industrial applications. This series of EMD diesel engines has an excellent reputation for inservice reliability in all types of applications. The operating history (pages 7 through 11 of the March 29, 1984 meeting transcript) for the four mobile diesel generators shows that on a per-diesel-generator basis there were 4 failures out of 279 start attempts or 98.6% reliability per diesel. When four diesel generators are considered (rather than one), the reliability of the four mobile diesel generators (for the Shoreham application where only one is needed to supply minimum required safety loads) approaches 100%.

Evaluation Findings

The review of the alternate ac power sources proposed by the applicant for low-power operation at Shoreham covered single-line diagrams, station layout drawings, schematic diagrams, descriptive information and a confirmatory site inspection. The staff concludes that the alternate ac power sources have the required redundancy, meets the single failure criterion, and have the capacity, capability, and reliability to supply power to all required safety loads for low-power operation. The design, thus, provides reasonable assurance that ac power will be available within 55 minutes following a design-basis event LOCA and is acceptable, as described above.

13 CONDUCT OF OPERATIONS

13.5 PLANT PROCEDURES

13.5.1 Procedures for Augmentation of Electrical Power

The staff has reviewed the procedures to be used in providing electric power to the Shoreham Nuclear Power Station emergency buses following a loss of normal off-site power sources. The purpose of the review is to determine whether the existing procedures can be implemented to restore electric power to mitigating equipment (e.g., RHR pumps, containment coolers) in a time period that will allow the plant operator actions necessary to prevent exceeding 10 CFR 50.46 limits.

The following operational procedures were reviewed:

TP 29.015.03 - "Interim Emergency Procedure (5% Power); Restoration of AC Power With Onsite Mobile Generators"
SP 29.015.02 - "Loss of All AC Power Emergency Procedure"

These procedures were reviewed for useability and technical accuracy with the existing electrical distribution systems.

The following briefly describes the expected sequence following a loss of off-site power:

Upon loss of both the Normal and Reserve Station Service Transformers (NSST and RSST), the available TDI diesels are designed to start and close onto the emergency buses automatically. Then the emergency electrical loads are designed to automatically sequence onto the bus. No operator action is necessary other than to monitor these automatic actions.

If the TDIs fail to start or load, the on-site 20 MW gas turbine is to be used to power the emergency buses. The gas turbine automatically starts on a loss of off-site power. The operators verify that power is available from the gas turbine by observing control room indication of power available to the RSST. This is designed to occur within 2-3 minutes following a loss of power. An equipment operator is instructed to then connect the 20 MW gas turbine to the 4 KV bus through a locally operated breaker, and to reset the emergency bus program lockouts. The 4 KV emergency bus loads are designed to then automatically start in sequence.

If the 20 MW gas turbine fails to start or if it cannot be loaded, the temporary (EMD) on-site diesel generators are to be used. The EMDs are designed to start and synchronize together automatically following loss of power to the 4KV-SWG-11 bus. Procedure TP 29.015.03 instructs the control room operators to isolate the 4KV-SWG-11 bus from the NSST and RSST, shed the 4 KV emergency buses (101, 102, and 103) from 4KV-SWG-11 bus, and shed the loads from the 4 KV emergency buses in preparation for reenergizing the 4 KV buses. An equipment operator is to go to the emergency and normal switchgear rooms to remove undervoltage bus program fuses, and to ensure locally operated breakers are lined up in preparation for power restoration. The NSST may then be isolated from the grid if a fault exists in the NSST, and the EMD diesel generators are to be connected to the 4KV-SWG-11 bus. The procedure then instructs the control room operators to energize the emergency buses and emergency bus loads.

The staff observed operational demonstrations of the use of the 20 MW gas turbine and the EMD diesel generators on July 2, 1984. The demonstrations included the simulated loss of AC power with subsequent automatic start of the respective power sources, the operators performing the necessary actions to restore electrical power to the emergency buses, and the operators starting and operating representative emergency bus loads.

The operational aspects of these demonstrations were evaluated by observing the operators perform the necessary actions to restore AC power to the emergency buses using either the 20 MW gas turbine or the EMD diesel generators. The staff evaluated the procedures used, equipment accessibility, lighting conditions, operator familiarity with the required equipment and operations, and operator transit routes used to reach the necessary equipment.

The following changes will be necessary for the staff to find the procedural and operational aspects of the augmented electrical power system at Shoreham acceptable.

1. To enhance visibility of the NSST disconnects during station blackout conditions at night or during adverse weather conditions, emergency lighting must be installed at the NSST to illuminate the disconnects.

2. To prevent possible personnel injury and the resulting time delay on a transit from the control room to the emergency switchgear room, the portion of the I-beam that protrudes into the stairwell leading from behind the control room back panels to the emergency switchgear room must be removed or padded.

3. To enable the operators to readily and accurately access the undervoltage bus program fuses in the emergency switchgear room, the covers for these cabinets must be clearly labeled as containing the undervoltage bus program fuses. In addition, the fuse block for the undervoltage bus program fuses must be clearly identified within the cabinet. These labels must be of sufficient size and contrast to allow rapid recognition of the proper cabinet and fuse block under station blackout conditions.

4. To provide additional assurance that all operators are familiar and proficient with the equipment and procedures to be used, each operating shift must satisfactorily perform TP 85.84042.3, "Supplemental Diesel Generator-EMD-(GM); Electrical Functional Test Procedure."

5. To reduce the possibility of error while implementing the procedures, the following modifications to the listed procedures are necessary.

    a. TP 29.015.03

        1) Place a line, to be used as a placekeeping aid, next to each action step in Section 4.0.

2) Step 4.1 - The list of breakers should be expanded to include 1R22* ACB-102-1..

3) Step 4.3 - All 4 KV loads that need to be in pull-to-lock (PTL), must be listed. The current wording, "This includes ..." implies that loads other than the ones listed need to be placed in PTL.

4) Step 4.4 - As currently worded, the followup action to this step will cause Step 4.5 to be executed regardless of the condition of OCB 1350 and 1360. Step 4.4 should be separated into the two discrete actions being performed (possibly through the use of substeps). The procedure also needs to specify which action step is to follow successful interaction with the system operator to open OCB 1350 and 1360.

b. SP 29.015.02

1) This procedure needs to include or reference the actions that are to be taken to restore power to the emergency buses using the on-site 20 MW gas turbine. This should include a direct reference to the on-site 20 MW gas turbine, to meet the same intent as the reference to the Holtsville gas turbines in Step 3.4.

2) At the appropriate step in this procedure, a reference needs to be made to TP 29.015.03.

The staff will condition the Shoreham license to require the completion of these items prior to fuel load.

With the resolution of these confirmatory items, the staff concludes that there is reasonable assurance that the operators can properly implement the necessary procedures for restoration of AC power to the emergency buses and equipment using the on-site 20 MW Gas Turbine and the EMD diesel generators.

15.0 TRANSIENT AND ACCIDENT ANALYSIS

By letter dated March 21, 1984 (SNRC-1026), the applicant presented a supplemental motion for a low power operating license to the Atomic Safety and Licensing Board panel. Clarifications and additional information were given by the applicant at the March 29, 1984 meeting held in Bethesda, Maryland. The objective of this supplemental motion is to show that the pending diesel generator issues being litigated need not be resolved prior to the granting of a low power license. Pursuant to this objective, the applicant provided design information and analyses to demonstrate that even if one assumes the unavailability of all three onsite diesel generators in conjunction with a design basis event and the concurrent loss of offsite power, there is reasonable assurance that alternate AC power can be made available in sufficient time to assure that structures, systems, and components important to safety perform as intended. As a result of Commission review of the supplemental motion by the applicant it determined that, in the absence of qualified diesel generators, the applicant must request an exemption to GDC-17.

On May 16, 1984, the Commission issued criteria to be satisfied by the applicant if it chose to request an exemption to GDC-17 (CLI-84-8). One criterion was that the applicant should include a discussion of its basis for concluding that, at the power levels for which it seeks authorization to operate, operation would be as safe, under the conditions proposed, as operation would have been with a fully qualified onsite A/C power source. The applicant's motion of May 22, 1984 and submittal of June 28, 1984 (SNRC-1060), responded to that criterion. The applicant assumed that the criterion is satisfied because at 5% thermal power with enhanced offsite power, the deterministic thermal and radiological success criteria are met given the assumption of no qualified diesels. We have reviewed those submittals and conclude that, for the transients and accidents analyzed in Chapter 15 of the Shoreham FSAR, operation with the enhanced offsite power supply at 5% power is as safe as operation with fully qualified TDI diesels at 5% power. This assessment is based primarily on the fact that: 1) for most transients and accidents, no fuel failures occur whether or not TDI diesels are available and, 2) for those few instances (e.g., fuel handling accident) in which fuel failure can occur, the activity available for release to the environment is negligibly small whether or not TDI diesels are available. Details supporting this conclusion are given in the remainder of this evaluation.

The alternate AC power supplies at the site consist of one 20 MW gas turbine and four 2.5 MW mobile diesel generators. According to the applicant, the gas turbine can restore power to the ECCS pumps within 10 minutes and the mobile diesels can restore power to the ECCS pumps within 30 minutes. During a loss of offsite power and loss of the gas turbine, only one of the four mobile diesels is required to mitigate the most limiting accident (LOCA). Restoration of power to one of the three divisions will ensure power to at least one of the 2 ECCS pumps. A detailed evaluation of electrical systems is given in section 8.3.1 of the SSER.

LILCO requests NRC approval for the following activities at Shoreham.

(a) Phase I: fuel load and precriticality testing

(b) Phase II: cold criticality testing

(c) Phase III: heatup and low power testing to rated pressure/temperature conditions (approximately 1% rated power); and

(d) Phase IV: low power testing (1-5% rated power)

These phases are distinct; each consists of a separate set of operations and testing. Together, they include the full sequence of activities associated with fuel loading and low power testing up to 5% of rated power.

The staff has reviewed all of the events considered in Chapter 15 of the FSAR to determine the effect on public health and safety of operation of the Shoreham plant during all the four phases referred above. The staff has reviewed the applicant's analyses given in LILCO's motion for low power operation. The evaluation was based on the availability of alternate AC power supplies provided by LILCO, with no credit assumed for the TDI diesels. We find LILCO's submittal to be acceptable. A detailed evaluation of the four phases of operation is given below.

Phase I: <u>Fuel Load And Precriticality Testing</u>

This phase of the Shoreham plant operation includes only initial fuel loading and precriticality testing. The reactor will remain at essentially ambient temperature and atmospheric pressure. The reactor will not be taken critical. Any increase in temperature beyond ambient conditions will be due only to external heat sources such as recirculation pump heat. There will be no heat generation in the core.

The review of the FSAR Chapter 15 analysis revealed that of the 38 accident or transient events addressed, 22 of the events could not occur during phase 1 because of the operating conditions of the reactor. These events all involve operational modes or component operations which are not possible during this phase. Because no steam is available, all events which would require pressurized conditions are precluded. Other events are precluded by definition (i.e., control rod removal error during refueling, fuel assembly insertion error during refueling; a fuel insertion error during initial loading would be of no consequence because there is no criticality and because of the absence of decay heat). In addition to the 22 events which cannot occur, there are 5 events for which the component operation evaluated in Chapter 15 could occur, but the phenomena of concern in Chapter 15 could not exist.

All recirculation pump events such as recirculation pump trip and abnormal start up of an idle recirculation pump would be of concern only if they could affect core physics or thermal hydraulic conditions. With no nuclear heat generation in the core, there are no pertinent phenomena to evaluate.

The remaining eleven events addressed in Chapter 15 could possibly occur. For events such as continuous rod withdrawal and a control rod drop accident or a liquid radwaste tank rupture, there could be no radiological consequences because there are no fission products.

In Phase I, fuel loading and precriticality testing, the reactor will not be taken critical. There will be no heat generation in the core. There will be no fission products. Because there will have been no power generation and, consequently, no decay heat, there will be no need for cooling systems to remove decay heat.

Availability of AC power is not a safety concern during Phase I because many of the transients cannot occur and for those that can occur, there can be no radiological consequences regardless of whether or not AC power is available. Therefore, there is no risk to the public health and safety. We find the LILCO discussion of Phase I to be acceptable.

Phase II: Cold Criticality Testing

This phase of operation of the Shoreham plant includes cold criticality testing and very low power testing at essentially ambient temperature and atmospheric pressure. The power level during this phase of testing will be in the range of 0.0001% to 0.001% of rated power.

The review of Chapter 15 for Phase II operation indicates that most of the transients are not possible for the same reasons described in the Phase I evaluation. Because the fission product inventories in the core will be significantly less during Phase II operation than for conditions analyzed in the FSAR and essentially all fission products will be retained in the fuel pellets, the radiological impact for the continuous control rod withdrawal during startup transients and, fuel handling accidents, is insignificant.

Because of the low pressure condition, it is not reasonable to postulate a loss-of-coolant accident during Phases I and II operation. The NRC normally postulates breaks only in high energy lines; for Phases I and II, there are no high energy lines because the reactor system is at atmospheric pressure.

If a loss-of-coolant accident should occur during Phase II testing, LILCO states that there would be time on the order of months available to restore make-up water for core cooling. At the decay heat levels which would exist under these conditions, heat transfer to the environment would remove a significant fraction of the decay heat. Realistic calculations would be expected to show that the temperature never approaches 2200°F. However, even if no heat transfer from the fuel rods and equilibrium fission products are assumed (i.e., infinite operation at .001% power), then a bounding analysis shows that more than 30 days are available to restore cooling prior to exceeding a temperature of 2200°F. Therefore, even assuming the unavailability of onsite power sources, there is a high probability of restoring AC power and preventing fuel failure.

Availability of AC power is not a safety concern during Phase II, because many of the transients cannot occur and for those that can occur, it is very unlikely that fuel failure could occur. Even if it did, there can be no significant radiological consequences due to very low fission product inventory. Therefore, there is no significant risk to the public health and safety.

We have reviewed the LILCO discussion of safety significance of Phase II operation and find it acceptable.

Phases III and IV: Low Power Testing Up to 5% of Rated Power

This phase of operation of the Shoreham plant includes reactor heatup and pressurization. Power level is taken in progressive steps to 1% of rated power. After the required physics tests and other pre-operational tests have been completed, the power level is taken in progressive steps from 1% to 5% of rated thermal power. All systems and their support systems, especially the Automatic Depressurization System (ADS), High Pressure Coolant Injection System (HPCI), Reactor Core Isolation Cooling System (RCIC), Core Spray System, Residual Heat Removal System (RHR), and the Remote Shutdown System will be operational during both phases of operation.

The review of the FSAR Chapter 15 analysis shows that of the 38 accident or transient events addressed in Chapter 15, 5 events can not occur during this phase. Generator load rejection and turbine trip with failure of generator breakers to open events are not possible because the generator will not be connected to the grid. Control rod removal error during refueling and fuel assembly insertion error during refueling are precluded by definition. A cask drop accident is precluded by design, hence it is not postulated in the analysis. The remaining 33 events are considered.

For all of the events, operation of the plant up to 5% of rated power will be bounded by the Chapter 15 analysis, most of which predict no fuel failures. For example, the turbine trip event is analyzed with the assumption that the limiting event occurs with the reactor operating at 105% of rated steam flow coupled with failure of the turbine bypass valves to open. Even this limiting event does not result in any fuel failures. The FSAR specifically notes that turbine trips at power levels less than 30% of rated power are bounded by the limiting analysis. Another example is the loss of feedwater heating event. This event is analyzed with the assumption of continuous operation of the feedwater system and the most severe possible loss of feedwater heating, resulting in the injection of colder feedwater. For operation at power levels less than 5%, the impact of lost feedwater heating is minimal because of the low feedwater flow.

For low power testing up to 5% power, the fission product inventory in the core will not exceed 5% of the values assumed in the FSAR. LILCO estimates that the fuel burnup during low power testing will be less than 200 MWD/MTU (Ref: LILCO Letter SNRC-1036 dated April 11, 1984). This low fuel burnup enhances safety in three ways: (a) the amount of decay heat present in the core following shutdown is substantially reduced resulting in reduced cooling system requirements (b) the amount of radioactivity that could be released upon fuel failure is substantially (much more than a factor of 20) reduced, and (c) if additional failures were postulated to occur, the operator will have a longer time to take corrective actions.

For example, on loss of feedwater, the water level in the reactor will decrease at a slower rate than if the event occurred at 100% power. If HPCI or RCIC operate at least once during the first four days to restore normal water level, then no additional make up will be required to prevent core uncovery due to boil-off. Similarly, in the loss of condenser vacuum event, the operator will have more time to identify the decreasing vacuum and to take steps to remedy the situation before automatic actions such as turbine trip, feed pump trip or main steam isolation occur. Another example is the main steam isolation valve closure event. At five percent power, the amount of heat produced upon isolation of the reactor vessel (which is followed by a reactor trip) results in a much slower pressure and temperature increase than would be experienced at 100% power. This gives the operator more time to manually initiate reactor cooling rather than relying on automatic action. In effect, the operator may end the transient before there is any substantial impact on the plant.

Another factor contributing to the enhanced safety during low power testing is the reduction in the required capacity for mitigating systems. Because of the lower levels of decay heat present following operation at 5% power, the demand for core cooling and auxiliary systems is substantially reduced, permitting the operation of fewer systems and components to mitigate any event. It follows that the AC power requirements for event mitigation are substantially reduced for 5% power operation as compared to 100% power operation. (Five minutes after shutdown, about 42 GPM makeup is required to compensate for boil-off; after 8 hours, 12 GPM are required).

Because of the lack of seismic qualification for the enhanced offsite power, each of the anticipated operational occurrences was reviewed for vulnerability to a seismic event. One transient, a stuck open relief valve transient, was identified as a potential concern. The basis of the concern was that a stuck open relief valve would cause the reactor pressure to decrease and would eventually cause the HPCI and RCIC systems to stop operating. If a seismic event caused sufficient damage to the offsite power system, no AC power would be available to provide makeup of water lost through the stuck open relief valve.

In a conference call on July 12, 1984, the applicant stated that no single active failure can cause a safety/relief valve to stick open while operating in the safety mode. Therefore, there is no basis for postulating a stuck open valve for the safety mode of operation. Plant procedures instruct operators to manually start RCIC to control reactor pressure following MSIV closure rather than using a safety/relief valve in the relief mode. Thus, there is no basis for considering a stuck open safety/relief valve in conjunction with a seismic event.

The Standby Gas Treatment System (SGTS) is used to mitigate the consequences of two accidents: the fuel-handling accident and LOCA. The considerations for the LOCA are discussed above.

In a fuel handling accident, those fission products which are in the fuel-cladding gap are subject to release from damaged fuel assemblies, but not the fission products which remain in the fuel itself. At 5% power, not only is the total fuel inventory 20 times smaller than at full power (5% versus 100%), but also the fraction of that inventory that has left the fuel and entered the gap is at least 20 times smaller as well. This reduction of fission products in the fuel-clad gap alone compensates for a loss of the SGTS due to unavailability of the onsite diesels (this system was assumed in the SER to reduce the post-accident release of iodine fission products by a factor of 20). However, the consequences of postulated fuel-handling accidents could also be mitigated by imposing a technical specification restriction on movement of irradiated fuel. Restricting the movement of irradiated fuel for a period of 40 days would more than compensate for the iodine removal capability of the SGTS. The decay allowed for by the forty day period would also produce more than a factor of 20 reduction in radioactive iodine released during a postulated accident.

Containment Isolation

With respect to containment isolation, LILCO, as noted in a letter response dated April 11, 1984 (SNRC-1036), has performed an evaluation of all containment penetrations to assure adequate isolation capability. Based on this effort only two 3/4" diameter valves were found to require prompt closure capability to assure containment integrity. For these two valves, containment integrity was threatened only for the unlikely event of a breach in the Reactor Building Closed Cooling Water RBCLCW system inside the containment coincident with a LOCA. For all other LOCA events, containment integrity was assured for all penetrations including the above mentioned valves. To ensure containment integrity in a timely manner for this limited condition, LILCO has committed to assign an equipment operator to the reactor building whenever the reactor vessel is pressurized during Phases III and IV.

The staff has evaluated the applicant's study of containment integrity for the stated events. With LILCO's commitment to station an assigned person to assure containment integrity for the case of a breach in the RBCLCW system, the staff concurs that containment integrity is assured for all LOCA events.

The applicant has evaluated the response of the primary containment in the unlikely event of Loss of Offsite AC Power, pipe break outside containment and a feedwater line break. For all cases, the applicant found that suppression pool cooling would not be required for about 30 days to limit the pressure and temperature conditions within the containment to below design values. The staff concurs with the applicants evaluation and finds this to be more than sufficient time to provide pool cooling and therefore concludes the containment is not threatened for the above events.

The applicant has also performed a detailed analysis of the drywell temperature response to the total loss of drywell cooling. The analysis was performed for several drywell initial temperatures and relative humidity and the reactor at 100% power and 5% power. The calculated drywell response to these transients indicates that the maximum normal operating limit of 145°F will be exceeded shortly after the total loss of drywell cooling; however, the drywell temperature response is still enveloped by the environmental qualification conditions of safety-related equipment in the primary containment.

We have reviewed the applicant's analyses and agree with the applicant's conclusion that the safety-related equipment would be expected to function under the postulated loss of drywell cooling capability.

LOCA Analysis

Of all the transients and accidents, the Loss Of Coolant Accident (LOCA) is the most limiting one with regard to AC power unavailability. Other transients and accidents are less severe. For small break accidents, RCIC and HPCI systems will be used to mitigate the accident. All components (other than room cooling) required for operation of RCIC and HPCI systems are completely independent of AC power. HPCI and RCIC use steam as the motive power and DC power for initial valve operation and turbine control. Those parts of the RCIC system required for injection are seismically qualified. Modifications to the HPCI system, which should make HPCI capable of withstanding a seismic event, are in progress. The license will require that these modifications be completed prior to entering Phase III testing. No core damage is involved for small breaks because RCIC and/or HPCI will maintain the reactor vessel water level within normal operating limits.

In the worst situation (for large break LOCA) where the vessel pressure decreases rapidly, RCIC and HPCI systems will not be operable. Since AC driven ECCS pumps are assumed to be unavailable, the reactor vessel level decreases rapidly, the reactor trips and MSIV's close. The applicant, in its letter SNRC-1035 dated April 6, 1984, submitted a GE analysis for the scenario described above. GE performed the analysis to determine the time to reach 10 CFR 50.46 limits. Four cases were considered:

(a) The first case uses a core thermal peaking factor of approximately 5. (A peak rod MAPLHGR of 1.34 Kw/ft was used). Using approved 10 CFR 50.46, Appendix K models and assumptions, core uncovery time was calculated for infinite reactor operation at 5% power. This case indicates that 55 minutes are required to reach the peak cladding temperature limit of 2200°F. Even at 55 minutes, no fuel failures were predicted to occur.

(b) This case utilizes a core thermal peaking factor of 3.38 (A peak rod MAPLHGR of 0.91 Kw/ft was used). Using approved Appendix K models and assumptions, core uncovery time was calculated for infinite reactor operation at 5% power. This case indicates that 86 minutes are required to reach the peak cladding temperature limit of 2200°F. No fuel failures were predicted.

(c) This case takes into account a bound on the expected operating history of the core during the startup phase. A core thermal peaking factor of 3.38 corresponding to a peak rod MAPLHGR of 0.91 Kw/ft was used in the analysis. Approved Appendix K models and assumptions were used. This case indicates that <u>110 minutes</u> are required to reach the peak cladding temperature limit of 2200°F. No fuel failures were predicted.

(d) A more realistic LOCA analysis without the stringent Appendix K criteria was performed. A core thermal peaking factor of 3.38 corresponding to a peak rod MAPLHGR of 0.91 Kw/ft was assumed in the analysis. This case takes into account a bound on the expected operating history of the core during the startup test phase. The results indicate that there would be <u>3 to 4 hours</u> available prior to reaching the 2200°F limit. No fuel failures were predicted.

It is expected that no more than 30 minutes will be needed to restore power to the ECCS pumps from alternate AC sources. The GE analysis indicates that a time period of 1 to 4 hours will be available for restoring AC power during a LOCA with simultaneous loss of off-site power. We find this acceptable.

Table 8.1 of the Shoreham SER depicts the divisional arrangement of various safety systems. Division I supplies power to core spray pump A and LPCI pump

A, Division II supplies power to core spray pump B and LPCI pump B and Division III supplies power to LPCI pumps C and D. Prompt restoration of power to any one of the three divisions will ensure availability of AC power to at least 2 of the ECCS pumps. One of the four mobile diesels can supply power to one ECCS pump in one division. One out of the six ECCS pumps is sufficient for core cooling and to maintain cladding temperatures within the limits of 10 CFR 50.46. In the March 29, 1984 meeting, the applicant described the use of the procedures and training of operators to perform the procedural actions during a loss of off-site power. Because of the time available and operator training there is a high confidence that alternate AC power sources can restore power to the ECCS pumps within the needed time frame. Further evaluation of operator training and procedures is found in Section 13.5 of this SER.

On the basis of its evaluation, the staff has concluded that there is reasonable assurance that the 10 CFR 50.46 criteria will not be violated. Therefore, there is no significant risk to the public health and safety.

23 CONCLUSIONS

The staff has reviewed the applicant's submittals and motions for low-power operation of the Shoreham plant and the request for an exemption from the provisions of GDC-17. We have performed scoping calculations to verify the results presented by the applicant and have considered the effect of loss of all AC power on transients and accidents. For those events that could be postulated to occur, the staff has reasonable assurance that sufficient time exists so that AC power could be made available to those systems required to maintain core cooling prior to release of any radioactive fission products from the fuel. Therefore, there is no fission product release that could be postulated during operation up to 5% of rated power without TDI diesels available. Since operation at power levels up to 5% of rated power with the TDI diesels available also results in no fission product release for the postulated events, we conclude that operation without TDI diesels is as safe as operation with TDI diesels available for power levels up to 5% of rated power. We therefore conclude that the applicant has provided adequate technical justification to support the granting of an exemption from the requirements of GDC-17.

Sim 1-5

JUDGE MILLER: Copies have been furnished to all parties and counsel?

MR. PERLIS: Right.

JUDGE MILLER: Anything further?

MR. ROLFE: LILCO is prepared to make an opening statement if the Board desires to proceed that way.

JUDGE MILLER: Well, we have no objection. We leave that to counsel. You know what you are going to do and if you think it would be helpful, we will certainly go ahead and receive it as we will for all parties.

MR. ROLFE: We think it might with Your Honor's permission.

JUDGE MILLER: Go ahead.

Before I forget it, at the conclusion of this phase of the evidentiary hearing, we are going to want closing arguments which are of course distinguishable from opening statements. They are arguments, but not only that, we attach considerable significance to such arguments. We want them to be in depth and we want them to cite transcripts, documents, exhibits and the like. In other words, we want these closing arguments to be meaningful.

When we come to proposed findings of fact, we want them to be just that, proposed findings, and not arguments or not concealed arguments. If you wish to file at that time a brief going into matters that are possibly argumentative

Sim 1-6

or conclusionary, you may do so. But we would like to have the proposed findings to be kept strictly factually limited.

We are probably going to grant a simultaneous filing of about three weeks from the closing of this portion of the evidence, and we will expect the oral argument to be given at the close of this evidentiary argument to be in considerably depth. We will rely upon it considerably and we will also give all counsel an opportunity to refute, if they wish, or go into matters that are of significance while it is all fresh in our minds.

We want to give you advance notice of what we expect and the fact that it will not be perfunctory or pro forma unless you wish your case to be tried that way.

end take No. 1 Sue fols

Proceed.

#2-1-SueT

MS. LETSCHE: Excuse me, Judge Miller, if I might just ask a question?

JUDGE MILLER: Yes.

MS. LETSCHE: With respect to your request for closing arguments of counsel that would include citations to the transcripts and documents and such, I would request that perhaps when we get near the end of the hearing we might want to discuss the scheduling of that. Perhaps it might be the morning following --

JUDGE MILLER: It will be one hour after that probably.

MS. LETSCHE: -- the last day.

JUDGE MILLER: We will give you one hour to pull yourself together. We figure you can be working as you go along in the evenings.

MS. LETSCHE: But we wouldn't have the transcripts from the --

JUDGE MILLER: You will have them daily and you can do the best you can. You will have all but the last one. And you will have your prefiled in the case of your own direct testimony and your own exhibits.

So, you will have ninety-nine percent, maybe a hundred percent if you make arrangements with the reporter.

Proceed.

MR. ROLFE: Judge Miller, LILCO is prepared in

#2-2-SueT1

this resumed hearing to introduce additional evidence to show that it should be granted an exemption and accordingly a low power license to test Shoreham at up to five percent rated power without completion of licensing proceedings concerning the TDI diesel generators.

Operation, as proposed by LILCO, will be safe and should be allowed as it is in the public interest. And LILCO will address both of these issues.

JUDGE MILLER: Both of what issues?

MR. ROLFE: The safety and the public interest in exigent circumstances.

In the context of the Commission's May 16 Order, which instructed that LILCO should address first the exigent circumstances that favor the granting of an exemption under 10 CFR 5012.A, should it be able to demonstrate that in spite of its non-compliance with GDC-17, the health and safety of the public would be protected; and, second, LILCO's basis for concluding that at the power levels for which it seeks authorization to operate, operation would be as safe under the conditions proposed by LILCO as operation would have been with a fully qualified onsite AC power source.

JUDGE MILLER: Wait a minute. You are going kind of fast. Would be as safe as?

MR. ROLFE: Yes, sir. Those were the words of

#2-3-SueT

the May 16th Order I was quoting.

JUDGE MILLER: Let me ask the Staff about some of the implicit meanings of that Order, inasmuch as we had discussions from time to time. We are not at all clear as to exactly what that Order means, so that's why the first time you say as safe as I'm alerting all counsel, in fact, we expect to hear about that.

Go ahead.

MR. ROLFE: Your Honor, we intend to address the meaning of that in the closing argument. At this point, I don't think the Board wants argument.

JUDGE MILLER: No, we don't want argument. We just are alerting you.

MR. ROLFE: Thank you, sir. Since the health and safety issues are a predicate to the getting to the exigent circumstances and public interest issues, let me address those issues first.

LILCO's evidence, both that already admitted and that admitted in this resumed hearing, will demonstrate the safety of the proposed mode of operation by demonstrating that the applicable deterministic criteria are met, even without assuming that the TDI diesel generators will work; thus, we draw the conclusion that the plant is as safe in the proposed mode of operation as a plant with qualified onsite diesel generators would be.

#2-4-SueT

JUDGE MILLER: At what percent power?

MR. ROLFE: At five percent power. The evidence will demonstrate the time necessary to restore AC power to meet the limits specified in 10 CFR, Section 50.46 and Appendix K; LILCO's ability to restore power within those times and the ability to restore power within those times will be shown by the capability of the power generation sources which will be available to LILCO, the reliability of those power sources and the feasibility of the procedures for using those power sources to restore AC power in the event that offsite power is lost.

Much of this evidence has already been established. The evidence pertaining to the times necessary to restore AC power was given last time at the April 24 and 25 beginning of these hearings. As the Board will recall, LILCO proposes to conduct low power testing in four phases.

The first phase is fuel load and pre-criticality testing. Certain facts have already been established conclusively with respect to Phase 1 by this Board's Order granting in part and denying in part LILCO's motions for summary judgment. And just briefly, without dwelling on it, with respect to Phase 1 the Board has already established that during all of the activities in Phase 1, the reactor will remain at essentially ambient temperature and atmospheric pressure. The reactor will not be taken critical. Any

#2-5-SueT

increase in temperature beyond ambient conditions will be due only to external heat sources such as recirculation pump heat. There will be no heat generation by the core. During Phase 1 fuel loading and pre-criticality testing, there are no fission products in the core and no decay heat exists; therefore, core cooling is not required.

In addition, with no fission product inventory there are no fission product releases possible. Even a loss of coolant accident would have consequences during Phase 1, since no core cooling is required.

And the Board concluded in its Order one of the findings: No core cooling is required during Phase 1 and, therefore, no AC power is necessary during Phase 1 to cool the core.

Thus, it has already been established by that Order that the plant is as safe during Phase 1 as it would be with qualified diesels, because you simply don't need AC power during Phase 1. So, there will be no further health and safety evidence with respect to Phase 1 of low power testing.

The Board only need to look at the exigent circumstances and public interest evidence which LILCO will proffer in support of its exemption in order to grant the exemption. Indeed, there is some question whether in view of the remarks that the Commission made at its opening

#2-6-SueT

meeting on July 25 --

JUDGE MILLER: Wait just a minute. Isn't it some restriction on quoting or using such transcripts? Staff, what is the rule?

MR. PERLIS: The transcript is intended solely for informational purposes and is not to be part of a record in a formal hearing.

JUDGE MILLER: I think that's the rule.

MR. ROLFE: Your Honor, I did not intend to get into the transcript.

JUDGE MILLER: Well, you mentioned it and I assumed --

MR. ROLFE: You are correct.

JUDGE MILLER: Okay.

MR. ROLFE: I merely mentioned it. I don't know whether there will be any Orders coming out of that. I merely wished to inform the Board that LILCO would be looking at that issue and might be addressing it, because there may not even be any need during Phase 1 to have an exemption granted.

With respect to Phase 2 which the Board will recall is cold criticality testing, we are in much the same situation. Most of the facts, all of the health and safety facts, pertinent to Phase 2 have already been established through the summary judgment or summary disposition

#2-7-SueT

Order. Among them, the Board has found that because of the extremely low power levels reached during Phase 2 testing, fission product inventory in the core will be only a small fraction of that assumed for the Chapter 15 analysis.

The FSAR assumes operation at a hundred percent power for a thousand days in calculating fission product inventory. In the inventory during Phase 2, low power testing, will be less than one-one hundred thousandth of the fission product inventory assumed in the FSAR. If a LOCA did occur during the cold criticality testing phase, there would be time on the order of months available to restore makeup water for core cooling.

And again there is no need to rely on the TDI diesel generators or any source of AC power for mitigation of the loss of AC power then or the feedwater system piping in break event during Phase 2. The Board also concluded that none of the events analyzed in Chapter 15 could result in a release of radioactivity during cold criticality testing that would endanger public health and safety, and that even if AC power were not available for extended periods of time fuel design limits and design conditions of the reactor coolant pressure boundary would not be approached or exceeded as a result of anticipated operational occurrences, and the core would be adequately cooled in the unlikely event of

#2-8-SueT

a postulated accident.

So, again the health and safety issues have been decided for Phase 2. We are left solely with looking at the public interest issues or the exigent circumstances if indeed again in light of what the Commission did an exemption even needs to be granted for Phase 2.

Phase 3 involved heatup and low power testing to rated pressure and temperature conditions at approximately one percent, or up to approximately one percent, of rated power.

And Phase 4 involves low power testing from one to five percent of rated power.

For purposes of discussion, I will talk about them together though, of course, the risks attendant to Phase 3 are lower than those attendant to Phase 4 because we have less decay heat and less fission products which will be generated. The evidence concerning the time necessary to restore power during Phases 3 and 4 has already been established. Again, the panel of Messrs. Dawe, Rao, Eckert and Kascsak testified at the beginning of these hearings. Their testimony was uncontradicted by Suffolk County.

By agreement of the parties, that panel has not been recalled and will not be appearing again in light of the Board's Order pursuant to Suffolk County's motion.

#2-9-SueT1

JUDGE MILLER: Let me inquire now whether counsel for other parties have -- is that the subject of an agreement?

MR. PERLIS: I believe so.

MS. LETSCHE: Yes, Judge Miller. The County agreed to that.

JUDGE MILLER: And the State?

MR. PALOMINO: Yes.

JUDGE MILLER: Thank you. Okay. We take it then as having been agreed by counsel, and that's perfectly satisfactory to us.

Proceed.

MR. ROLFE: Judge Miller, for the Board's information, that agreement also extended to Mr. Museler who submitted testimony last time and will not be appearing again.

In any event, without going into detail, it has been established that at Phase 4, the limiting event is the LOCA and during the LOCA at five percent power, using a conservative analysis, LILCO would have eighty-six minutes to restore AC power to protect against any adverse consequences. Using a more realistic analysis, LILCO would have three hours to restore AC power.

end #2
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LILCO's evidence will show its ability to restore AC power during those timeframes. LILCO has already su itted evidence indicating that there are numerous ways for it to restore AC power to Shoreham within minutes.

At the risk of repetition, I will just briefly go through those once more. The evidence already shows that LILCO has interconnections with two different power pools, with four different interconnections upon which it can rely to get additional power to its grid.

LILCO has black start gas turbines at each of its major generating stations, thereby lessening the likelihood or the possibility of any system-wide outage.

JUDGE MILLER: Define back start once again for the record.

MR. ROLFE: Black start means capable of being started without any outside power source. I will also be using from time to time, and the witnesses may, the term, 'deadline,' which means automatic start upon sensing a loss of voltage. So, a deadline black start power source is one that would automatically start by itself with no outside assistance upon sensing a loss of voltage on the circuits to which it is connected.

LILCO has deadline black start gas turbines at a number of points throughout its system. It has several of them at Holtsville, it has black start gas turbines at

Southold, Easthampton, and Port Jefferson, all of which are capable of providing AC power to Shoreham within minutes.

LILCO provides power to the Shoreham area through multiple transmission paths. I believe there are seven different circuits coming into the Shoreham area. There are independent rights of way actually serving the Shoreham plant, over which these transmission circuits travel. All of that lessens, to a great degree, the possibility of ever having a loss of power -- a loss of offsite power at Shoreham, and also enhances LILCO's ability to get AC power from these various offsite sources in the event that there were a temporary loss of offsite power.

Additionally, at the Shoreham site LILCO has a twenty megawatt gas turbine which is, again, a black start deadline gas turbine, and four 2.5 megawatt diesel generators. They will be referred to as the General Motors EMD diesel generators.

Much of the testimony that LILCO will be submitting in this resumed hearing focuses on the twenty megawatt gas turbine and the EMD diesel generators, but as the Board listens to that evidence, I ask it to keep in mind that the system as a whole must be taken into consideration, and that the rest of the power sources offsite actually exceed what GDC 17 requires for an offsite power system.

Now, the testimony about these other power sources has already been submitted. There has also already been a great deal of testimony about the twenty megawatt gas turbine and the EMD diesels.

All of the evidence together will show that the gas turbine -- 20 megawatt gas turbine at Shoreham will start automatically upon a loss of voltage. Messrs. Gunther and Schiffmacher have already discussed the reliability of the twenty megawatt gas turbine in their testimony submitted on April 24 and 25. Their additional testimony during this resumed hearing, will describe the testing for the gas turbine and the additional procedures for restoring power using the gas turbine at Shoreham.

They will further describe how the gas turbine has been tested, and how the procedures for using that gas turbine have actually been drilled and that power was restored from that gas turbine in that drill to Shoreham within approximately three minutes.

So, the testimony will demonstrate that the twenty megawatt can carry the necessary load. That it is reliable given its operating history, and that the procedures for operating it at Shoreham to supply necessary AC power to carry emergency loads are feasible.

The remainder of the additional health and safety evidence which will be submitted during these resumed hearings, and the bulk of the evidence, focuses on the EMD diesel generators.

Mr. Gunther and Mr. Schiffmacher will testify that those diesel generators have been tested. The procedures for using those diesel generators have been drilled and power was resto ed to the necessary emergency loads within approximately nine minutes during that drill.

They will further tell you that LILCO intends to provide for an emergency tie-in of these diesel generators so that there will be an alternate method of supplying power from the EMD diesels other than the presently intended method of going through the normal switch gear room.

Therefore, if there were, for example, a fire in the normal switch gear room, or a seismic event, there would be an alternate procedure for tying in the EMDs directly to the emergency switch gear room. The second panel LILCO intends to present is a panel of siesmic experts.

That panel consists of three engineers who specialize in siesmic work. Mr. Meligi, who is the head of the component qualification division of Sargent & Lundy. Sargent & Lundy did a comprehensive study of the EMD engines and the associated equipment. Sargent & Lundy has also performed similar analyses on 12 other EMD diesel sets.

The panel will also consist of Dr. Christian, who is a senior consulting engineer for Stone & Webster, and who serves as a Stone & Webster consultant concerning geotechnical engineering, earthquake engineering, numerical modeling, computer applications, seismic hazard studies and related areas.

The third member of that panel will be Mr. Wiesel, a senior structural engineer in Stone & Webster's structural division.

Stone & Webster studied the foundation of the EMD diesels. Sargent & Lundy did a comprehensive study of the machines themselves, and the conclusions were that the machines and the apparatus associated with the machines are capable of surviving the .2 G safe shutdown earthquake, design basis earthquake. The foundations -- the study there concluded that the EMDs have resistance to sliding and overturning well in excess of that needed to resist the SSE. The switch gear installation for the EMD has resistance to sliding and overturning needed to resist earthquakes of at least .13 G's, which exceeds the operating basis earthquake for Shoreham, and that the soils will resist liquefaction for earthquakes up to .13 G's, which again exceeds the operating basis earthquake for Shoreham, which is .1 G.

I might add that above .13 G's, the study doesn't indicate that there will necessarily be problems, only that there is some uncertainty as to what might happen in the soil liquefaction area above that level.

The probability of a .13 G earthquake or more at Shoreham during low power testing, according to the testimony of the seismic panel is less than one-tenth the probability of the safe shutdown earthquake occurring during the forty year life of the plant, and also Shoreham is in an area of low seismistics.

So, the seismic panel gives assurance of the EMDs availability after enduring an expected earthquake. But this assurance is just added assurance in any event, because the evidence already establishes that without the loss of coolant accident, LILCO would have up to thirty days to restore AC power to the plant.

Therefore, it would have plenty of time even if some of its power sources were damaged in an earthquake to restore or repair some of those sources in order to restore necessary power to the site.

But in any event, as the EMD seismic panel will demonstrate, those machines are capable of surviving a substantial earthquake in excess of the operating basis earthquake at Shoreham.

The next and last panel in the health and safety area discusses the reliability and performance of the EMD diesels at Shoreham. This panel consists of Messrs. Iannuzzi and Lewis, who work with diesels. They both work for the Power Systems Division of Morrison & Knudsen. I dare say that the evidence will show that they know stationary diesels used at electric plants, both in nuclear and commercial applications, better than anyone else who will testify at these proceedings.

Mr. Iannuzzi is the Manager of Engineering for the PSD Division of Morrision & Knudsen. Mr. Lewis is the Technical Services Manager. They will tell you that while there are differences between a qualifying diesel and the EMDs at Shoreham, the EMDs have proven themselves highly reliable both throughout the industry and these specific machines, and that given the time available and the low amount of power that actually would be needed in the event of a loss of offsite power, that these machines are assured of operating satisfactorily and reliably to provide the necessary power.

More specifically, among the points that they will tell the Board is that the EMDs at Shoreham have the same engine and generator as is used on EMD engines at various nuclear plants, and you will hear in Mr. Iannuzzi's and Mr. Lewis' qualifications, that they have extensive experience with these EMD diesels at use in both nuclear plants and in commercial operations.

They will further tell you that the only thing that is different between these and diesels that are qualified nuclear diesels actually in use at various nuclear plants is the auxiliary package on the diesels.

But despite those differences, in their extensive familiarity with the industry performance of these EMD diesels, there have been no reported failures of the auxiliary package of the type that are on the diesels at Shoreham resulting in a shutdown of these diesels in the industry.

They will tell you that this design has been in widespread usage in both nuclear and non-nuclear applications with excellent reliability, and more specifically they will tell you that these diesels at Shoreham have, themselves, an excellent performance record. There have been no starting failures. These diesels have been used for thousands of hours as peaking units for New England Power Company. They were used at unmanned locations, operated remotely.

They were used at a hundred and ten percent of rated load in contrast to their need at only a hundred percent of rated power at Shoreham, and that during that extensive use for tens of thousands of hours, there were no shutdowns, and there have been no shutdowns on these diesels for anything other than scheduled maintenance.

End 3.
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Sim 4-1

So these diesels have proved themselves in rugged service. They have been maintained properly and the differences from nuclear applications are not significant given the lack of fast starts or the fact that these diesels will not have to engage in fast starts as a nuclear qualifying diesel might.

And they will conclude that they expect the likelihood that all four units will start and operate in an emergency situation is very high and that therefore the likelihood that one of the four will start and operate is virtually assured.

So in sum on the health and safety issues, LILCO's evidence proves by exceptionally qualified witnesses that there will be no adverse health and safety consequences, that the deterministic success criteria will be met as they would have to be for a plant with qualified diesels operating at five percent power and that therefore operation as proposed is as safe in this mode as it would be with qualified diesel generators.

In listening to that health and safety evidence, I would ask the Board, in addition to just listening to the substance of the evidence, to compare the witnesses, to look at the qualifications of the witnesses which LILCO proffers to the Board, examine their credibility and note that LILCO's witnesses that will testify are engineers, they

Sim 4-2

are professionals involved on a day-to-day basis actually with their areas of expertise. They are not simply consultants and they are not simply professional witnesses. These are people who have to make a living in dealing with these machines, in making decisions on the day-to-day basis about them and in standing behind those decisions.

They have presented you with their independent thoughts and analyses in contrast to some of the other testimony that has been prefiled where the thoughts and analyses that are presented are no more than somewhat of a criticism of that given by the LILCO witnesses.

So not only the substantive facts, but the source of those facts is indicative of the safety of the mode of operation which LILCO proposes for low power in furtherance of its application for exemption.

Next, LILCO will turn to the exigent circumstances in public interest testimony which warrants the granting of this exemption.

LILCO's application for exemption points out eight different areas, most of which were mentioned by the Commission in its May 16 order. Those eight include fairness to the applicant based on the length and effort of these licensing proceedings, the status of construction at Shoreham, the fact that the plant is ready to begin low power testing, the need to eliminate Long Island's and LILCO's dependence on foreign oil, the economic benefits attendant to low power testing, the furtherance of rational regulation, LILCO's good faith effort to comply with GDC 17 by having qualified on-site power sources, whether public interest demands that strict compliance with the regulations be required and the training benefits attendant to low-power testing.

Some of these require no more evidence. For example, the areas of rational regulation is really a legal argument that LILCO has raised. The fairness in harmonizing the somewhat unclear regulations of the NRC, the differences between the GDCs and 50.57(c), which has been discussed and briefed extensively in earlier portions of this proceeding.

Similarly, the lack of public need or public interest in strict compliance with the regulations is really subsumed in the health and safety evidence. When LILCO proves that operation during this mode would be as safe as it would be even with a qualified on-site power source, there won't be any additional evidence which is needed on that point.

As to the remainder of these points, four different witnesses panels will touch on various areas. Messrs. Gunther and Schiffmacher will testify that the construction of the plant is complete, that LILCO is ready to load fuel within two to three weeks of approval of its low-power license, and also they will describe the training

Sim 4-4

benefits attendant to low-power testing.

Five thousand hours of training will be accomplished during Phases I and II, six thousand hours of training will be accomplished in Phases III and IV, and by completing this testing and training now rather than waiting until the TDI diesel licensing proceedings can be concluded, there are a number of benefits, including that more time will be afforded to conduct this low-power testing and there will be greater opportunity to remedy any problems without affecting the ultimate commercial operation date of Shoreham.

The next witness who will touch on the exigent circumstances and public interest area is Mr. Cornelius Szabo, who is LILCO's Manager for Resource Evaluation. Mr. Szabo formerly worked in the oil industry for Exxon and Mobil. He has been a consultant and he has conducted audits for Aramco, which is the oil company based in Saudi Arabia. He has testified before several State Utility Commissions on fuels matters and he was formerly LILCO's Manager of Fossile Fuel Procurement and the Manger of the Fuels and Chemical Division.

He will tell you how all of LILCO's plants are oil fired and how 90 percent of LILCO's oil that is used now currently is derived from foreign sources, how substantially all of the oil used by LILCO is affected by foreign events in terms of price and stability of supply. He will tell you

Sim 4-5

how LILCO's plants by and large use residual oil, the production of which is being phased out by U.S. refineries because it is unprofitable.

So he will tell you how if the exemption allows low-power testing to be conducted early and eventually allows commercial operation to be reached three months earlier there is a potential benefit to the public by increasing the stability of supply, the price of the electricity which will be generated using this oil, all of which will result by decreasing dependence on foreign events for the oil necessary to produce electricity on Long Island.

The next witness will be Anthony Nozzollilo who will testify concerning the potential economic benefit. Mr. Nozzollilo is the Manager of the Financial Analysis and Planning Department of LILCO and he will testify that if Shoreham reaches commercial operation three months earlier as a result of the granting of this exemption, there is a potential benefit to LILCO's customers, its ratepayers of between \$8 million to \$45 million in terms of present worth of dollars analyzed over a number of years.

He looks at the effect of Shoreham on the rate-payers over this period of time into the future and he looks at its effect on the company-wide revenues. In other words, he doesn't consider Shoreham in isolation because when ratepayers pay rates, the rates are determined by LILCO's

Sim 4-6

company-wide revenue requirements.

And despite making several conservative assumptions in his analysis, he calculates that saving that three months could safety LILCO's ratepayers anywhere from $8 to $45 million.

Now I might mention at this time that LILCO's application for exemption postulated a savings of $90 to $135 million, as I believe I may have explained to the Board on one other occasion. The derivation of that figure is the actual increase in book costs for the Shoreham plant, but that figure does not represent the actual savings by getting the plant into operation early.

In any event, the test mony profferred by Mr. Nozzollilo will show a definite economic advantage to possible early attainment of commercial operation which might be made possible by early conducting of low-power testing.

The last witness will be Mr. Brian McCaffery who is LILCO's Manager of Nuclear Licensing and Regulatory Affairs in the Nuclear Operations Support Department. Mr. McCaffery will tell you that he is familiar with the course of these licensing proceedings and will address several areas.

First, he will address LILCO's good faith efforts to comply with GDC 17. This is not a case where LILCO

Sim 4-7

has simply tried to get around the regulations established by the Commission by asking for this exemption. As I am sure that everyone is aware, LILCO has made a number of efforts to have a qualified on-site diesel power source.

LILCO bought TDI diesel generators whose specifications called for them to comply with GDC 17. When problems arose with the TDI diesel generators, LILCO spent vast amounts of money, manpower and other resources to develop the DROR program. LILCO has gone out and acquired additional diesel generators, the Colt diesel generators which are being installed now at Shoreham.

And even for this low-power operation, as the Board is well aware, LILCO has installed additional new power sources in an attempt to comply with GDC 17, and by those I refer to the EMD diesels at Shoreham.

Mr. McCaffery will further testify about the cost of the Shoreham licensing proceeding to LILCO, the costs in terms of money, in terms of manpower and other resources. And although must of this is obvious merely from perusing the record which is available to the Board, Mr. McCaffery will tie this together to show that fairness to the applicant demands that if this plant can be operated safely during the proposed mode of low-power testing, and LILCO believes and will prove that it can, that this exemption ought to be granted.

In sum, LILCO's evidence will show that the plant is safe and can be operated as safely as a plant with on-site diesel generators at five percent power, and that exigent circumstances and a consideration of the public interest support the granting of this exemption to allow low-power testing on all of the four phases which LILCO proposes. And if the Board does not agree with that, then LILCO requests that at a minimum the Board grant the exemption for those of the four phases which the Board feels can be performed safely with the proposed mode of operation.

Thank you.

JUDGE MILLER: Very well.

At this time I would like to place in the record the names of the persons who have submitted from time to time written limited appearance statements. There are about 68 in number and we would like to have it incorporated in the record, please.

(The document referred to follows:)

WRITTEN LIMITED APPEARANCE STATEMENTS (68)

Alcorn, Jane

Beatty, George E. Jr.

Blumberg, Peter S.

Bredes, Nora

Burke, Alfred E., Mr. & Mrs.

Caputo, Joseph R.
Comptroller, Suffolk County

Caravassi, Mary

Cianchetti, Rose and Robert

Cohen, Perry

College House, Inc.

Commercial Envelope Manufacturing Company

Defeo, Andrew and Germaine

DellaVecchia, A., Mr. & Mrs.

DeSantis, Marguerite

DeYoung, Jane

Ewers, R. M.

Forst, Jack and Helene

Gannon, Robert, Mr. and Mrs.

George, Chris

Glenn, Abraham G., M.D.

Goldfarb, Ted

Gordon, Robin
LWV of Nassau County

Hegarty, Mike and Sue

Heller,, Sue

Huber, Geri

Huber, John and Family

Jamieson, Ann, Alice & William

Karlson, Marion and Kenneth

Keabey, John T.

Kelly, R. F., Mr. and Mrs.

Klein, Kal & Eleanor

Kluewer, Jeff

Kristel, Ira B.

Latham, Kathleen Leslie

Lawrence, N.

Long Island Restaurant and Caterers Association

Luckacovic, John

Martin, P., Mr. and Mrs.

Massino, William

Meregoni, Marge

Metta, Lillian Lu

McCormack, Kathy

McMahon, Joseph and Susan

Nesin, Richard and Susan

Newman, Eileen

North Shore Coalition for Safe Energy

Ortiz, Manuel and Germaine

Pasamanick, Murray

Plastic Industries, Inc.

Pollicino, F., Mr. and Mrs.

Polyprint Packaging Corporation

Ridan Displays, Inc.

Romaine, Shirley

Schienberg, Mark

Sears, Ellen Rita

Shen, Way

Slatkin, Heida and Marcia

Stalzer, Joseph and Family

Sussman, M. H.

Tiedke, Jean H.
LWV of Suffolk County

Vento, Mr. and Mrs.

Vicker, Kay Halkins, Ph.D.

Volpe, Richard

Walker, Patricia

White, Thomas H., Mr. & Mrs

Wiggins, Beverly

Wittmer, M., Mrs.

Yelen, Rosalie

Sim 4-9

JUDGE MILLER: Are you ready to proceed, counsel, with your first witness?

MR. EARLEY: Yes, sir.

JUDGE MILLER: You may do so.

MR. EARLEY: Judge, LILCO calls to the stand Mr. William Gunther and Mr. William Schiffmacher.

Whereupon,

WILLIAM E. GUNTHER, JR.

-- and --

WILLIAM G. SCHIFFMACHER

were called as witnesses on behalf of LILCO and, having been first duly sworn by Judge Miller, were examined and testified as follows:

JUDGE MILLER: Thank you. You may be seated.

DIRECT EXAMINATION

BY MR. EARLEY:

Q Gentlemen, would you please state your names and your employment address for the record, please.

A (Witness Schiffmacher) My name is William G. Schiffmacher. I am employed by Long Island Lighting Company. My address is 175 East Old Country Road, Hicksville, New York.

A (Witness Gunther) My name is William E. Gunther, Jr. I am employed by Long Island Lighting Company. My business address is Post Office Box 628, the Shoreham Nuclear Power Station, Wading River, New York.

Sim 4-10

Q Gentlemen, do you have in front of you a document entitled "Supplemental Testimony of William E. Gunther and William G. Schiffmacher on Behalf of Long Island Lighting Company"?

A (Witness Schiffmacher) Yes, we do.

A (Witness Gunther) Yes.

Q And that document consists of 22 pages plus a single attachment?

A (Witness Schiffmacher) That is correct.

Q Gentlemen, do you have any changes to that testimony?

A (Witness Gunther) Yes. I would like to make one change on page 21 at the very bottom of the page. I would like to delete August 1st, 1984 and replace that with August 15th, 1984. That is the only change.

Q Gentlemen, with that correction is your supplemental testimony true and correct to the best of your knowledge and belief and do you adopt it as your testimony in this proceeding?

A (Witness Gunther) Yes, I do.

A (Witness Schiffmacher) Yes, I do.

MR. EARLEY: Judge Miller, these witnesses were voir dired on their qualifications when they took the stand on I believe it was April 24th.

If the Board wishes, they can summarize the

Sim 4-11

qualifications, but they have done that before and LILCO is ready to proceed.

JUDGE MILLER: Let me inquire first, are you profferring them for any other areas of expertise except those which were the subject of voir dire or at least a representation of counsel to the Board at the April 24th hearing?

MR. EARLEY: Judge, no. They are covering essentially the same areas that they covered before.

JUDGE MILLER: I asked areas of expertise and not what they are covering, but what they are covered by.

MR. EARLEY: The same areas of expertise.

JUDGE MILLER: All right.

Let me inquire now of staff, do you have any objection or do you wish any further voir dire?

MR. PERLIS: We have no further voir dire.

JUDGE MILLER: Suffolk County?

MS. LETSCHE: We have no additional voir dire of these witnesses.

JUDGE MILLER: The State of New York?

MR. PALOMINO: No, Your Honor.

JUDGE MILLER: Thank you.

Very well. You may proceed then without going into the subject matter from the former voir dire except insofar as it may touch upon this supplemental testimony in

Sim 4-12

an explanatory fashion and you use your own judgment on that.

DIRECT EXAMINATION (Continued)

BY MR. EARLEY:

Q Gentlemen, for the record and for the Board, would you please briefly summarize what is contained in your supplemental testimony?

A (Witness Gunther) This additional testimony reiterates the testing that is performed during Phases I, II, III and IV highlighting the training and experience benefits that can be obtained from conducting low-power testing at this time.

Additionally, it describes the procedures that have been formulated and actually drilled to verify that the 20 megawatt gas turbine and the four GM-EMD diesels can perform as described previously in testimony.

And, finally, the testimony describes an emergency tie-in that is capable of being installed if required in the future.

Q Gentlemen, does your testimony include any information on the status of the plant?

MS. LETSCHE: Excuse me, Judge Miller, just a point of clarification. It was my understanding that since the testimony was prefiled that that was what we were going to be dealing with in this proceeding, and I am not sure what additional direct testimony is being elicited here by counsel for LILCO. I don't mind a summary.

JUDGE MILLER: I hadn't heard of any additional direct testimony.

MR. EARLEY: Judge, I just want to make sure we get a complete summary of what has been prefiled.

JUDGE MILLER: Yes. You are not going down the scope at this time at any rate of the prefiled direct testimony?

MR. EARLEY: No, sir.

JUDGE MILLER: All right. You may proceed.

WITNESS GUNTHER: The testimony also includes a statement regarding the readiness of the plant at this time to load fuel and proceed with the low-power testing Phases I through IV.

MR. EARLEY: Judge Miller, at this time LILCO's panel is ready for cross-examination and LILCO moves to have included in evidence in this proceeding the supplemental testimony of Messrs. Gunther and Schiffmacher.

JUDGE MILLER: We will mark for identification the profferred supplemental testimony of those witnesses. What would your exhibit number be, do you recall?

MR. EARLEY: Judge, I am afraid I don't recall from the last time.

JUDGE MILLER: Well, you may supply it. It will

Sim 4-14

given the identification number next following the one that you last used for the record.

MR. EARLEY: Yes, Judge.

JUDGE MILLER: It will be marked for identification at this point untill cross-examination has been concluded.

Sim 4-15

JUDGE MILLER: Cross-examination, Suffolk County.

MS. LETSCHE: Judge Miller, in light of the Board's previous practice with respect to motions to strike, the County did not file written motions to strike with respect to the LILCO prefiled testimony.

We do have certain portions of testimony that we do believe should be stricken, however, and I will mention those now, if the Board wishes, with respect to Messrs. Gunther and Schiffmacher's testimony.

JUDGE MILLER: Well, you may mention it at such time as you deem appropriate and most conducive to clear procedure. You can do it now or you can do it in the middle or you can do it at the end. We don't mind. Just do whatever way commends itself for clarity.

MS. LETSCHE: Okay. I will deal with those when I get to that section in my cross-examination if that is all right.

JUDGE MILLER: Fine.

CROSS-EXAMINATION

INDEX

BY MS. LETSCHE:

Q Mr. Gunther, I think my first group of questions are going to be addressed primarily to you.

I would like to direct your attention, please, to page 2 ... your prefiled testimony. On that page you begin the description of the testing that is going to take

Sim 4-16

place during Phase I of LILCO's proposed low-power testing program; is that correct?

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A (Witness Gunther) That is correct.

#5-1-SueT

Q And the first phase, if you will, of Phase I is initial core loading, right?

A (Witness Gunther) That is Phase I, is fuel loading.

Q All right. That consists of the actual loading of the core with the fuel bundles followed by certain testing to verify operability before it goes critical in Phase II; is that correct?

A That's correct.

Q Now, that first process, the initial core loading that you describe on Page 2 of your testimony, takes an elapsed time of at least 288 hours; is that correct?

A That's correct.

Q Now, you describe, beginning on Page 2 and carrying over to Page 3, four types of testing that are associated with that core loading process.

Now, the first one there on the bottom of Page 2, Item (A), water chemistry surveillance testing, you state that that testing must be performed prior to, during and after the fuel loading operation.

That's right, isn't it?

A Yes, it is.

Q So this particular testing you are going to be performing not just in Phase I but also during other phases of your low power program; is that right?

#5-2-SueT

A Yes, that's correct.

Q Now, am I correct, Mr. Gunther, that this testing is described in LILCO's FSAR as one of the start-up or fuel loading tests?

A Yes.

Q And that's on Page 14.1-68 of the FSAR; is that right?

JUDGE MILLER: Do you have it before you?

WITNESS GUNTHER: No. I don't have the FSAR before me. But it is in the FSAR.

JUDGE MILLER: Yes. You are being asked now about a particular section or page, and I don't want you just to guess.

WITNESS GUNTHER: I would like to see the page, then. I don't recall the exact page number in the FSAR.

MS. LETSCHE: I don't have the entire FSAR. I imagine your counsel probably has it.

I can show you that section if that would help you.

JUDGE MILLER: Well, if you could show him the section or page you have just alluded to so that he can verify it, I think would be sufficient at this point.

MS. LETSCHE: We are handing the witness Chapter 14 of the FSAR.

WITNESS GUNTHER: Can I have the page cite again,

#5-3-SueT

please.

BY MS. LETSCHE: (Continuing)

Q Yes. I'm sorry. It's 14.1-68.

A (The witness is going through a document.)

Yes, this test section does describe the chemistry I'm talking about in my testimony.

Q In Part (A), right?

A That's correct.

Q Now, the test that is described or designated (B) on Page 3 of your testimony, the control rod drive stroke time and friction tests, now you state that those are required to ensure that the reactor shutdown capability is maintained at all times and to ensure that the control rod drive mechanisms are performing as designed.

I take it, Mr. Gunther, that these tests also are set forth in Chapter 14 of the FSAR as part of the normal fuel loading cycle; is that correct?

A Yes, that's correct.

Q Maybe you can verify for me that these are described at Page 14.1-71 of the FSAR?

A (The witness is going through a document.)

That's correct.

Q The procedures that are described in Part (C) of your discussion Page 3 of your testimony involves, as I read it, a couple of things. You have installation and

#5-4-SueT

calibration and utilization of special instrumentation.

And I take it that that instrumentation must be installed, calibrated and utilized in order to properly monitor the core conditions during the testing that is going to follow this; isn't that right?

A Yes, that's correct.

Q And in addition, part of what you describe in Section (C) there is testing of the source range monitors and calibration of the neutron monitoring instrumentation --

A Correct.

Q -- that's a separate process. And that testing and calibration is necessary in order to verify the final alignment of that equipment; is that correct?

A Yes, it is.

Q And these procedures are also set forth in the FSAR as part of the start-up testing process; isn't that right?

A Yes, they are here.

Q Now, the procedures that are described in Part (D) of your testimony on Page 3, core verification instrument operability checks, is how you describe that. Those are also part of the standard start-up test procedure; isn't that right?

A Yes, that's true.

Q Am I correct that what is described in (D) is at

#5-5-SueT

least in part sort of a final check on what you described up in Part (C) there, additional verification of this instrument operability?

A This portion of the testing is performed once the core is entirely loaded and includes a final alignment and calibration of the nuclear instrumentation described in Part (C) as well as performing several other checks regarding the fuel orientation itself.

Q Some of those things included some kind of actual visual observation of the fuel after it's loaded; isn't that right?

A That's correct.

Q Now, the tests that you describe in Sections (A) through (D) on Pages 2 and 3 are tests that would be performed whether LILCO obtained its low power license after having complied with GTD-17 or if LILCO obtains its low power license pursuant to the grant of an exemption; isn't that right?

A The testing described in the testimony is part of the standard power ascension program, and the portion extracted from that power ascension program is simply the testing that is performed at the low five percent power.

In this case, Phase I, which is just a fuel loading operation per se.

Q Right. And those tests would be performed whenever

#5-6-SueT

the low power testing is conducted; isn't that correct?

A Yes, that is correct.

Q Now, beginning on Page 4 you describe a number of tests that are also part of the Phase I section of the low power program; is that correct?

A Yes, it is.

Q And these take place after you have the fuel in the vessel?

A That's correct.

Q Now, this second phase of Phase I, is how I will refer to it, according to your testimony involves approximately 150 hours of elapsed time; is that right?

A Yes, it is.

Q I take it that's the minimum amount? That assumes no delays or problems arising during the course of this testing; is that right?

A That's the amount derived from the schedule and would be an optimum time.

Q Okay. And I take it that's also true for the 288 hours that you described for the actual core loading earlier; is that right?

A That's correct.

Q The first test that you describe on Page 4 involves the low power range monitors, the local power range monitors. Excuse me. This testing and obtaining of data

#5-7-SueT

is, Mr. Gunther, something that is part of the normal start-up test process described in the FSAR, isn't it?

A Yes, it is.

Q The second set of procedures that are described in Part (B) of your testimony on Page 4, obtaining of zero power radiation background readings, that's also something that is required according to the FSAR; isn't that right?

A Yes, it is.

Q Now, the test you describe in Part (C), recirculation system instrument calibration checks, those tests are necessary, I take it from your testimony, in order to verify the performance of those systems; is that right?

A Yes, it is.

Q And those tests are also required by the FSAR; is that right?

A Yes, they are.

Q The same is true for the tests that are described in Part D on Page 4?

A Yes.

Q In Section (E), you refer to cold MSIV timing as a functional test. That test is a requirement of the Shoreham technical specifications, isn't it?

A That's correct.

Q And that testing must be performed before any actual operation is permitted; is that right?

#5-8-SueT1

A That's correct.

Q Now, am I correct that the testing and the activities that are described in Parts (A) through (E) on Page 4 of your testimony must be performed whenever LILCO receives a low power license and decides to begin operation of Shoreham; isn't that right?

A Yes, that's correct.

Q You are not testifying that these tests wouldn't be performed if LILCO were to receive --

JUDGE MILLER: You have covered that about six times, counsel. I think you can move on.

BY MS. LETSCHE: (Continuing)

Q You state on Page 5 of your testimony, Mr. Gunther, that the experience and training gained from these activities -- and I take it you are referring to the ones you just talked about on Page 4 -- provide valuable Shoreham specific augmentation to training that reactor operators have previously undergone.

Do you see that reference?

A Yes, I do.

Q Am I correct that you are talking about the testing that you have described on Page 4 in that sentence?

A Yes, that is correct.

Q Now, this Shoreham specific augmentation of previous operator training would be received by those

#5-9-SueT

operators whenever this low power testing took place; isn't that right?

A Yes, that is correct.

Q Now, beginning on Page 5 you start talking about Phase II, the cold criticality testing portion of LILCO's low power test program. And you mention in the second sentence that reactor operators must annually perform a minimum of 10 reactivity control manipulations.

When does that requirement begin? When does that requirement kick in for the reactor operators?

A Upon obtaining a license, post fuel load.

Q I take it that -- let me make sure I understand -- once any operating license is granted to LILCO that the ractor operators licensed for Shoreham operation are going to have to perform at least 10 reactivity control operations every year, right?

A That's correct.

Q Now, you state in the -- I guess it's the fourth sentence in that first full paragraph on Page 5, you state that during the cold criticality phase of the low power program, additional time has been allotted in the schedule so that all operating crews will have the experience of taking the reactor critical.

What is the schedule that you are referring to there in that sentence, Mr. Gunther?

#5-10-SueT

A The power ascension program has been scheduled in detail to incorporate each test that has to be performed and the series of operations within the plant that must be performed in order to get to that pre-test condition. This schedule is called the power ascension test program.

What we have done is to remove a portion of that program strictly to be the testing to be performed below the five percent power. So that when a five percent license is obtained we can go right into that testing.

The portion of the additional testing I'm talking about here is approximately 72 hours that has been added to the schedule to provide the operators with time to perform the criticality maneuvers and obtain this additional training and experience that I'm talking about in my testimony that will be very valuable to them.

Q Just so that I understand, you are saying that 72 additional hours have been added to the time required to perform the Phase II activities?

A Yes, that is correct.

Q Okay. Now, the schedule that you refer to, that isn't contained in the FSAR, is it?

A No, it's not.

Q Is that something that LILCO prepared since its application or its supplemental motion for a low power license in March of '84?

#5-11-SueT

A There has always been a power ascension program test schedule. What was done subsequent to applying for the five percent license was to extract the portion of the test program that deals with testing up to five percent power so we can focus on those activities to be conducted.

MS. LETSCHE: I would like to have marked as Suffolk County Exhibit LP -- I do not recall what the next number is -- a document which is titled "Time Summary of the 5% Power Tests" and has numbers at the bottom, L-214 through L-233, and a final page that doesn't have a number on it.

And my colleague will pass copies of these out.

(Mr. Birkenheier is distributing copies to the Board members, the court reporter, and counsel.)

JUDGE MILLER: When can you supply the exhibit number for identification, counsel?

MS. LETSCHE: I will check the transcript during the break and find out what the number is.

JUDGE MILLER: Fine.

BY MS. LETSCHE: (Continuing)

Q Mr. Gunther, do you have the document that we have just handed out and had marked for identification?

A Yes, I do.

Q Do you recognize this document?

A Yes, I do.

Q Is this the schedule, the five percent power

#5-12-SueT1

ascension test program schedule, that you were just describing to me?

A This is the schedule without the additional time for reactor criticals to be pulled by reactor operators.

Q Okay. So the time periods that are set forth in this document are the minimum amounts without any additional training or heatups or testing; is that right?

A Yes, that's correct.

Q Now, looking at the first page of this exhibit which has the L-214 at the bottom and is titled "Table 1, Time Summary of the 5% Power Tests" am I correct that the first item under the overall time requirements that is identified as fuel loading prerequisites, that that item takes place before Phase I actually begins?

end #5
Joe flws

A Yes, that is correct.

Q And am I correct that the second item, entitled, Open Vessel Testing, constitutes Phases 1 and 2, as you have described them in your testimony.

A Yes.

Q And am I correct that Item 3, titled, Initial Heat Up, is the equivalent of Phase 3 as described in your testimony?

A Yes.

Q And that Item 4, titled, Low Power, Five Percent CTP Testing With Subsequent Heat Ups, constitutes Phase 4?

A Yes.

Q And the amount of hours and days that are listed on this Table 1 summary, represent the elapsed time to perform the activities in any given category, is that right?

A That is correct.

Q And I also assume that these are the times necessary to perform those activities, assuming that no test problems or delays arise during the performance of those procedures, is that right?

A Yes.

JUDGE MILLER: Pardon me. You are allowing no time for building upon experience, or minor goofs, or things like that?

WITNESS GUNTHER: That is why I hesitated a little bit, Judge. We don't assume any particular problems, but we certainly have derived the schedule from previous plant start-ups. This has been done many times before, and we have used the composite of those times for our schedule making purposes.

BY MS. LETSCHE: (Continuing)

Q Just so I understand, Mr. Gunther, I know you say in your testimony that the two to three months is the approximate time to perform your low power testing, and that you recognize that additional delays or problems could arise. I believe you say that a few pages beyond where we are in your testimony right now.

You say that on page 9, if you want to look at it. My question was with particular reference to the times that are set forth in this time summary, which we have marked and have been discussing now, and it is my understanding that these times in here do not include assumed times arising out of problems or delays, isn't that right?

A (Witness Gunther) Again, there are no particular problems anticipated that are thrown into the schedule. The scheduled times are derived from typical times it takes to perform those functions and operations that I have described.

Q Okay. Now, you mentioned a few minutes ago that you were going to add an additional 72 hours, I believe, into the schedule for Phase II to provide additional training for the operating crews, is that right?

A Yes.

Q And is that what you were referring to at the top of page 6 of your testimony, where you say: LILCO plans to repeat the operations during this phase of low power testing to offer each operating shift this valuable BWR experience?

A That is correct.

Q LILCO has six operating shifts, is that right?

A Yes.

Q Now, would you turn to the page of the exhibit which is entitled, Appendix 2. It has L 220 at the bottom right hand corner. Now, I think we have agreed that this -- that the items that are set forth in Appendix 2 represent the procedures that are going to be performed in both Phases I and II of your program, is that right?

A Yes.

Q Now, can you identify for me which operations set forth in this Appendix 2 are the ones that LILCO plans to repeat in the 72 hours that you mentioned a minute ago?

A At the bottom of that page, L 220, Section 2.5, and/or 2.7, it is the same function, only different rods are pulled in a different sequence to obtain criticality.

Either one of those two steps would be performed.

Q And I take it that once you -- in addition to taking the reactor critical, you will then perform a cooldown or a shutdown after you do that, is that right?

A There would be no cool down necessary. The reactor stays at ambient pressure and temperature conditions. We would perform a shutdown by inserting the rods in reverse order.

Q Right. So that would be Section 2.9?

A Yes, that is correct.

Q Now, according to Appendix 2 taking the reactor critical takes either 32 or 12 hours, and shutting it down by inserting the control rods in reverse order takes 48 hours, is that right?

A Yes, that is what it says.

Q Well, am I right then that your additional 72 hours that you are going to add here would involve only -- would involve one additional taking of the reactor critical during Phase II?

A No, that is not correct. On 2.9, where it states shut down the reactor by inserting all control rods in reverse order, that is a shut down to complete cold shut down conditions, all rods inserted; and that takes approximately 48 hours. Or 48 hours has been allotted in the schedule.

To perform any additional critical for operator training purposes, it would not require inserting all control rods to the full in position.

It would just be necessary to take the reactor sub-critical, let it stabalize, and then bring the reactor critical again for the next crew to obtain that experience and training.

So, the 48 hours is not indicative of the time it would take to perform those ten additional criticals that we are talking about.

Q Okay. You are talking about performing ten additional ones --

A I am sorry. Six. I stand corrected. Well, can I clarify that a little bit more. Six operating crews will obtain the experience.

On each operating crew there are five licensed operators. We would like each licensed operator to get that experience. So, there would be a multiple number of criticals during this phase of testing. What the exact number is is not really important. The time that the reactor remains critical is small.

Q You state that you estimate there would be about five thousand total man hours of training accomplished during fuel loading pre-criticality testing and cold criticality testing at Phases I and II, right?

A Yes.

Q Now, I take it that that five thousand man hours includes the additional criticals that you plan on performing during Phase II, is that right?

A Yes, it does.

Q Mr. Gunther, how many operating plant personnel, including licensed operators, would be involved in performing the Phase I and Phase II testing?

A The personnel involved directly in the testing -- of course, the entire operating section, which consists of 31 licensed operators and supervisory personnel. The Reactor Engineering Department is very, very much involved with the program, and that department consists of five engineers and six shift technical advisors.

Maintenance personnel and instrumentation and control personnel are also involved with testing to verify instrument calibrations and alignment, as well as performing the additional mechanical maneuvers involved with the actual fuel loading process.

Q And I take it that the five thousand total man hours of training covers all those people, is that right?

A Yes, it does.

Q You begin talking about Phases III and IV at the bottom of page 6 of your testimony. Now, I am correct, aren't I, that the testing that is described here, and you reference your earlier testimony also for the description of Phases III and IV, that those testing procedures are set forth in the FSAR, and would be performed whenever low power testing is conducted, is that right?

A Yes, that is correct.

Q Now, I believe you said in your previous testimony that Phase -- that you intend to perform in Phase IV two heat-ups, is that correct?

A There were two scheduled heat-ups, with a possible third.

Q Okay. And looking again at the exhibit, in particular the portion of the first page, Table 1, under Section B, am I correct that the two heat-ups, three heat-ups division is the same that you just referred to. These are the times required if you do two heat-ups as opposed to three heat-ups?

A I am sorry. Can you give me that reference, please?

Q Yes. The Section B of the document we have marked as Suffolk County Exhibit Low Power -- and I am going to supply the number -- exhibit something. The time summary.

I have just been told that this is going to be Exhibit 2.

JUDGE MILLER: 2? Thank you. The record will so reflect.

XXXX INDEX

(The above mentioned document is marked for identification as Suffolk County Exhibit LP-2.)

BY MS. LETSCHE: (Continuing)

Q That the times set forth under the column headings two heat-ups and three heat-ups in Section B of the first page of Suffolk County Exhibit LP-2, reflect the difference in times required for performing either two or three heat-ups during Phase IV?

A (Witness Gunther) Yes, that is correct.

Q I take it, though, that you don't intend to perform the main turbine roll during Phase IV, is that right?

A No, we don't.

Q So, we would deduct that bottom line of four hours?

A Yes.

Q Okay. Now, you say at the bottom of page 7 and carrying over to page 8, and I think here you are still talking about Phases III and IV, that LILCO intends to expand low power testing program, and that you have scheduled time at the conclusion of Phase IV testing for reactor operators to perform additional reactor heat-ups.

Now, that is in addition to the two or three that you might perform?

A Yes, that is right.

Q Now, am I correct that -- strike that. How many additional reactor heat-ups does LILCO intend to perform at the end of Phase IV?

A If given the opportunity to perform the low power test program at this time, we would have additional time to give all six operating crews the training benefit and the experience benefit of a reactor heat-up, so I would be talking about a minimum of three more, possibly as many as five more reactor heat-ups.

Q Now, if LILCO were to get its low power license, and get a full power license shortly thereafter so that you would have the full power license by the time you finished two or three reactor heat-ups, which is what is in Phase IV, does LILCO still intend to perform additional three to five reactor heat-ups to provide training?

A No. That would not be necessary. In higher power testing, the program calls for a multiple number of reactor start-ups, shut downs, reactor heat-ups. That training and experience would occur at that time.

Q You state that it is estimated that six thousand man hours of training would occur during Phases III and IV. Am I correct that that training would accrue to the same individuals you identified for me before with respect to Phases I and II?

A The personnel I mentioned previously would be included.

In addition, the health physics technicians would start obtaining some additional training and experience due to the fact that radiation does exist.

Q If you have the time and so decide to do some additional heat-ups, -- let me rephrase that. You state that time has been scheduled at the conclusion of Phase IV to perform additional heat-ups, and you told me you were thinking of three to five.

How much time has been added to the schedule for those additional heat-ups?

A Three days.

JUDGE MILLER: Pardon me. How much?

WITNESS GUNTHER: Three days.

JUDGE MILLER: Thank you.

BY MS. LETSCHE: (Continuing)

Q Mr. Gunther, just so I can finish identifying and verifying what this exhibit, Suffolk County Exhibit LP-2 consists of, would you verify for me that what is entitled Appendix 3, which begins on the page that has L 223 at the bottom right hand corner, describes the procedures that would be performed during Phase III of LILCO's low power test program?

A Yes, that is correct.

Q And the portion entitled Appendix IV, which begins on the page with L 227 at the bottom right hand corner constitutes Phase IV of the planned low power program, is that right?

A With the exception that 4.1 is included in Phase III. That is the rated pressure and temperature conditions that constitute up to one percent power in the reactor.

End 6.
Mary fols.

Sim 7-1

Q And I take it also that Section 4.5, which is on the last page, which is the turbine role, is not included in Phase IV, right?

A (Witness Gunther) That is correct.

MS. LETSCHE: Judge Miller, at this time I would like to move into evidence what has been marked as Suffolk County Exhibit LP-2.

JUDGE MILLER: Well, I think properly you should offer it into evidence if it is in your own case. However, you may use this, and the other parties may use it during the course until that happens.

I think we will take about a 10-minute recess.

(Mid-morning recess taken.)

JUDGE MILLER: You may proceed.

MR. EARLEY: Judge Miller, may I raise one thing before we start?

JUDGE MILLER: Yes.

MR. EARLEY: You asked about numbering testimony as exhibits. I checked the transcript the last time we were in hearings. We weren't marking direct testimony as an exhibit number. We were just calling it testimony and then binding it into the transcript at the time it was ---

JUDGE MILLER: Not binding it in, but we were giving transcript numbers to each page ---

MR. EARLEY: Yes, to each page.

Sim 7-2

JUDGE MILLER: --- as though read or testified to verbatim.

MR. EARLEY: Yes. sir. I assume then that we want to continue with that same method rather than giving it a specific exhibit number.

JUDGE MILLER: Yes, if that is the practice that we followed before.

MR. EARLEY: Yes, sir.

MS. LETSCHE: Judge Miller, I have a preliminary matter also. I understand that the Board wishes that we actually move into evidence during our direct case exhibits that we discussed during the cross-examination.

JUDGE MILLER: Yes.

MS. LETSCHE: But I wonder if we could at least find out if there is going to be any objection to the admission of that, particularly as it goes to the foundation for the exhibit because, if that is the case, I would need to follow up with these witnesses in order to continue to establish additional foundation if that were ruled necessary.

JUDGE MILLER: Well certainly foundation is going to be necessary for any exhibit. Now it may be that it is self-evident ---

(At this point one of the camera people turned on his lights.)

JUDGE MILLER: I am sorry. You will have to

Sim 7-3

reduct that light.

(The camera lights were turned off.)

JUDGE MILLER: What is your problem?

MS. LETSCHE: Well, as far as I am concerned, I have laid an adequate foundation for the admission of this exhibit. However, if there were an objection to its admission, an objection based on lack of foundation, or lack of relevance for that matter, or the Board were to rule that it failed to establish an adequate foundation, I would need to have these witnesses available to be able to remedy that problem.

JUDGE MILLER: These aren't your witnesses, are they?

MS. LETSCHE: No, and that is why they are not going to be available to me.

JUDGE MILLER: I know, but what is the source of this document? Did you get the number, by the way?

MS. LETSCHE: It is Suffolk County LP-2.

JUDGE MILLER: What is the source of that? Where did it come from?

MS. LETSCHE: From LILCO.

JUDGE MILLER: Well, aren't you in a pretty good position if it comes from LILCO to be able to offer it?

MS. LETSCHE: I assume I am.

JUDGE MILLER: Except I don't know about relevancy

Sim 7-4

or matter of that kind.

MS. LETSCHE: My only point, Judge Miller, is that if there were to be an objection at the point that I actually formally move this into evidence during the presentation of our direct case, I would want the opportunity to recall these witnesses if necessary to establish an additional foundation if that were the objection.

JUDGE MILLER: Well, let's get at it A, B and C. In the first place, if you had that problem, you certainly could have used the rules of evidence to ask for admissions as to the authenticity and already had that matter cleared up.

(B), if you want these witnesses for your own case, you can subpoena them. Remember, they are not your witnesses.

Now, (C), are there going to be any objections to this document?

MR. EARLEY: Judge Miller, I don't think so. I would like to discuss it with my witnesses, but we will be prepared to let the County know what whether we are going to object before the witnesses leave the stand.

JUDGE MILLER: All right. We encourage that because it will perhaps save time on the part of all of you.

All right. You may proceed on that basis.

MS. LETSCHE: Thank you.

Sim 7-5

BY MS. LETSCHE:

Q Mr. Gunther, on page 8 of your testimony I would like to direct your attention to the answer to Question 3, which begins on that page.

You discuss there the power ascension test program at Shoreham, which is the entire process, including the low-power testing process that gets you from zero to 100 percent power; is that right?

A (Witness Gunther) Yes.

Q And I take it from the numers that you have set forth in your testimony that the power ascension test program will take roughly nine to ten months to complete and that it will take roughly seven to eight months to get to 100 percent power after a full-power license is issued; is that right?

A Yes, that is correct.

MS. LETSCHE: I would like to have marked as Suffolk County Exhibit LP-3 the document which my colleague is handing out, which is Figure 14.3.1-1, titled "Approximate Schedule for Startup," which is taken from the Shoreham FSAR.

(The document referred to was marked Suffolk County Exhibit LP-3 for identification.)

XXXXX

BY MS. LETSCHE:

Q Mr. Gunther, do you recognize what has been

Sim 7-6

marked as Suffolk County Exhibit LP-3 for identification as a figure from the Shoreham FSAR?

A (Witness Gunther) Yes, I do.

JUDGE MILLER: Is there any question that this comes from the FSAR?

MR. EARLEY: Counsel for Suffolk County represents that it did and I have no reason to disagree. It appears to be an FSAR page.

JUDGE MILLER: All right. Well, since this document is already in evidence -- hasn't this been offered into evidence, the FSAR?

MR. EARLEY: Yes, it has, Judge.

JUDGE MILLER: I think it has. So, therefore, I don't think we need to have any more questions about the basis or the foundation, do we?

MR. EARLEY: No, Judge.

JUDGE MILLER: Being an FSAR document, we will admit this one into evidence as Suffolk County's LP Exhibit No. 3.

(Suffolk County Exhibit LP-3, previously marked for identification, was admitted into evidence.)

(The exhibit follows:)

Suffolk County LP-3

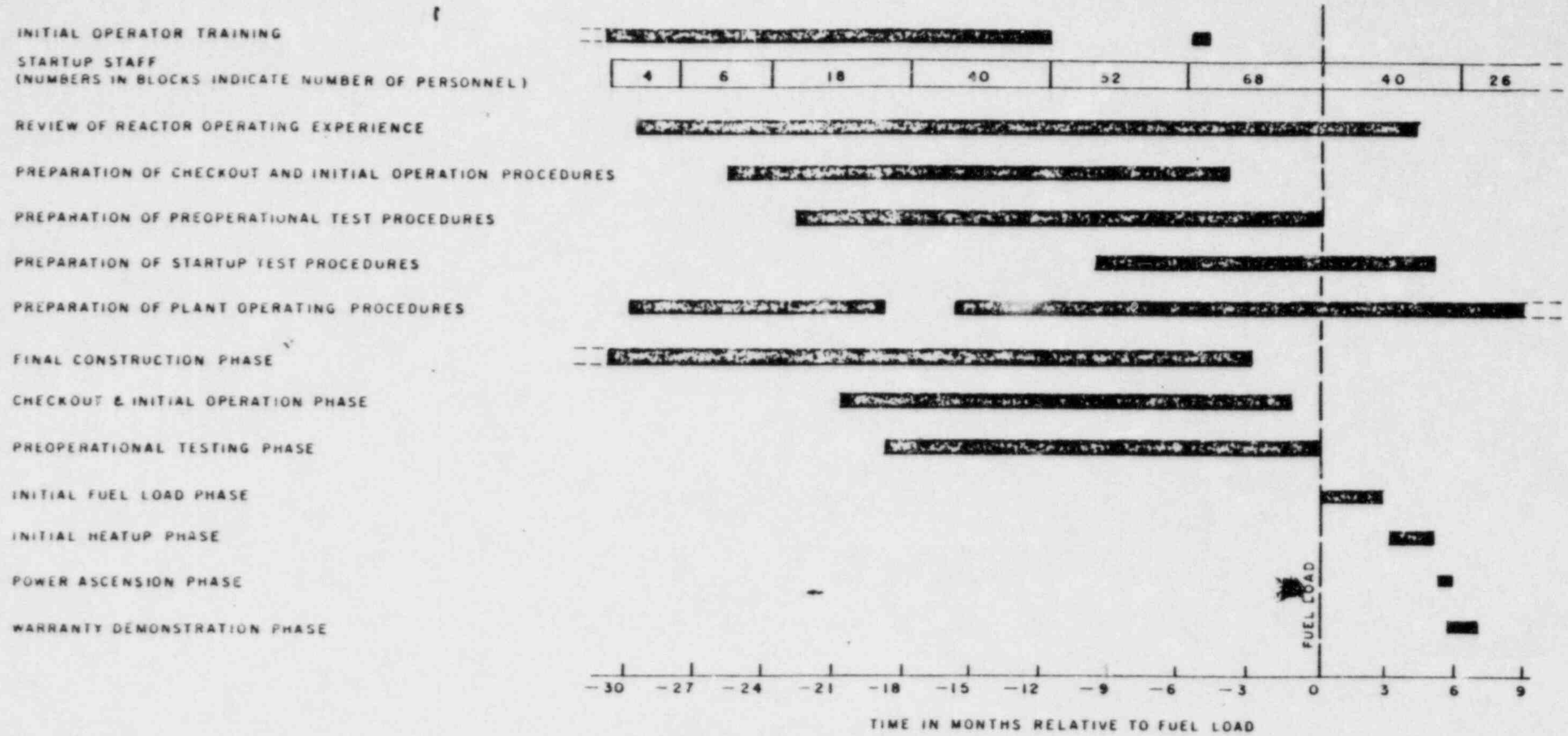

FIG. 14.3.1-1

APPROXIMATE SCHEDULE FOR STARTUP

SHOREHAM NUCLEAR POWER STATION – UNIT 1

FINAL SAFETY ANALYSIS REPORT

REVISION 4 – FEBRUARY, 1977

BY MS. LETSCHE:

Q Now, Mr. Gunther, going to the last four items listed in this table, I would like to just clear up a couple of questions I have.

The item listed as initial fuel load phase, I take it that that would be equivalent to the preparation for fuel load and Phases I and II of the LILCO low-power test program?

A (Witness Gunther) Yes.

Q And on this FSAR table the amount of time allotted for that process is a little less than three months; is that correct?

A Yes.

Q Now the next item, initial heatup phase, am I correct that that would include Phases III and IV in the low-power program?

A I believe so. We would have to reference exactly what they are talking about on the graph. It could include simply Phase III, up to rated conditions.

Q I see, and in that case Phase IV would be part of the power ascension phase?

A That is correct.

Q Well, it is true, isn't it, that according to this schedule in the FSAR the time from initial fuel load to the completion of initial heatup is roughly five months

Sim 7-8

or so? Would you agree with that?

A It appears to indicate that, yes.

JUDGE MILLER: Pardon me. Now are you testifying that that is a fact in your best judgment, or are you testifying that that is what appears on this exhibit? They are two different things. So let's be clear.

WITNESS GUNTHER: No.

BY MS. LETSCHE:

Q My question was is that what this FSAR table shows?

A (Witness Gunther) Yes, it does.

Q The power ascension phase, which is described in this FSAR schedule, I take it, would include the testing to get up to 100 percent power; is that right?

A Yes.

Q And according to this schedule contained in the FSAR, the amount of time from fuel load to completion of the power ascension phase is roughly six months; is that correct?

A Yes.

Q Mr. Gunther, beginning on the bottom of page 9 of your testimony you mention a number of procedures that have been revised or written to incorporate the new proposal for AC emergency power made by LILCO, and you list those on page 10. Are these procedures that you list on page 10 now

Sim 7-9

finalized?

A Yes, they are.

Q Mr. Schiffmacher, at the bottom of page 10 you sponsor an answer which talks about procedures for the system operator.

In the last sentence there you state that certain procedures have been established for restoration of power to Shoreham. Are you referring there to any of the procedures that are listed on page 10?

A (Witness Schiffmacher) No, I am not.

Q Mr. Gunther, I would like to direct your attention to page 11 of your testimony, please. You state in the answer to question 5 that as part of the training provided to all six operating crews and management license holders that a walk-through was conducted. When was that walk-through conducted?

A (Witness Gunther) During the six-weeks cycle of training in which all of the licensed personnel took part in this training. The classroom portion was conducted and then that was followed up by an actual walk-through of the procedures and it included a description of how the diesels and gas turbine operate by functionally looking at those machines and looking at the equipment itself.

Q Can you tell me when it was that that occurred? I understand it was over a six-weeks span, but can you give

Sim 7-10

me an approximate time?

A Yes. It begain in the middle of April and concluded by the end of May.

JUDGE MILLER: 1984?

WITNESS GUNTHER: 1984.

BY MS. LETSCHE:

Q And am I correct that the procedures that were walked through are the ones that you list on page 10?

A (Witness Gunther) Yes, that is right.

Q All of those?

A Several of the procedures listed on page 10 are normal operating procedures that were previously issued years ago and the operators were trained on those as part of their license requirements. So those were not repeated, but the new procedures dealing with the gas turbine and the GM-EMD diesels were part of that training.

Q Okay. Just so that we can make sure that the record is clear, why don't you tell me which of the procedures on page 10 were not included in the walk-through?

A The procedures, fourth and third from the bottom, 23-30801 and 23-30901, are the normal station procedures associated with the electrical distribution system, both the normal and the emergency systems at the plant.

Q Isn't that also true for the loss of all AC power, procedure 29.015.02?

Sim 7-11

A The loss of all AC power procedure is a permanent plant procedure, that is correct. It was revised significantly though enough that we did conduct special training on that procedure.

end Sim
Sue fols

#8-1-SueT

Q Do you have a copy of that procedure up there with you, Mr. Gunther, the loss of all AC power procedure?

A I can get access to one fairly quickly.

Q Okay. Why don't you do that?

JUDGE MILLER: What is the relevance of that? Why are we taking the time to do this?

MS. LETSCHE: I have some questions concerning that procedure and the revisions to it.

JUDGE MILLER: I know, but what's the relevance of the questions that you have concerning a procedure?

Where are you going?

MS. LETSCHE: Well, Mr. Gunther has stated in his testimony that operators have been trained with respect to these procedures and that they have been revised in order to reflect the new AC power configuration now proposed by LILCO.

JUDGE MILLER: Yes.

MS. LETSCHE: And I have some questions concerning those revisions that he has referred to in this procedure.

JUDGE MILLER: What questions do you have?

MS. LETSCHE: Well, Judge Miller, I would prefer to ask them of the witness rather than --

JUDGE MILLER: I know what you prefer, but I would prefer to get a direct answer, please. Where are you

#8-2-SueT

leading and what's the purpose of this? We are taking time, and I want to know where it's headed.

Try to find that document if you can while we are determining where she is going.

MS. LETSCHE: I would have provided copies myself to the witness except I only received a copy of this document -

JUDGE MILLER: That's all right. We don't care.

MS. LETSCHE: -- from LILCO this morning.

JUDGE MILLER: I'm asking where you are going. What is the purpose of this cross-examination?

MS. LETSCHE: The purpose of this line of questioning, Judge Miller, is to establish, which I believe I would, that this procedure does not have any references to the restoration of AC power using the new AC power configuration proposed by LILCO, and that instead it relates only to the AC power configuration that existed earlier, which is not being relied upon for purposes of this exemption application.

JUDGE MILLER: And, therefor? What is your position? Suppose what you say is correct, what's the conclusion?

MS. LETSCHE: And, therefore, that this procedure does not provide any additional pertinent or relevant training or information that goes to the matters at issue here; that is, the operability or implementability of the new AC power configuration.

#8-3-SueT

JUDGE MILLER: Have you located the document?

MR. ROLFE: Yes.

JUDGE MILLER: Okay. Ask your question.

BY MS. LETSCHE: (Continuing)

Q Mr. Gunther, am I correct that the procedures set forth in Procedure SP-29.015.02 relate to the use of qualified emergency diesel generators for the restoration of AC power?

A Yes, this revision does do that.

Q And this revision is dated June 12, 1984; is that right?

A Yes.

Q And this procedure does not instruct the operators to utilize either the 20 megawatt gas turbine or the EMD mobile diesel generators in the event of a loss of AC power, does it?

A No, it does not.

Q Now, you state on the top of Page 12 that the permanent station procedure for the loss of all AC power has been revised to include an immediate action step that requires the operator to contact the system operator.

Now, the procedure you are referring to there is the one you have before you, isn't it?

A No, I'm not. I'm referring to the latest revision of that procedure, which is Revision 6, and does include

#8-4-SueT

specific instructions to check with the system operator regarding the operation of the 20 megawatt gas turbine as well as the other Holtsville gas turbines and provides additional instruction to proceed to the procedure that deals with getting the EMD diesels on line if there is no offsite power available.

Q Now, Revision 5 which is the one we were just discussing is dated July 20, 1984; isn't that right?

The effective date is June 12, 1984 but the date of its issuance is July 20, 1984, is it not?

A This information copy was made up July 20th.

Q Right.

A I don't think there is any other significance to that date, July 20th.

Q And you are telling me that the testimony that is contained on Page 12 of your testimony is based on a Revision 6 of this procedure; is that correct?

A Yes, that's right.

MS. LETSCHE: Judge Miller, at this time I move to strike the testimony on Page 12, that is the answer to Question 6 by Mr. Gunther that relies upon Revision 6 of Procedure 29.015.02 on the grounds that the County, although having requested these procedures in initial discovery and again when the testimony filed by LILCO was received, was not provided with any procedure until this morning when

#8-5-SueT

Revision 5 was provided. We have yet to see or obtain any kind of access, in fact, or know of the existence of any Revision 6 which is what this gentleman's testimony is based upon.

And in light of the Board's Order requiring supplementation of discovery and stating that it didn't intend to have trial by ambush, I would move that this testimony be striken.

JUDGE MILLER: Counsel.

MR. EARLEY: Judge Miller, we oppose that motion. We have continued to provide the County with information. They are on notice of what the witness was going to testify to in the prefiled testimony.

LILCO, as all utilities do, continues to update their procedures as required to reflect what they are going to do. I'm not sure of the exact date of Revision 6, and I don't believe we have a copy of Revision 6 here. We can certainly get that.

But, as a practical matter, the witness has testified as to what we are going to do. Whether it had been incorporated into a procedure or not, I don't think is particularly important in this proceeding. We certainly can check and see if there is an approved Revision 6.

It's my understanding some of those approvals may have just occurred in the last day or so. So, it's a

#8-6-SueT

matter of getting the procedures to reflect what the witness is willing to testify to under oath that the Company is doing. And we certainly have been diligent in providing the County with information as soon as we get it.

But, it's an ongoing process with a number of people involved. And the second a procedure is approved, it takes some finite period of time to actually get the procedure to the attorneys and to the County.

JUDGE MILLER: Staff.

MR. PERLIS: Your Honor, the Staff has no information as to when the procedures were revised or what documents LILCO has given Suffolk County. We believe the testimony is relevant.

As to whether it should be striken because the information wasn't given, we need to know when that information was available to LILCO and when it was given to the County. We don't have that.

MS. LETSCHE: Judge Miller, if I might respond to one thing Mr. Earley stated. One reason why this is very pertinent is that this witness stated in his testimony, dated July 16th, that a station procedure had been revised to include particular things. If we are now hearing from Mr. Earley that in fact maybe that procedure does not in fact exist or has not been approved yet, we certainly haven't se. it. The witness apparently doesn't have it with him.

#8-7-SueT

I think there is substantial question as to the credibility and the reliability of this piece of testimony which talks about a procedure having been revised.

JUDGE MILLER: When was the information available?

MR. EARLEY: Judge, I'm afraid you will have to ask the witness the precise timing. When the testimony was filed, the --

JUDGE MILLER: Well, go ahead and ask him, because we did direct all counsel to revise and keep currently updated the testimony.

Now, if this was something that was in a very short period of time, we keep getting filings, that might be one thing, although we don't really approve of it. But, on the other hand, if it's information that was available and it is referred to in the prefiled direct testimony, has been revised there may be a serious question about your compliance with our Order.

What are the facts? So, if you care to ask the witness, if you need to verify factual information, you would have leave to ask him a question or two to ascertain dates.

INDEXXXX

DIRECT EXAMINATION

BY MR. EARLEY:

Q Mr. Gunther, are you familiar with Revision 6 to the procedure in question?

#8-8-SueT

A Yes, I am.

Q Do you know when that procedure was approved?

A Yes, I do. It was a week ago today.

Q And when you filed your testimony, what was the basis for your statements in the testimony concerning the procedure being revised?

JUDGE MILLER: Which testimony now are we talking about?

MR. EARLEY: The testimony that is the subject of this motion.

JUDGE MILLER: I know that, but what page are you referring to, since it's written Direct Prefiled Testimony?

MR. EARLEY: It's the testimony on Page 12 that the County has moved to strike. It's the answer starting at the top of the page.

And I believe that's what counsel has indicated.

JUDGE MILLER: All right. Let me ask the witness, are you looking at that portion of your prefiled testimony?

WITNESS GUNTHER: Yes, I am.

JUDGE MILLER: Who prepared that prefiled testimony?

WITNESS GUNTHER: I did.

JUDGE MILLER: When did you prepare it?

WITNESS GUNTHER: In early July.

JUDGE MILLER: Did anyone assist you in its

#8-9-SueT

preparation?

WITNESS GUNTHER: Mr. Schiffmacher worked with me on portions of it certainly.

JUDGE MILLER: And who was responsible for this statement that the procedure for the loss of all AC power has been revised and so forth?

WITNESS GUNTHER: I am.

JUDGE MILLER: And what were you basing that on?

WITNESS GUNTHER: At the time, we had a procedure revision in the review cycle, and that cycle consists of a very detailed review, both technically and safety evaluation, to ensure that the document is correct and can be put into use.

At the time this procedure was in this review cycle, we performed a demonstration drill for the NRC and provided them with copies of Revision 5.

JUDGE MILLER: 5. We --

WITNESS GUNTHER: Yes.

JUDGE MILLER: -- are talking about 6.

WITNESS GUNTHER: That was still in the review cycle and not approved at that time. They requested the latest approved copy of our procedures.

JUDGE MILLER: You gave them 5?

WITNESS GUNTHER: Yes.

#8-10-SueT1

JUDGE MILLER: When did you give them 6?

WITNESS GUNTHER: We haven't given that to them yet.

JUDGE MILLER: I think we will strike it. You should have. Perhaps you, not as a witness, maybe you weren't aware of it. Counsel were told to update these things.

Now, if you are going to come in and have testimony based on a Revision 6 which hasn't been furnished to the Staff or to the County, you are clearly in violation of our admonition.

WITNESS GUNTHER: May I just add something, Judge?

JUDGE MILLER: Yes.

WITNESS GUNTHER: The procedure would have been approved in time if not additional comments and changes to the procedure were requested by the NRC as a result of their review of the procedure. These additional comments were incorporated into Revision 6 to satisfy the concerns in Supplement 6 of the SER.

And that delay in additional review time took the additional week or two that I'm talking about here. It certainly wasn't anticipated --

JUDGE MILLER: It's not the delay in the review time. The question is the delay in the transmission of

#8-11-SueT

that information to other parties, including here both Suffolk County counsel and counsel for NRC. Now, if you have got any explanation, tell me. But you haven't given me anything that satisfies our rule, which you may not have been aware of.

This is nothing personal to you.

WITNESS GUNTHER: Well, my concern is only that in the past when providing Suffolk County with draft documents that are not approved, we sometimes get into a long debate regarding their relevance and in particular some of the steps that might --

JUDGE MILLER: Now, you are giving me a lot of debate on relevance that we are not interested in at this point.

Do you have any further explanation of why the information regarding Revision 6 was not transmitted both to NRC counsel and to Suffolk County counsel?

WITNESS GUNTHER: Only that it has not been formally issued and copies are not available.

JUDGE MILLER: Very well. The portion will be striken.

MR. EARLEY: Judge Miller, can we get clarification of what portion will be striken? Will it be the first sentence?

JUDGE MILLER: It will be the second sentence.

#8-12-SueT

If you consider that the word "Yes" is one sentence, then it will be the sentence that follows it. There may be additional matters that are not objectionable.

We are striking the words in the first line starting, "The permanent station procedure," et cetera and going to the end or period of that sentence.

That is striken for failure to transmit the information upon which it's based in a timely fashion. Now, we will let stand the remainder because there is no indication that there has been any failure to furnish information that was directed.

You may proceed.

MS. LETSCHE: Yes, Judge Miller.

BY MS. LETSCHE: (Continuing)

Q Mr. Gunther, am I correct that the last sentence of Answer 6 which says, "The operator also has available a new procedure for the loss of all AC power which, among other things, directs..." that that sentence also refers to this Revision 6 or 5 that we have been talking about here?

JUDGE MILLER: Not 5 now. We are talking about 6.

BY MS. LETSCHE: (Continuing)

Q 6. Yes, Revision 6.

A Yes, that's correct.

MS. LETSCHE: Judge Miller, I move to strike

#8-13-SueT1

that sentence also.

JUDGE MILLER: Any reply by counsel?

MR. EARLEY: Judge, we object on the grounds previously stated. There is no need to reargue.

JUDGE MILLER: In that event, the ruling will be as previously stated also. It's striken.

end #8
Joe flws

BY MS. LETSCHE: (Continuing)

Q Now, Mr. Gunther, the use of the indicating lights to show breaker position and the availability to the operator of information regarding the twenty megawatt gas turbine, I take it that those procedures are also set forth in Revision 6, aren't they?

A The modification that was implemented to install that indication is not a part of the procedure, no.

Q I understand that. But the instructions to the operator with respect to the use of those indicating lights and the use of information concerning the availability of the unit are set forth in Revision 6, aren't they?

A There are three or four different procedures in which those indicating lights are referenced. That would be one of them, yes.

MS. LETSCHE: Judge Miller, on that basis I move to strike the remainder of this answer.

JUDGE MILLER: Was that information contained in any prior document other than Revision 6? Or is it limited and solely based upon Revision 6?

WITNESS GUNTHER: Judge, the other -- there are other procedures that utilize that indication, so the operator was aware of the indication and other procedures exist which are listed in that previous table that have referenced that indication.

JUDGE MILLER: What I am inquiring about is if

Revision 6 information, if that is the sole basis of your testimony here it would have to be striken.

On the other hand, I want to be sure there were no prior disclosures that covered the same subject matter. We can hear from counsel on that too, if you wish?

WITNESS GUNTHER: If I can go to the fifth line. I am just referring to the fact that an indicating light has been installed. Whether or not it is in the procedures is not important to that portion of the testimony.

JUDGE MILLER: When was it installed?

WITNESS GUNTHER: Within the last month.

JUDGE MILLER: Has that information been available to others?

WITNESS GUNTHER: There were two occasions when Suffolk County was at the site, and at least on one of those two occasions reference was made to indicating lights to be installed.

JUDGE MILLER: Reference was made?

WITNESS GUNTHER: Yes.

JUDGE MILLER: I am inclined to think we are going to rule differently on this. We think you did have sufficient information, counsel, but we will hear from you if you have anything further.

MS. LETSCHE: If I could have just a moment.

JUDGE MILLER: Yes.

MS. LETSCHE: Judge Miller, I believe it is correct that during the July 2nd procedure that went on, an indicating light was present and the County was aware that that light was present.

The basis for my Motion to Strike, however, is the fact that this statement by this witness is in response to the question on page 11, have existing plant procedures been revised to reflect availability of the MD diesel generators and the twenty megawatt gas turbine.

And in responding to that question, Mr. Gunther refers to these indicator lights and the availability to the operator of certain information about the gas turbine.

Presumably, he is talking about that because the procedure which is what is answered, talkes about instructs the operator as to what to do with that equipment. What action to take based on what that equipment tells him.

And the basis of this Motion to Strike is that that procedure instructing the operator as to what to do with the equipment has never been made available to the County and as I said, we didn't know it existed until just now.

JUDGE MILLER: Well, you may correct grammatically, however we are interested in the realities. We wanted to be sure that our instructions to update information were followed. That is the purpose. We are not trying to exclude testimony that could be of help.

We think that this information was available, as counsel has fairly indicated, and we think that is sufficient for the purpose. So we will let stand now the remainder of this answer commencing at the top of page 12 of the prefiled written testimony, which is response to Question 6, with the two portions which we have previously striken stands striken.

You may proceed.

BY MS. LETSCHE: (Continuing)

Q Mr. Gunther, I would like to take you back to page 10. That list of procedures. Can you identify for me the revision numbers, and the dates of the procedures that you are referring to here? We have already done it for the loss of offsite power procedure, but for the remainder, please?

A (Witness Gunther) Not at this time. I would have to get that information. I don't have that with me.

MS. LETSCHE: Well, Judge Miller, I don't know what you want to do. I think it is important to find out which procedures and revision numbers and dates are being referred to by this witness in light of --

JUDGE MILLER: Well, you can ask him. The record will reflect whatever his response is. It is a matter of weight at that point.

MS. LETSCHE: Well, in light of the witness' inability to identify what these procedures are that he is referring to, in that case I would move to strike all the reference to procedures in the testimony.

JUDGE MILLER: That Motion will be denied. Now, you may ask him questions pertaining to any of them.

MS. LETSCHE: Well, I just asked him, and he told me he was unable to tell me what revision nunmbers or dates --

JUDGE MILLER: He said at such time that he could obtain the information. So, I said it was a matter of weight, and not admissibility.

MS. LETSCHE: The point, Judge Miller, is that I can't cross examine if I don't know what he is referring to.

JUDGE MILLER: Well, you are about in the same boat he is, I guess, at the moment.

MS. LETSCHE: Well, no, I am not. Because you refuse to strike his testimony, and presumably it is going to be admitted into evidence --

JUDGE MILLER: Now, you are continuing to argue the point, Counsel. I told you it goes to the weight, and I am not going into matters of weight of evidence at this time. I am going into admissibility. We struck that which we held to be inadmissible. The remainder stands. Now, let's move forward.

BY MS. LETSCHE: (Continuing)

Q Mr. Gunther, on page 11, you refer to the training that has been provided to the operating crews covering surveillance procedures associated with a twenty megawatt gas turbine.

I take it from your prior answer that you cannot tell me what revision or date of the procedures associated with the twenty megawatt gas turbine were covered in this training that you reference here, is that correct?

A That is correct.

MR. EARLEY: Objection.

JUDGE MILLER: You are a little bit late there.

MR. EARLEY: Judge, I think it would be fair to the witness if she wants to ask questions about procedures to give him the procedure she is interested in asking about.

JUDGE MILLER: He can ask for it. This is an intelligent expert witness. If he is not able to answer and needs further material he can request it. He can couch his answers to so indicate.

But your objection is overruled. What was your answer?

WITNESS GUNTHER: That is correct.

JUDGE MILLER: Very well. You may proceed.

BY MS. LETSCHE: (Continuing)

Q Now, Mr. Gunther, I would like to direct your attention to page 14 of your testimony.

You are talking there about the July 2nd demonstration. Near the bottom of the page, you say: Upon a request from the NRC Staff to manually start and synchronize the 403 engine, the test engineer reset the unit fault enunciator.

NOw, am I correct that this manual start and synchronizing process was done at the EMDs themselves, and not in the control room?

A (Witness Gunther) Yes, that is correct.

Q And am I also correct that the unit fault enunciator which was reset is in the EMD control cubicle?

A That is right.

Q And that the relay flag, which you mention on page 15, which indicated a trip of engine 401, was also an indication in the EMD control cubicle, is that correct?

A Yes.

Q I would like to direct your attention to page 16 of your testimony. In the answer to Question 8, you mention in the second paragraph, a minor wiring modification that is being made to the enunciator reset circuitry.

Am I correct that that enunciator reset circuitry is in the EMD control cubicle?

A Yes, that is right.

Q Who is performing that modification?

A The modification was performed by our modification group. It has been completed and satisfactorily tested.

Q You say, 'our modifications group.' Is that LILCO employees?

A Part of the LILCO plant staff organization.

Q You also reference further down a second minor modification that has to do with the time available for the engines to synchronize. Is that modification also being performed by LILCO plant staff?

A Yes . That modification also has been completed and tested.

Q Mr. Gunther, on page 17, in response to Question 9, you state that system operators have been directed to notify the Shoreham Watch Engineer immediately whenever the conditions you describe above are experienced. Am I correct that that direction you are referring to there is in the standing order that you referred to up above?

A No, that is not correct. The system operators receive their instructions from the system operator, who issued a memo to that regard that Shoreham was to be the priority item as far as power restroration was concerned on the grid.

Q Okay. So, this direction then is in the form of an order -- of a memorandum, I am sorry.

A Yes.

Q I would like to have you turn to page 18 of your testimony, please. In Question 11, there is a reference to the fact that the EMD diesel generators will be connected into the four KV buses on the secondary side of the NSST.

Am I correct that that means on the plant side of the NSST?

A Yes, that is correct.

Q Now, in the answer to Question 11, you state that it is possible to supply power to an emergency bus from the -- I am sorry, -- it is possible to supply power to an emergency bus by routing power through the RSST supply breakers, and you say that operators are required to be familiar with these, with the system, and are aware that these alternate means of supplying power are available.

Now, I take it that the alternate means you are talking about here are not -- does not include the alternate routing arrangements to an emergency switch gear room which you talk about in the next page, is that right?

A No, they are two different items.

Q Right. Now, I am talking about the first one. The alternate means you refer to on page 18. Am I correct that those alternate means referred to there all result in powering a bus in the non-emergency switch gear room?

A Yes, that is correct.

Q Now, on page 19, Mr. Schiffmacher, I guess these questions go to you. You discuss an emergency tie-in that -- some sort of routing arrangement that LILCO is thinking about putting into place, is that right?

A (Witness Schiffmacher) Yes. We plan to install an alternate routing into the emergency switch gear room from the EMD.

Q Now, your testimony says that the capability will exist to connect the EMD switch gear to the plant emergency switch gear, but I am correct, aren't I, that that capability does not exist now?

A The capability at the present time today does not exist.

Q Okay, thank you. Now, you state that this connection will be accomplished by a capable connection from the EMD switch gear to emergency switch gear room 102. Can you tell me what pumps are powered from emergency switch gear room 102?

A Not specifically, but perhaps Mr. Gunther can.

A (Witness Gunther) The four thousand volt loads coming off 102 include an RHR pump B, core spray Pump B, surface water Pump B, control rod drive pump, and two reactor building standby ventilation system chillers.

Q Now, Mr. Schiffmacher, on page 20, there is a question about a raceway for the cable to be used in this new connection. And your answer says that the raceway will be either supported in a way that will survive a seismic event, or that it will be installed after a seismic event.

I am correct, aren't I, that a raceway does not exist now, right?

A (Witness Schiffmacher) At the present time, no.

Q And that at this point LILCO hasn't decided how such a raceway would be supported if it was determined that one was going to be put in.

A We have conceptually come up with what we know we want to do. We can do it several ways. There are various ways to engineer this project. We haven't picked out the one we want to do yet.

Q Now, on page 21, you state that if the requested exemption resulting in a low power license is granted, LILCO will have selected portions of these modifications completed prior to commencing Phase III of the low power testing program.

I take it from this that sitting here today LILCO does not know which portions of these modifications would be completed prior to the beginning of Phase III, is that right?

A That is not entirely true, no.

Q It is true, isn't it, that some of the elements of this modification are not even planned to be installed until after a seismic event were to occur?

A The time existing after an event until power is required is amble such that we could make the final cable connection in the allotted time to restore power. If we wanted to do something quicker than that, we would make the connection a different way.

MS. LETSCHE: Judge Miller, at this time I move to strike the testimony which begins on page 19 and continues to page -- until about half way down page 21, that includes the last sentence in the answer to Question 11 and all of Answers 12, 13, 14 and 15. The Grounds for this Motion are that this testimony is purely speculative.

There is no definitive plan. Identification of a plan. Configuration. Nothing exists at the plant. LILCO has said and states in the testimony that the capabiliy does not now exist to accomplish this proposed alternate routing. That the emergency -- this proposed alternate routing could be used at some point in the future, but that they haven't decided yet in which of several possible ways the routing would be created or used.

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Sim 10-1

That the engineering details are not even completed yet and that portions of this, and the portions are not identified, are not even going to be completed until after there has been a seismic event at the plant, and that none of this work is going to be done unless or until a requested exemption is granted.

The basis for the motion, in addition to the fact that this is all speculative and there is no definitive identification of what this configuration is, because clearly it doesn't exist yet, contained in this testimony is that it is impossible for this Board to make a finding that such a configuration could work or could improve safety or could even exist when LILCO itself has said that it doesn't exist and they don't know how they are going to do it.

I move to strike the testimony on that basis.

JUDGE MILLER: Counsel.

MR. EARLEY: Judge, LILCO objects. First of all, the testimony is not speculative. We have provided the County as an attachment to the testimony the conceptual diagram for the hookup. The witness has testified that ---

JUDGE MILLER: Pardon me. What is that document, Attachment 1?

MR. EARLEY: That is Attachment 1 to the testimony.

JUDGE MILLER: Okay.

MR. EARLEY: The witness has testified that in

Sim 10-2

his expert judgment the connection is feasible. LILCO in the testimony has made a commitment that they will have this hookup available.

The specific details of the hookup have not been decided upon, but the witness has said that there are a number of ways to do it.

If the County wants to probe the witness' knowledge and opinion on those number of ways, they are certainly free to do that, but the testimony is not speculative. The actual details haven't been set out, but the feasibility has been determined by the witness and we have provided information to the extent that we have it on how it is going to be done.

Certainly given that LILCO is making that commitment, the Board certainly can determine that there will be some benefit and that LILCO will have it done, and as with any commitment, it will be subject to the review by the NRC Staff to make sure that we live up to our commitments.

JUDGE MILLER: Staff.

MR. PERLIS: The Staff also opposes this motion to strike. The witness is available for cross-examination if the County wishes to explore the basis for the statements made. However, the witness has testified that this capability will exist and that it is capable of being implemented after a seismic event in part.

If the County wishes to cross-examine as to the basis for that statement, the witness is here. But we don't believe that that is a basis for a motion to strike.

JUDGE MILLER: The motion will be denied. We pointed out that this is cross-examination and there has not been an opportunity for redirect by the staff. Now you may or may not wish to renew the motion when we have the whole record made.

It is also true that it is for you to decide whether you wish to probe further or to leave the record as it is. You have expressed no view on that.

The motion, however, will be denied.

Proceed.

By the way, we have an additional page 22 that was attached later. I assume everyone, including counsel for Suffolk County, has it?

MS. LETSCHE: Yes. We did receive that.

JUDGE MILLER: Okay.

CROSS-EXAMINATION (resumed)

BY MS. LETSCHE:

Q Mr. Schiffmacher, I would like to direct your attention to Attachment 1 to your testimony which I believe you describe it as the conceptual drawing of this proposed configuration. That conceptual drawing does not describe

Sim 10-4

the cable connections at the EMD control cubicle, does it?

A (Witness Schiffmacher) Other than saying that we would have the 750 MCM cables connected ---

JUDGE MILLER: Wait a minute. I can't hear you.

MS. LETSCHE: Let me ---

JUDGE MILLER: Let him finish the answer first, at least what he has already said. Do it a little slower so I can understand you.

WITNESS SCHIFFMACHER: The drawing shows that the 750 MCM cables go from the vicinity of the roof bushings, from the roof bushings themselves to the emergency switch gear. There is a not a detail on the roof bushings besides the drawing. However, we know how we are going to do that.

BY MS. LETSCHE:

Q Now am I also correct, and I think you can answer this one yes or not, Mr. Schiffmacher, that the drawing which is attached to your testimony does not show how this proposed new cable tray is going to be tied into the connection that ties it into the emergency switch gear room? The drawing does not show that, does it?

A (Witness Schiffmacher) The cable tray or the cables?

Q The cables.

A The cables?

Sim 10-5

Q Yes.

A No. It just shows them entering the emergency switch gear room 102 and going to a lineup of breakers, circuit breakers. There is no detail on the connection to the circuit breaker itself.

Q This drawing that is Attachment 1 does not show how the cable raceways will be supported, does it? Can you answer that yes or no?

A I can't answer it yes or no.

Q Okay. That is fine.

(Pause.)

Did you say you can or you can't?

A I cannot answer it yes or no.

Q This drawing, which is Attachment 1, does not indicate which elements of this proposed modification will be installed before as opposed to after a seismic event, does it? Can you answer that one yes or no?

A I can answer that yes or no. It does not.

Q And the drawing also does not show which portions of this proposed modification would be completed before rather than after Phase III of the low-power testing program, does it?

A No, it does not.

Q Mr. Gunther, in the answer to Question 16 on page 21 you reference minor modifications to the enunciator

Sim 10-6

logic relating to the EMD diesel generators. Am I correct that this enunciator logis referred to here is in the EMD control cubicles?

A (Witness Gunther) Yes.

Q Mr. Gunther, I would like to direct your attention to your new page 22. I guess it is not new, but page 22 of your testimony. Now you state there that fuel load could take place within two to three weeks of obtaining a low-power license.

Am I correct that the activities that would have to be conducted during that time are those that are listed as fuel loading prerequisites on what was marked as Suffolk County Low-Power Exhibit No. 2 that we discussed this morning?

A Yes, that is correct.

Q And you also have to wait until you get your neutron sources; is that right?

A Yes.

Q Now you mentioned at the bottom of page 22 the construction activity associated with Colt diesels. You are not involved in any of that construction activity, are you?

A No, I am not.

Q You state that that work is being performed outside the protected area fencing. Isn't there also

Sim 10-7

construction work relating to the Colt diesel building and auxiliary equipment that is taking place inside the fencing in the area where the EMDs are?

A The only construction even remotely in the area of the EMDs is associated with the fuel oil tanks for the Colt project. The protected area fence line has been moved to make that construction work outside of the security protected area fence line.

Q I see. When was that fence moved?

A In this month of July in any case, early July.

Q Now in connection with the fuel oil tanks, those are the tanks that are going to hold the fuel for the Colt diesels; is that right?

A Yes, that is right.

Q The construction activity relating to those involves, does it not, some construction equipment vehicles and other sorts of equipment?

A Yes.

Q You mention in the last sentence that -- you mention the tie-in of the Colt auxiliary systems. What are the Colt auxiliary systems that you are referring to there?

A The service water supplies, plant air tie-ins, fire protection and systems that support the operation of the diesels.

Sim 10-8

Q I take it that there are other systems other than the service water supplies and the plant air tie-ins, aren't there?

A Yes. The Colts will eventually become part of the permanent plant system and other systems would be tied in to support the diesel operation as TDIs are supported now.

Q When are these tie-ins of the Colt auxiliary systems anticipated to occur?

A I am not familiar with that schedule.

Q Well, I take it you are not real familiar either with what all the systems are that need to be tied in; is that right?

A No, that is not correct.

Q Well, can you identify them for me? So far I have only gotten service water supplies and the plant air tie-ins.

A There would also be a closed loop cooling water system, a reactor building closed loop cooling water system supplies to jacket water coolers. Of course, the plant electrical systems, lighting, emergency lighting would also have to be provided. Heating and ventilation has to be tied in to again the permanent plant systems. There is a multitude of auxiliary systems that support operation of any major equipment such as a diesel engine and they will

Sim 10-9

be tied in eventually.

Q I take it you don't know whether there could be a need for equipment outages related to tie-ins of the Colt auxiliary systems during the low-power test program?

A No, I am not certain of that.

Q Mr. Gunther, could you look at Attachment 1 for me, please, and identify roughly on there for me where the protected area fencing has been moved to?

A The area that is north of the EMD diesels, the storage tanks, the fuel storage tanks, it would be to the east of those tanks, and that fence line extends up to the technical support center and the office building annex which is not shown but is further north. It encompasses the two aux boiler tanks, the three TDI tanks and then just adjacent to the TDI oil tanks will be the Colt oil tanks, just north of that. And the fence line runs directly east going north/south, but directly east of those tanks.

Q You are saying the fence runs north and south east of those tanks?

A Yes, that is correct.

Q Just so I understand it, the Colt fuel tanks are now outside of the protected area fence?

A Yes, that is right.

Q Is the existing fuel oil filling station, which is shown on Attachment 1, inside or outside the protected

Sim 10-10

area fence?

A That is inside.

MS. LETSCHE: Judge Miller, other than to review my motion to strike the answers to Questions 12, 13, 14 and 15 on pages 19 and 20, which I would like to do, I have no further cross-examination at this time of this witness panel.

JUDGE MILLER: Very well. The motion will be denied at this time.

The staff.

MR. PERLIS: The staff has one question.

CROSS-EXAMINATION

BY MR. PERLIS:

Q I believe this is for Mr. Gunther.

On pages 13-2 and 13-3 of Supplement 6 to the Shoreham SER, are you familiar with those pages?

A (Witness Gunther) I have read the document.

Q The staff has indicated the following changes would be necessary for the procedural and operational aspects of the augmented and electrical power system at Shoreham. Could you tell us if LILCO intends to effect those changes?

A Yes. In fact, some of those changes have already been implemented, and, yes, we do plan to implement those changes.

MR. PERLIS: Thank you. That was the only

Sim 10-11

question I had.

JUDGE MILLER: Any redirect?

MR. EARLEY: Yes, Judge, unless the State has some questions.

JUDGE MILLER: Oh, I am sorry.

Did you have questions, Mr. Palomino?

MR. PALOMINO: Can we have a break?

JUDGE MILLER: Well, we would rather get this concluded, frankly, before we go out to lunch. Remember, the last time we went to lunch you never came back. We don't want to risk losing you.

(Laughter.)

I am only being semi-facetious on that, but we would like to conclude this, if you don't mind, sir.

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#11-1-SueT

CROSS EXAMINATION

BY MR. PALOMINO:

Q Mr. Gunther, on Pages 8 and 9 of your testimony, in answer to Question 3 you say, "Approval of LILCO's low power exemption request is likely to accelerate the time it will take to bring the plant to full power operation."

Is that correct?

A Yes, that's correct.

Q Is that regardless of whether or not that the offsite evacuation plan is approved?

A That statement is based upon the fact that those hearings are still in progress and it may take some time before they are finally decided.

Q And, in fact, the granting of this exemption has nothing to do with when it will be approved, when that plan will be approved and when you can go to full power?

MR. EARLEY: Judge, could I have the question repeated? I think I missed something.

JUDGE MILLER: Yes. Would you mind repeating it?

MR. PALOMINO: Well --

JUDGE MILLER: I think the question is whether or not it isn't a fact that the low power exemption request has nothing to do with the time that the full power matters and whatever pertaining thereto is concluded; isn't that it,

#11-2-SueT

sir?

MR. PALOMINO: That's it.

WITNESS GUNTHER: That's correct.

JUDGE MILLER: Pardon me?

WITNESS GUNTHER: That is correct.

JUDGE MILLER: All right.

BY MR. PALOMINO: (Continuing)

Q Now, also you say there are training benefits to be gained. If the TDIs were to be approved or the Colts were to go in place, that would be wasted training, wouldn't it, with what the Staff has gone through on these emergency diesels and turbines?

A No, that's not true. The training benefits that I've cited in my testimony relate to operation of the reactor, and have nothing to do with the actual training that has been conducted on the supplemental AC sources. So, granting of a license would provide us with those training and experience benefits right now.

Q Well, you walked them through the process, didn't you?

A Yes, we did.

Q All right, let me ask you. If they are going to go to another system ultimately that could create confusion, couldn't it?

A Not in my opinion, no.

#11-3-SueT

MR. PALOMINO: I have no further questions.

JUDGE MILLER: Thank you. Is there anything further now of these witnesses?

MR. EARLEY: Judge, I do have some redirect.

JUDGE MILLER: All right. Go ahead.

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REDIRECT EXAMINATION

BY MR. EARLEY:

Q Mr. Gunther, this morning in discussing the additional training that would occur, I believe it was in Phase II, with respect to operation of control rods, you indicated that an additional 72 hours would be obtained.

Was that 72 hours in terms of total hours?

A Yes. That's an actual 72 hours that has been added to the schedule to include the additional reactivity manipulations.

Q What kind of manhour training would you obtain from that?

A Hundreds of actual manhour training benefit.

Q You were asked a number of questions concerning whether certain training activities would be the same during low power testing now as they were originally scheduled in the FSAR.

Do you have any opinion about whether there are any benefits to that training, whether or not they are the same types of training conducted now as originally intended?

#11-4-SueT

A Yes, I do. The fact of the matter is, much of the testing is required by the FSAR and already scheduled in our power ascension program regardless of when the testing actually occurs.

However, if additional time was allotted for the low power test program training benefits could be derived that were not even anticipated prior to the beginning of the program. It provides us with additional flexibility to perform even other testing that I haven't specifically listed here in my testimony to perhaps be conducted over again for training or experience benefit.

Q Mr. Gunther, you were asked some questions about Suffolk County Exhibit LP-3, which is entitled "Approximate Schedule for Startup."

Could you tell me whether -- could you tell me how the schedule that is set out in Suffolk County Exhibit LP-3 relates to the schedule and the discussion on timing in your testimony?

A The table f m the FSAR is dated February 1977. It's over seven ye [illegible] And during that time, we have obtained an awful lot of start-up information from a number of other nuclear plants and have finalized a lot of the detail testing that we will be performing and have a very good handle on the exact time certain iterations will take.

I guess my point is, we have come a long way from

#11-5-SueT

this original table and I don't believe this table is relevant at this point in time based upon the additional information we have obtained in setting forth our present day schedule.

Q So, the schedule in your testimony is more exact than the approximate schedule in this Figure?

A Absolutely.

Q Mr. Gunther, when a procedure is revised at the Shoreham plant, what steps are taken with respect to the training of operators?

A When a procedure is revised and it effects an operating procedure, the training department of the Shoreham Nuclear Power Station is made aware of the change and conducts requalification training to all licensed operators and non-licensed operators if it does affect them during their normal requalification program.

At Shoreham, we have six operating crews, one of which is always in a training week. And it is the intent of that training week to stay abreast of any modifications that are being performed in the plant as well as any procedural or administrative changes as well as regulatory changes that have occurred since they had their last training.

So, we use that training week to stay abreast of all these types of changes.

Q You were asked a question concerning the alternate tie-in to the emergency switchgear room, Mr. Gunther, concerning what pumps were powered from emergency switchgear room 102.

Is it possible to provide power from that emergency switchgear room to any of the emergency switchgear rooms?

A It's possible, yes.

Q Mr. Schiffmacher, you were asked a number of questions about the alternative routing of power to the emergency switchgear room.

Could you explain the options that you considered with respect to the alternate tie-in of the EMDs?

A (Witness Schiffmacher) We have specifically considered two options at this point in time, though there may be others. The two options are basically, if I can refer to Attachment 1, as we see there with the 750 MCM cables at grade between the control house of the EMDs to the wall mounted pull box, what we would conceive of there is that the conduits would be mounted on the seismically qualified diesel generator rooms and into the emergency switchgear rooms. There would be a connection which would remain unclogged at the wall mounted pull box and from that point, after a seismic event, we could attach a cable.

Down at the control house itself, we would have

#11-7-SueT

the opportunity to add to route the cable up using flexible braid connected to the bushings on top of the control house providing a connection that way. That would take, in terms of time, say a day or several days.

There is another way we have considered doing it, and that would be to make it a permanent connection between those points with seismically qualified switches at the control house and seismically qualified connection all the way to the emergency switchgear room in which case we would have to only operate the switches which could be done in a matter of moments to restore power to the emergency switchgear room.

Those are two ways, two prime ways we have considered of doing it.

Q Now, in your testimony on Page 20, you indicate that you verified the feasibility of these options.

What's the basis for that testimony?

A Well, the basis --

MS. LETSCHE: Excuse me. I object. That's beyond the scope of my cross-examination. I didn't ask any questions about this verification sentence that Mr. Earley is questioning about.

MR. EARLEY: Judge, the County tried to have the testimony struck on the grounds that they couldn't understand what the witness was saying. Then, County

#11-8-SueT

proceeded to ask questions and where the County thought they were going to get an answer that was not conducive to their case they avoided the question.

Several times the County asked, "Can you answer it yes or no," and at one point the witness said, "No, I can't."

JUDGE MILLER: I recall once. Is that what you are asking him now?

MR. EARLEY: Well, there were a number of questions concerning the whole setup of the -- and the potential setup -- of this hookup and I am just asking him to further elaborate on redirect about that.

I think the whole general subject was inquired into, and the fact that this particular sentence may not have been referenced in the question I don't think is important.

JUDGE MILLER: Restate your question.

BY MR. EARLEY: (Continuing)

Q Mr. Schiffmacher, on Page 20 of your testimony, you indicate that feasibility of the hookup of the EMD diesels to the emergency switchgear room has been verified, and I asked you for the basis for that conclusion.

JUDGE MILLER: He may answer it. Do you know?

WITNESS SCHIFFMACHER: Yes, I do. The basis for the verification is both onsite inspection and review

#11-9-SueT

of existing drawings on existing structures. The connection between these two points is not an extraordinary connection but in the realm of everyday engineering.

On that basis, we have looked at it. We know what materials are available, and we know we can make the connection.

BY MR. EARLEY: (Continuing)

Q You were asked a question about whether the drawing showed whether the cable will be seismically supported. And counsel asked whether you could answer yes or no.

Could you tell me whether the drawing indicates whether it will be seismically supported?

A The drawing specifically does not indicate that it will be seismically supported or not. However, the structures from other drawings, we have knowledge of which structures are seismically qualified. So, when you put a structure and seismically attach it to a seismic structure you have a seismically supported cable.

Other portions, for example, where it says cable at grade that was in the concept of installing the cable after the seismic event, So, there is nothing specific there in terms of a seismic support of a cable.

Q Are the cable connections that you are considering using in any way unique?

#11-10-SueT

A No.

Q Gentlemen, once a decision has been made to -- a decision has been made on how this connection will be made, will the operators be instructed and trained on this particular option?

MS. LETSCHE: I object.

JUDGE MILLER: Sustained. That is leading. Why don't you just ask him what, if anything, would happen in that event?

BY MR. EARLEY: (Continuing)

Q All right. Mr. Gunther, what, if anything, will be done by plant staff when a decision is made to hookup or setup this particular alternative tie-in?

MS. LETSCHE: I object in addition to -- not on the leading grounds this time, but the fact that that is asking for pure speculation on the part of the witness.

A decision hasn't been made, the decision as to what is going to be done hasn't been made, and asking about what may happen after those two nonexistent things happen is asking for speculation and is not proper.

JUDGE MILLER: We don't consider that speculating in terms of interrogation of expert witnesses under these circumstances.

You may answer.

WITNESS SCHIFFMACHER: The modification group of

#11-11-SueT

the plant staff would be involved with that modification. And as such the engineering would be done, approved by the plant management, review of operations committee, since it does affect the safety related system. Plant operating and maintenance personnel, electricians in particular, would be involved with training to learn how to make this connection and what materials would be involved and where those materials are located.

MR. EARLEY: Judge Miller, I have no further questions.

JUDGE MILLER: Suffolk County.

MS. LETSCHE: I have just a couple of followup questions.

RECROSS EXAMINATION

BY MS. LETSCHE:

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Q Mr. Gunther, Mr. Earley asked you about the additional 72 hours that are added to your schedule for Phase II and you said that that would include hundreds of manhours; is that right?

A (Witness Gunther) Yes.

Q Now, those hundreds of manhours and the additional training are included in the roughly 5,000 manhours that you reference on Page 6 of your testimony, right?

A Yes, that's correct.

Q Now, you also stated in response to a question

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from Mr. Earley that if you have additional time for low power testing that you could get some additional training that maybe isn't even mentioned in your testimony.

I take it that that training is only going to happen if there is additional time available between the completion of Phase IV and the issuance of a full power license to LILCO; is that right?

A The answer meant to say that the time could be utilized, the time between a low power license test program and the approval to proceed with full power testing could be utilized in many different ways, including the repeating of some testing that I haven't even mentioned in my testimony.

Q All right. Okay. Now, with respect to the table in the FSAR that was Suffolk County Low Power Exhibit Number 3, that table in the FSAR has not been amended since 1977, has it?

A I will have to take your word for that. I don't know if this is the latest one and the latest document.

Perhaps we could check with our licensing people at a break and verify that.

Q Mr. Schiffmacher, you answered a couple of questions from Mr. Earley about two options that LILCO has considered with respect to this conceptual tie-in.

LILCO hasn't decided yet which of those two options to utilize, right?

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A (Witness Schiffmacher) No. We've made no specific decision. We could go either way.

Q And I take it also that LILCO has not ruled out considering other options; isn't that right?

A If there was another option that was attractive from a technical point of view or had some other merits, certainly we would consider that.

At the present time, these look like the best options.

Q Now, I take it, Mr. Gunther, from your answers to Mr. Earley's testimony, or questions, excuse me, that if LILCO were to decide to do something and picks an option as to how to do it, that after those decisions were made in addition to implementing the hardware changes required, there would also have to be appropriate changes made in procedures; isn't that right?

A (Witness Gunther) There would be training involved with personnel. Exactly what procedures would have to be changed, I would have to see what the modification was first.

Q All right. So --

A Essentially that becomes part of the modification to update the procedures.

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Whatever changes might have to be made to the procedures would then have to be reviewed and approved by the RAC Committee, and that whole process you described before, isn't that right?

A Yes, that is correct.

Q And then the additional training would actually have to be performed for the operators with respect to these revised procedures that would be written, isn't that right?

A Yes.

Q And you can't, obviously, tell us now what any of those procedures or training or any of those changes would be, can you?

A I don't know exactly which ones would be involved, no.

MS. LETSCHE: Judge Miller, at this time I renew my Motion to Strike the portions of the testimony dealing with this new configuration based upon the redirect which Mr. Earley conducted, and the recross which I have just conducted.

It is very clear that not only have no decisions been made as to what hardware or -- what hardware will be used or how these modifications will be performed. In addition, they haven't even narrowed down the number of options which would be considered.

Furthermore, in addition to the actual hardware and equipment changes that supposedly might be made at some point in the future, it is clear that there would be other procedural modifications. A review process and training that would be necessary, which these witnesses themselves have stated they are unable to identify or discuss sitting here today.

And on that basis, the fact that none of this testimony is specific and has not been decided or committed to by LILCO, they have not been able to identify what it is that they say they are going to do.

I move to strike this testimony as not reliable and not probative.

JUDGE MILLER: That will be denied. They are not required to specify that which they are not necessarily required to make decisions where they have testified they have at least two options, and the engineering bases for them. That is sufficient.

So it will be denied. Mr. Palomino?

MR. PALOMINO: No further questions.

JUDGE MILLER: Staff?

MR. PERLIS: No further questions.

JUDGE MILLER: I take it that concludes examination of these two gentlemen, correct? I am sorry. Judge Bright has some questions.

XXINDEX

BOARD EXAMINATION

BY JUDGE BRIGHT:

Q I just have a couple of small things. On this Attachment 1 of yours. Either one of you. What you are saying you intend to do here is to have an alternative, a redundant way of getting power out of these EMDs, is that true?

A (Witness Schiffmacher) That is correct, Judge.

Q But the power , all of it, from these four EMDs will all go through the -- what is it called? The switch gear --

A Judge the intent here is if for some reason we can't get through the normal switch gear room, we have a direct express feed to the emergency switch gear room available to us. We can go one way. If that is not available, we go to the emergency.

Q Okay. But -- what my question really was, is the power from the EMDs, will not go directly to the emergency switch gear room, it will go through the EMD switch gear first, is that right?

A Yes. There is a control cubicle, that is right.

Q Okay. And one other little thing. An educational item. What is a gaitronics unit.

JUDGE MILLER: How do you spell that?

WITNESS: G-a-i.

BY JUDGE BRIGHT: (Continuing)

Q What is that for?

A That is for communications in the plant, Judge.

Q Just interplant communications?

A Yes, sir.

JUDGE BRIGHT: Thank you.

JUDGE MILLER: I assume there are no further questions now. Very well. Thank you, and you may step down.

(Panel stands aside.)

JUDGE MILLER : We will now recess for lunch. Let's take about an hour and a half. That will be by my watch about a quarter to two. Is there anything -- any documents, numbers, information that counsel have agreed to or you anticipate or has been furnished. If so, communicate.

(Luncheon recess taken.)

(1:54 p.m.)

AFTERNOON SESSION

JUDGE MILLER: Are you ready to proceed? Call your next.

MR. EARLY: Judge, if I may get something clarified. Did you admit into evidence Mr. Gunther and Mr. Schiffmacher's testimony as amended by Motion to Strike? If not, I renew my Motion.

JUDGE MILLER: You were going to offer it after the cross.

MR. EARLY: I renew my Motion to admit the Gunther Schiffmacher testimony.

JUDGE MILLER : Subject to the Motion you made as we went along -- do you have any objections to the admission of the testimony?

MS. LETSCHE: Not except for those Motions.

JUDGE MILLER: The Staff?

MR. PERLIS: The Staff has no objection.

JUDGE MILLER: The testimony will be admitted with the rulings made by the Board, including several deletions as well as one or two Motions made by Counsel for Suffolk County, and they will be carried on with their own transcript page numbers verbatim in the transcript as though it were direct testimony.

Okay.

(Testimony follows.)

LILCO, July 16, 1984

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-4
	)	(Low Power)
(Shoreham Nuclear Power Station,	)	
Unit 1)	)	

SUPPLEMENTAL TESTIMONY
OF WILLIAM E. GUNTHER
AND WILLIAM G. SCHIFFMACHER
ON BEHALF OF LONG ISLAND LIGHTING COMPANY

Q.1. Gentlemen, you previously testified in this proceeding on April 24 and 25. What is the purpose of this supplemental testimony?

A. (Gunther and Schiffmacher) The purpose of this supplemental testimony is to provide additional details concerning those matters about which we testified on April 24 and 25, to describe further the procedures which will be followed in operating the AC power sources during low power testing and to describe the training and other benefits which will accrue from conducting low power testing early.

Q.2. Mr. Gunther, during your previous testimony on April 24, 1984, certain matters were stricken from an affidavit incorporated with your testimony. Many of those matters pertained to training benefits from the low power testing program proposed by LILCO. Please describe those training benefits.

A. (Gunther) Important hands-on experience is gained by reactor operators during the power ascension program, including the low power test program. Beyond the normal training benefits gained during low power testing, LILCO intends to give the operators additional training during the low power test program. This testimony describes the training benefits that LILCO will gain if low power testing is allowed to proceed.

Fuel loading and precriticality testing (Phase I) involve placing fuel in the vessel and conducting various tests of reactor systems and support systems. Initial core loading involves the placement of 560 fuel bundles in specified locations within the reactor vessel. This major step requires significant testing as fuel loading progresses, and it takes at least 288 hours. The following testing is associated with initial core loading:

(A) Water chemistry surveillance testing. This testing must be performed prior to, during and after the fuel loading operation. The purpose of water chemistry surveillance testing is to ensure clarity of the water so that the fuel loading process can proceed and to minimize the amount of the corrosion products in the primary system.

(B) Control rod drive stroke time and friction tests. These tests are performed during the fuel loading step to ensure that the reactor shutdown capability is maintained at all times and to ensure the control rod drive mechanisms are performing as designed.

(C) Installation, calibration and utilization of special startup neutron instrumentation. This instrumentation is required for core loading activities to ensure proper monitoring of core conditions by the Operating, Reactor Engineering and Instrumentation and Control personnel. Source range monitor testing and alignment tests calibrate the neutron monitoring instrumentation and verify proper final alignment of this vital equipment.

(D) Core verification instrument operability check. These checks are performed to verify that the equipment utilized to determine that the core has been loaded correctly is operable. Final core verification checks are completed at this time.

The tests listed in (A) through (D) above involve valuable supplemental training and experience for personnel assigned to the Reactor Engineering Section, Radiochemistry Section, Operating Section, Maintenance Section and Instrumentation and Control Section. The training described in steps (B), (C) and (D) can be fully accomplished only during the fuel load operation.

Following placement of the fuel in the vessel, a number of tests must be performed to verify the operability of systems prior to going critical in the reactor. This phase of startup testing takes approximately 150 hours and includes the following:

(A) Local Power Range Monitor (LPRM) sensitivity data. During this test, the 31 local power range monitor strings are calibrated and verified to be operable. Instrumentation and control technicians will perform this testing, and obtain training in the use of calibration procedures and special test equipment.

(B) Zero power radiation survey for background readings. Various locations in the plant are surveyed by health physics technicians to determine background radiation levels with fuel in the vessel.

(C) Recirculation system instrument calibration checks. Operation of the recirculating pumps with fuel in the vessel is conducted to determine core internal pressure drops and to verify system performance. Operation of the system above minimum speeds with the vessel internals installed can be accomplished only with fuel in the reactor.

(D) Control rod drive scram time testing. Following fuel load, each control rod drive mechanism is scrammed from its full withdrawn position following control rod coupling surveillance testing to verify that rod insertion can be accomplished within the prescribed time.

(E) Cold MSIV timing. This functional test of the main steam isolation valves verifies that their opening and closing times are within technical specification acceptance criteria.

Again, the testing and activities described in (A) through (D) above can be accomplished only after fuel has been placed in the vessel. The experience and training gained from these activities will be an invaluable Shoreham specific augmentation to the years of extensive preoperational training that the reactor operators have previously undergone.

Important operator hands-on experience is gained during Phase II, cold criticality testing. Reactor operators must annually perform a minimum of ten reactivity control manipulations. LILCO intends to permit the operators to perform many of these manipulations during the low power test program. In particular, during the cold criticality phase of the low power program, additional time has been allotted in the schedule so that all operating crews will have the experience of taking the reactor critical. This experience provides additional training for reactor operators in the use of appropriate instrumentation and equipment to determine when criticality is achieved during the withdrawal of control rods. This important experience on the Shoreham reactor can be gained only after fuel has been placed in the vessel. Similarly, Reactor Engineering personnel obtain valuable training and experience during this closely monitored activity. LILCO plans to repeat the operations during this phase of low power testing to offer each operating shift this valuable BWR experience.

During the course of fuel loading, precriticality testing, and cold criticality testing (Phases I and II), the plant staff must place in service, operate, test and maintain 41 plant systems. These 41 systems are described at pages 219 and 220 of the April 24, 1984 transcript of this proceeding.

The operation of these systems provides valuable training and experience to operating plant personnel, including licensed operators. LILCO plans to repeat certain of the activities in this phase of low power testing to provide additional, valuable BWR operating experience. It is estimated that there will be 5,000 total man-hours of training accomplished and achieved during fuel loading, precriticality testing, and cold criticality testing described above.

Phases III and IV involve heatup of the plant to normal operating temperatures and pressures and testing up to 5% of rated power. First, rod withdrawal sequences are followed to achieve criticality and system heatup from ambient conditions to 150 psig. The plant is then taken in steps to 250 psig, 250 to 350 psig, 350 to 550 psig, 550 to 800 psig and 800 to 920 psig. Once rated conditions are achieved, the power level is increased in progressive steps from 1% to 5% of rated thermal power. These activities are described in detail in my prior testimony at pages 221-26 of the April 24, 1984 transcript of this proceeding. Operating personnel and instrumentation and control technicians receive valuable training and experience in the course of these steps.

In order to support and perform all of the functions and tests performed during Phases III and IV described above, the plant staff will be required to place in service, operate, test and maintain the 54 plant systems described at page 227 of the April 24 transcript. It is important to emphasize again that the operation of these systems and the various functions and tests performed during Phases III and IV of low power testing, as with the activities during Phases I and II, will provide valuable training and experience to operating plant personnel, including licensed operators.

As noted already, LILCO intends to expand the low power testing program. For example, time has been scheduled at the conclusion of Phase IV testing for reactor operators to perform additional reactor heatups. Each operating crew will be given the opportunity to experience plant response to the transients involved with heatup and pressurization of the vessel and operation of important systems such as the High Pressure Coolant Injection (HPCI) and the Reactor Core Isolation Cooling (RCIC) systems. It is estimated that 6,000 man-hours of training will occur during Phases III and IV, in addition to the 5,000 man-hours during Phases I and II.

Q.3. In addition to the training benefits you just described, are there other benefits associated with LILCO's low power testing proposal?

A. (Gunther) Approval of LILCO's low power exemption request is likely to accelerate the time it will take to bring the plant to full power operation. The power ascension test program at Shoreham, which will ultimately result in the plant achieving 100% of rated power, will take 9 to 10 months to complete. This program includes the fuel loading and low power testing effort (Phases I through IV). These four phases will take approximately 2-3 months to complete. Thus, by performing these activities as soon as possible, 2-3 months can be cut off the power ascension timetable because once emergency planning and diesel generator issues are resolved, the test program could proceed to raise power above 5%.

Another important benefit of LILCO's low power proposal is that it may eliminate delays in Shoreham reaching full power operation if problems are encountered during low power testing. Although LILCO does not expect problems and we believe that a 2-3 month schedule is achievable, testing delays are not unknown. Some plants have taken many months to complete low power testing. Thus, by loading fuel and starting low power testing as soon as possible, LILCO may reduce the possibility that testing problems could cause substantial delay in reaching full power.

Q.4. When you last testified, you discussed LILCO's procedures for the restoration of AC power. Has LILCO now finalized these procedures?

A. (Gunther) Yes. A number of procedures have been revised or written to incorporate the supplemental power sources. Included in these procedures are emergency procedures, normal operating procedures, and test procedures:

TP 24.307.04, Bi-Weekly Surveillance Test of GM EMD Diesels,

TP 24.307.07, 20 MW Gas Turbine Monthly Surveillance Test;

TP 24.307.08, 20 MW Gas Turbine Semi-annual Surveillance Test;

TP 23.307.02, GM EMD Operating Procedure;

TP 24.307.05, Semi-annual Testing of GM EMD Diesels;

TP 29.015.03, Restoration of Power with GM EMD Diesels;

SP 29.015.02, Loss of All AC Power (Revised);

SP 23.308.01, Normal Electrical Distribution System (Revised);

SP 23.309.01, Emergency Electrical Distribution System (Revised);

TP 85.84042.3, GM EMD Diesel Electrical Functional Test;

TP 85.84042.1, GM EMD Diesel Mechanical Functional Test.

(Schiffmacher) As discussed on April 24 and 25, no procedures for the system operator to route power to Shoreham need be formally established other than the order to make Shoreham the first priority in restoring power. The System Operator's function is to route power to Shoreham through the best and fastest means available to him and he will do so based on the circumstances facing him in the event of an outage. Nevertheless, certain procedures have been established for restoration of power to Shoreham.

Q.5. Mr. Gunther, have the procedures you mentioned been communicated to the plant staff and operators?

A. (Gunther) Yes. Training has been provided to all six operating crews and to management license holders. This training included a detailed description of the EMD diesels and their auxiliaries, and the procedures associated with operating them during surveillance testing and in an emergency condition. As part of this training, a walk-through was conducted so that operating personnel could obtain hands-on experience concerning these engines and their relationship with the Shoreham Station power grid.

The training also covered the surveillance procedures associated with the 20 MW gas turbine. These procedures, required to satisfy the monthly and semi-annual SER surveillance requirements, are implemented in close coordination with the system operator who initiates the test by remotely opening the supply circuit breaker to the Reserve Station Service Transformer (RSST).

Q.6. Have existing plant procedures been revised to reflect availability of EMD diesel generators and the 20 MW gas turbine?

A. (Gunther) Yes. The permanent station procedure for the loss of all AC power has been revised to include an immediate action step that requires the operator to contact the system operator to determine the status of the 20 MW gas turbine. In addition, an indicating light for the 20 MW gas turbine output breaker position and the RSST supply breaker position (Shoreham OCB 640) have been installed in the Main Control Room so that the operator would have direct information regarding the availability of the unit. The RSST supply circuit breaker (Shoreham OCB 640) automatically opens on a loss of offsite power and guarantees that power provided by the 20 MW gas turbine is dedicated to use by the Shoreham station. The operator also has available a new procedure for the loss of all AC power which, among other things, directs the restoration of power using the EMD diesel generators.

Q.7. Have these procedures been tested or drilled?

A. (Gunther) A significant amount of testing has been conducted on all four of the GM EMD diesel generators. This testing has demonstrated the ability of the engines to start automatically on a loss of voltage condition, sequentially synchronize to their output bus, and carry required plant loads necessary to shut down the reactor safely.

Testing has also been conducted on the 20 MW gas turbine. The testing demonstrated the ability of the machine to start automatically and supply power to Shoreham within three minutes.

In addition, on July 2, 1984, tests were conducted and witnessed by the NRC and Suffolk County personnel to demonstrate the procedures utilized to restore power to emergency loads using the supplemental sources installed at Shoreham, namely, the GM EMD diesels and the 20 MW gas turbine. The tests demonstrated the ability of both the EMD diesel generators and the 20 MW gas turbine to supply power to emergency plant loads in a very short period of time.

1. GM EMD Diesel Generator Test

This test demonstrated the capability of the GM diesels to start automatically on a loss of voltage sensed at bus 11. Operating personnel then isolated the NSST from bus 11 (an NSST fault was simulated) and performed the necessary circuit breaker switching to restore power to emergency bus 103 which was deenergized at test initiation. Two RHR pumps were then started and operated at rated flow conditions.

Temporary Procedure 85.84042.3 was used to perform the test with the acceptance criteria being that the plant have at least one emergency core cooling pump at rated flow within thirty minutes of the loss of power condition. Rated flow (10,000 gpm) on the D RHR pump was achieved in eight minutes and twelve seconds, well within the thirty minutes acceptance criteria. A second RHR pump powered from the 103 bus was started and at rated flow within nine minutes of the loss of power initiation. As noted above, this rapid restoration of power was achieved even with the assumption of a fault on the low side of the NSST which required operation of the manual disconnect switch. Restoration would be even more rapid if no fault occurs on the NSST.

All four of the diesels started on the loss of power and three of the four synchronized to their common bus. Engine 403 did not synchronize within its allowed time and returned to an idle condition. This unit remained in a standby mode and the three available engines were lightly loaded carrying the 2100 kw load from the 2 RHR pumps and Bus 113 480 volt loads. Upon a request from the NRC Staff to manually start and synchronize the 403 engine, the test engineer reset the unit fault annunciator which caused a voltage signal in the 402 engine circuit breaker causing it to trip. The 402 trip was followed by a trip of engine 401 on reverse power (as indicated by a relay flag). Throughout this process, engine .04 successfully picked up and carried the entire load of 2100 kw. Engine 403 was manually synchronized to the bus about one minute later. Engines 401 and 402 were available for resynchronization but were left in the standby mode to maximize loading on engines 403 and 404.

2. 20 MW Gas Turbine Test

Following the GM EMD diesel test, the plant electrical systems were realigned to permit a test of the ability of the 20 MW gas turbine to supply emergency loads in the event of a loss of offsite power. A loss of power to the RSST was initiated by the system operator opening breaker OCB 640 at Wildwood. The proposed technical specifications included in the Staff's safety evaluation report (SER, Supp. No. 5) call for requiring the gas turbine to start in "2 to 3 minutes" and for operators to perform switching necessary to supply an emergency bus in "5 to 10 minutes." Both acceptance criteria were met in the test. The gas turbine output breaker closed in two minutes and thirty-one seconds of its start signal, and an RHR pump was at rated flow within three minutes and fifty seconds of the loss of power initiation.

Station Procedure TP 24.307.08, which is the six month surveillance test, was utilized for the 20 MW gas turbine test.

Q.8. You indicated that two of the EMD diesels tripped when an attempt was made to reset diesel 403. Please explain.

A. (Gunther and Schiffmacher) Under actual emergency conditions, the 403 engine would not have been manually reset since ample power was available from the three diesels that had synchronized with the bus.

A minor wiring modification is being made to the annunciator reset circuitry to eliminate the possibility of a diesel trip as a result of resetting a unit fault prior to starting a unit. Temporary lifting of leads determined that the source of the engine 402 trip problem was in the reset circuitry. Also, to preclude a repeat of the failure of the 403 engine to synchronize automatically, a second minor modification will be completed that increases the time available for the engines to synchronize. Both of these modifications had been previously identified as a result of preoperational testing but had not been implemented at the time of the demonstration. These modifications were scheduled to be completed prior to turning the EMDs over to the plant staff.

Q.9. You testified previously about the procedures for implementing some of LILCO's commitments to shut down the plant in the event certain situations occurred which could threaten the reliability of offsite power. Have instructions now been issued for plant shutdown in the event of loss of interconnections with other utilities?

A. (Gunther) Yes. A standing order has been issued to instruct the operator to proceed to a cold shutdown condition whenever two of the four interconnections to the New York Power Pool and New England Power Exchange are unavailable. This commitment was described in the testimony of William Museler. System operators have been directed to notify the Shoreham watch engineer immediately whenever the above conditions are experienced.

Q.10. Has the procedure for tying the 20 MW gas turbine to the necessary emergency power supplies been completed?

A. (Gunther) The GM EMD diesel procedure requires the reactor operator to perform certain switching operations to power the emergency buses that are different from normal operating procedures. Therefore it was appropriate to develop new procedures. Use of the 20 MW gas turbine, on the other hand, requires no different operator actions. The steps in reenergizing the RSST are the same no matter what is the source of power to the RSST. Therefore, no separate procedure is required; the normal operating procedure for restoring an emergency bus from the RSST is available and would be used.

Q.11. You have testified that normally the EMD diesel generators will be connected into the 4 KV buses on the secondary side of the NSST and that power will be routed through the normal switchgear room. Will there be alternative procedures for supplying power from the EMD diesels?

A. (Gunther) The emergency procedure for the restoration of AC power using the GM EMDs uses the NSST supply breakers to the emergency buses so that power to the RSST via the 20 MW gas turbine is still available. It is possible, however, to supply power to an emergency bus by routing power through the RSST supply breakers. Operators are required to be extremely familiar with the plant electrical system and are aware that these alternate means of supplying power are available.

These alternatives have been discussed with the operators in training. In addition, provisions have been made to supply power directly from the EMD diesels to the emergency switchgear.

Q.12. Please describe the alternative routing arrangements to the emergency switchgear.

A. (Schiffmacher) Capability will exist to connect the EMD switchgear to the plant emergency switchgear. This will be accomplished by a cable connection from the EMD switchgear to Emergency Switchgear Room 102. The EMD feed to the normal switchgear room will be disconnected, thereby creating an independent routing of power from the EMD diesel generators to an emergency switchgear room.

Q.13. What is the purpose of this emergency tie-in?

A. (Schiffmacher) In the event that the normal switchgear room is unavailable for the routing of power from the EMD diesels to the plant emergency systems, this emergency tie-in could be used. Added assurance of the availability of AC power would be achieved, for example, because the emergency switchgear room is seismically qualified. Since the EMD diesels can be expected to operate after a seismic event as described in the testimony of Messrs. Christian, Meligi and Weisel, this alternative tie-in of the EMDs to the emergency switchgear room assures the availability of AC power even after a seismic event.

Q.14. Will the raceway for the cable used in the emergency tie-in procedure be seismically supported?

A. (Schiffmacher) It will either be supported in a way that will survive a seismic event or installed after a seismic event.

Q.15. What is the status of this emergency tie-in for the EMDs?

A. (Schiffmacher) The conceptual design of modifications necessary to accomplish tie-in has been completed and its feasibility has been verified. Attachment 1 to this Supplemental Testimony is a drawing showing the planned location of this tie-in. For purposes of illustration, the area affected by this tie-in is enclosed by squiggly lines.

LILCO has not completed all engineering details or the construction. That additional work can be accomplished in approximately 4 weeks. Because this connection would only be used during low power testing if the TDI diesel generators are unavailable, and since the modifications can be accomplished quickly, LILCO believes it more prudent to await a decision on its Application for Exemption before implementing the modifications. If the requested exemption, resulting in a low power license, is granted, LILCO will have selected portions of these modifications completed prior to commencing Phase III of the low power testing program. Other elements of the modification will be installed after a seismic event if this tie-in is needed.

Q.16. Has installation of the EMD diesel generators been completed?

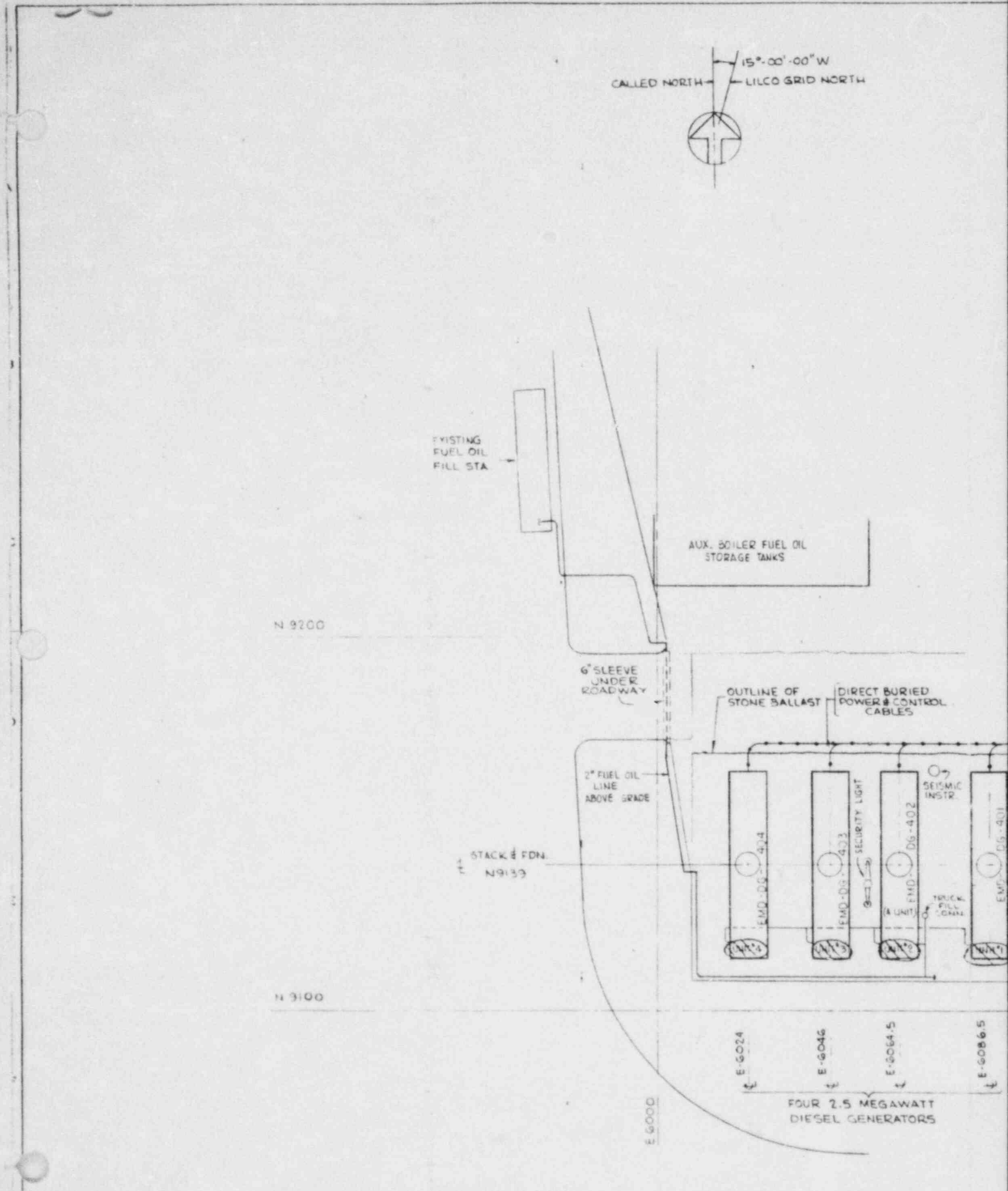
A. (Gunther and Schiffmacher) Yes, the installation is complete. This includes the engines themselves and their tie-in to the normal switchgear bus 11, and the manual disconnect switch located on the low side of the Normal Station Service Transformer (NSST). As of July 10, 1984, several minor modifications remain to the annunciator logic and the automatic synchronizing circuitry. Upon completion of this work, final acceptance testing of the diesels will be performed per approved station procedures. Turnover to the plant operating section is expected by August 1, 1984.

Q.17. Describe the readiness of the plant to load fuel.

A. (Gunther) The plant is physically completed and is being maintained in a condition that would allow fuel to be loaded within 2-3 weeks of obtaining a low power license. Normal surveillance testing on station equipment is in progress. LILCO is also taking advantage of the present shutdown condition to perform various minor maintenance and modification activities.

The major activity that must be completed prior to fuel load is the installation of the neutron sources into the reactor vessel. These sources will be shipped upon receipt of a license and will be installed within 2-3 weeks. This will allow final pre-fuel load testing to be completed so that fuel load activities may commence.

The construction activity associated with the Colt diesel project in no way impacts fuel load readiness. This construction work is being performed outside of the protected area fencing and requires no operator support or attention. Only when tie-in of the Colt auxiliary systems occurs will there be a need to coordinate station equipment outages to permit this occurrence.



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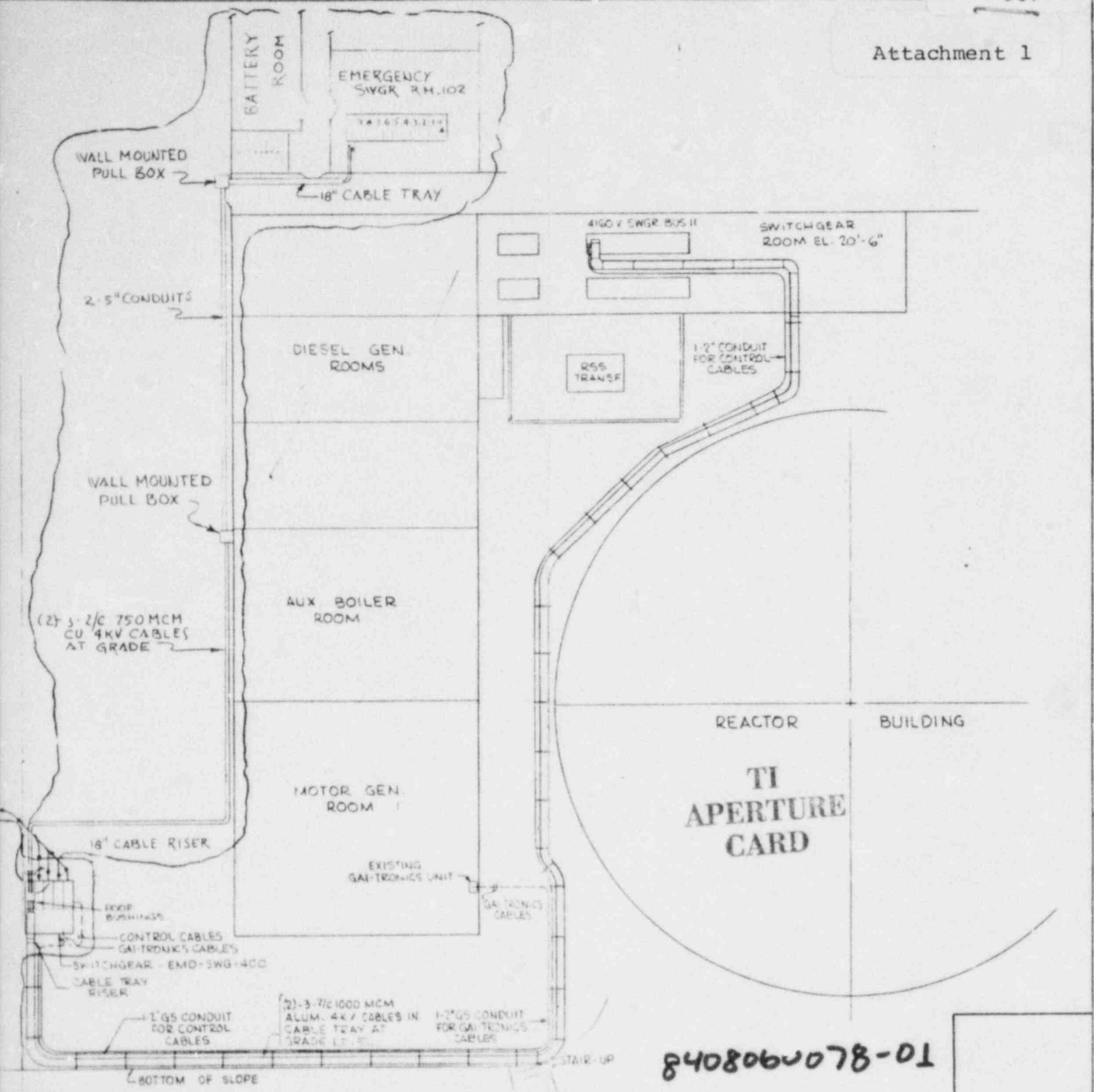
CALLED NORTH
LILCO GRID NORTH
EXISTING FUEL OIL FILL STA
AUX. BOILER FUEL OIL STORAGE TANKS
N 9200
6" SLEEVE UNDER ROADWAY
OUTLINE OF STONE BALLAST
DIRECT BURIED POWER & CONTROL CABLES
2" FUEL OIL LINE ABOVE GRADE
SEISMIC INSTR.
SECURITY LIGHT
STACK & FDN. N9139
EMD-DG-404
EMD-DG-403
EMD-DG-402
(A UNIT)
TRUCK FILL CONN.
N 9100
E-6024
E-6046
E-6064.5
E-6086.5
E 6000
FOUR 2.5 MEGAWATT DIESEL GENERATORS
ARCH
ENGRG.

1 2 3 4 5

Attachment 1



TI APERTURE CARD

8408060078-01

REFERENCE DWGS:

F-50238 - FOUND. & GRADING PLAN
F-50239 - FUEL OIL PIPING ARR'G'T
F-50241 - PWR & CONT. CABLE PLAN SH.1
F-50242 - PWR & CONT. CABLE PLAN SH.2
F-50243 - PWR & CONT. CABLE SECT. & DETAILS SH.1
F-50247 - PWR & CONT. CABLE SECT. & DETAILS SH.2
F-50248 - PWR & CONT. CABLE BLOCK DIAG.
F-50249 - CONDUIT & CABLE SCHEDULE
F-50244 - PLAN & DET. INST. 4KV DISC SW. IN CALVERT BUS-NSS
F-50245 - SECTION A-A
F-50250 - RELAY FUNCTIONAL DIAG.
F-50251 - SWGR. UNIT 11-1B AC & DC ELEM. DIAG.
F-50272 - 2.5MW DIESEL GEN. OUTLINE PLAN & ELEV
F-50273 - 2.5MW DIESEL GEN. CABLE CONNECTIONS

L 3017

Also Available On Aperture Card

S&W 13.12-002

NO	DATE	W.O.	DESCRIPTION	BY	CKD	APPD
3	[illegible]	-632	ADD ALTERNATE FEED TO RM 102	EVV		
2	[illegible]	[illegible]	ADDED COMPONENT NUMBERS	TK	JC	
1	[illegible]	[illegible]	RSV CABLE TRAY RUN & ADDED 1" CONDUIT FOR CONTROL CABLES	WR	JC	
0	[illegible]	[illegible]	ISSUED FOR CONSTRUCTION	RM	JC	

ALTERNATE AC POWER SUPPLY
DIESEL GENERATOR POWER BLOCK
GENERAL ARRANGEMENT PLAN

SHOREHAM NUCLEAR PWR. STA.
SHOREHAM, N.Y.

LONG ISLAND LIGHTING COMPANY
OFFICE OF ENGINEERING
175 EAST OLD COUNTRY ROAD
HICKSVILLE, NEW YORK

DWN: D. DUGAN
CKD: J. COSTRINO
SCALE: 1/16" = 1'-0"
DATE: [illegible]
W0 44430-632
F-50240-2
CABINET NO. 24
FOLDER NO. 29

xxxindex

MR. EARLEY: LILCO calls to the stand John Christian, Ahmed Meligi, and Robert Wiesel.

Whereupon,

JOHN T. CHRISTIAN,

AHMED E. MELIGI,

-and-

ROBERT C. WIESEL,

were called as witnesses on behalf of the Licensee and, having been first duly sworn, were examined and testified as follows:

DIRECT EXAMINATION

BY MR. EARLEY:

Q Gentlemen, for the record would each of you state your name and your business address, please?

A (Witness Christian) My name is John Christian. My business address is Stone & Webster Engineering Corporation, 245 Summer Street, Boston, Massachusetts.

A (Witness Wiesel) My name is Robert Wiesel, my business address is Stone & Webster Engineer Corporation, 245 Summer Street, Boston, Massachusetts.

A (Witness Meligi) My name is Ahmed Meligi, my business address is Sergent & Lundry, 55 East Monroe, Chicago, Illinois, 60603.

Q Gentlemen, do you have in front of you a document entitled, Testimony of John T. Christian, Ahmed E. Meligi, and Robert C. Wiesel, on behalf of Long Island

12-7-Wal

Lighting Company, a document which consists of 37 pages, plus four attachments, including a two volume attachment of a seismic report from Sergent & Lundy?

A (Witness Meligi) Yes, I do.

A (Witness Wiesel) Yes, I do.

A (Witness Christian) Yes, I do.

End 12
Mary fols.

Q Gentlemen, do any of you have any corrections to the testimony?

A (Witness Meligi) I have one small correction on page 22, the line before last of the second paragraph. It should read "found to have a fundamental natural frequency" instead of "found to have a fundamental material frequency."

JUDGE MILLER: Do you want to repeat that, somebody?

MR. EARLEY: Judge Miller, it is page 22 of the testimony. The subparagraph numbered two, the second to last line, the word "material" should be "natural." So it should read "fundamental natural frequency."

JUDGE MILLER: Okay. Thank you.

WITNESS MELIGI: This is the only correction I have.

WITNESS WIESEL: I have no corrections.

WITNESS Christian: Nor do I.

BY MR. EARLEY:

Q Gentlemen, with that correction, is this testimony true and correct to the best of your knowledge and belief and do you adopt it as your testimony in this proceeding?

A (Witness Meligi) Yes, it is.

A (Witness Wiesel) I do.

A (Witness Christian) I do.

Q Dr. Christian, are your professional qualifications

Sim 13-2

summarized on pages 2 through 6 of the testimony and included in Attachment 1 of the testimony?

A (Witness Christian) Yes, they are.

Q Dr. Christian, would you please summarize for the Board and parties briefly your professional qualifiactions?

A I am a senior consulting engineer at the Stone and Webster Engineering Corporation, and my duties there involved advice and guidance and analysis and leadership in a variety of disciplines. I am not assigned to any particular engineering discipline or to any particular project.

I have been employed by Stone and Webster since 1973 first as a consultant in the Geotechnical Division and second as a consulting engineer and then most recently since 1980 as a senior consulting engineer.

The areas in which I have been most active involve geotechnical engineering, earthquake engineering, numerical modeling, computer applications, seismic hazard calculations and related areas.

I have worked on a variety of nuclear power plants, earth dams, foundations, offshore structures and the like. I also am involved in a number of internal boards and committees on computer applications and am responsible in part for the development of offshore technology.

Prior to employment at Stone and Webster, I was

Sim 13-3

an assistant professor and then associate professor in the Department of Civil Engineering at the Massachusetts Institute of Technology. I held those positions from 1966 through 1973.

During that time I taught and did research in geotechnical engineering, earthquake engineering, numerical methods, finite element methods and the like. I also did consulting for a variety of industrial firms, including the Stone and Webster Engineering Corporation.

Prior to joining the faculty at MIT, I spent three years as a National Science Foundation graduate fellow obtaining my doctorate at MIT, and prior to that time, that is from 1959 to 1963, I was an officer in the United States Air Force.

I hold the degrees of bachelor of science, master of science and doctor of philosophy in civil engineering from the Massachusetts Institute of Technology.

I am a registered professional engineer in the Commonwealth of Massachusetts and in the State of Maine. I am a member of a number of professional societies, and of these there are several that are relevant to the present situation.

In particular, I am a member of the American Society of Civil Engineers, and within that society I am a member of the Executive Committee of the Geotechnical

Sim 13-4

Engineering Division. I have served or am now serving on the Soil Dynamics Committee of that Division, on the Committee on Safety and Reliability, the Committee on Computer Applications and Numerical Methods and the Committee on Publications.

I am a member of the Seismological Society of America, of the Earthquake Engineering Research Institute, the International Society of Soil Mechanics and Foundation Engineering, the British Geotechnical Society and the Boston Society of Civil Engineers, among others.

Q Thank you.

Mr. Meligi, are your professional qualifications summarized on pages 6 through 9 of the prefiled testimony and also included in Attachment 2 to the testimony?

A (Witness Meligi) Yes, they are.

Q Mr. Meligi, for the Board and parties, would you please summarize your professional qualifications?

A I am the Head of the Component Qualification Division in Sargent and Lundy. I was hired by Sargent and Lundy in 1971 as a seismic analyst, and then I got promoted three or four times. Then I was appointed the Head of this Division in 1981.

This Division has 130 engineers and we collectively are in charge of developing and implementing the qualification programs of components for nuclear plant

Sim 13-5

applications for all post-related plant conditions which includes the seismic event.

In the course of completing this work we have performed seismic qualifications for several General Motors EMD diesel engines which are similar to those installed in the Shoreham site.

We also are in charge of the qualification of all mechanical and electrical components for the safety applications in nuclear power plants.

Prior to my employment by Sargent and Lundy, I taught in Michigan Tech the engineering and mechanical courses and I worked in the aerospace industry in the areas of flutter and vibration analysis for about five years.

I guess this summarizes my professional qualifications. I am a registered professional engineer in the State of Illinois. I am a member of the American Society of Mechanical Engineers and the American Nuclear Society and the Institute of Environmental Sciences.

I am also the Secretary of the Special Working Group on Dynamic Analysis which is a subsection of Section 3 of the ASME and a member of the Working Group for Component Supports of the same Section 3.

I am a member of the ANSI N-45 for the operability of Class 2 and 3, ASME Class 2 and 3 pumps for

Sim 13-6

nuclear plants.

Q Thank you.

Mr. Wiesel, are your professional qualifications summarized on pages 9 through 11 of the prefiled testimony and included also in Attachment 3 of the testimony?

A (Witness Wiesel) Yes, they are.

Q Would you please summarize your professional qualifications?

A I am a senior structural engineer in the Structural Division of Stone and Webster. My current position is the Supervisor of Projects. My responsibilities in that position include the technical supervision of the structural engineering personnel assigned to the Shoreham project, as well as other nuclear projects within Stone and Webster.

Prior to this position, I was the lead structural engineer on the Shoreham project from the period of March of 1980 until February of 1984. In that position I was responsible for all of the engineering and design activities within the structural group for the Shoreham project.

Typically that responsibility included the seismic analysis and design of all of the safety related structures. It included the seismic analysis and design of cable tray supports, conduit supports and equipment foundations.

I am a registered professional engineer in the

Sim 13-7

States of New York and Massachusetts.

MR. EARLEY: Judge Miller, LILCO's panel is ready for voir dire examination.

JUDGE MILLER: Any voir dire examination?

MS. LETSCHE: The County has none.

JUDGE MILLER: New York?

MR. PALOMINO: None.

JUDGE MILLER: The Staff.

MR. PERLIS: The Staff has none.

JUDGE MILLER: As to the statement of qualifications as testified to by the witnesses, you might indicate now what field or fields you are profferring them to give testimony as experts, opinion evidence that is.

MR. EARLEY: Judge Miller, we are offering them as experts in the field of seismic analysis and seismic hazards calculation. Within those fields we discuss operability of seismic equipment. They cover the structural integrity of the EMD diesel generators. They also cover soils properties and soils mechanics as it relates to the ability to withstand earthquakes, as well as seismic hazard analysis, which involves the calculation of the relative frequency associated with earthquakes. It is called seismic hazard calculations.

JUDGE MILLER: Very well. You may proceed.

MR. EARLEY: Judge, the witnesses have indicated

Sim 13-8

that they adopt the testimony that is entitled "Testimony of John T. Christian, Ahmed E. Meligi and Robert C. Wiesel on Behalf of the Long Island Lighting Company."

I will ask the witnesses to briefly summarize their testimony.

Let me start with Mr. Meligi.

Would you please summarize the substance of your testimony.

WITNESS MELIGI: My testimony was written to explain the work we have done based on LILCO's request to verify and study the seismic capabilies of the EMD diesel engines installed in the Shoreham nuclear plant.

That testimony summarizes the work we have done in the different phases of the assignment whether when we had our walk-downs to verify and get the pertinent information to perform the work or whether the detailed analysis and the utilization of the available material we have had in Sargent and Lundy which proved to be relevant to verifying the seismic adequacy of the components associated with the assembly.

It also went on to present the conclusions of the study and the recommendations which have been made. The conclusions that we were able to reach is that the capabilities of the engines and the associated components required for the operation to generate the necessary power is verified to

Sim 13-9

withstand the Shoreham SSE and be able to perform their functions after this.

BY MR. EARLEY:

Q Mr. Meligi, for clarification's sake would you tell the Board what the level of the earthquake is that you referred to, the SSE?

A (Witness Meligi) The level of the safe shutdown earthquake was .2 G which was presented to us at the base of the engine.

Q Mr. Wiesel, would you please summarize your direct testimony, please?

A (Witness Wiesel) My testimony deals with the qualification of the EMD diesel foundations and the foundation under the switch gear for the EMD diesels.

It also deals with the fuel oil line feeding the EMD diesels.

The foundations under the EMD diesels themselves, the timbered foundations, we have evaluated the foundations and have concluded that they are adequate for .2 Gs as a minimum to preclude sliding or overturning.

We have also evaluated the switch gear foundations, which again are a timber arrangement, and we have determined that they are good for a minimum of .13 Gs for sliding or overturning.

The fuel oil lines, Stone and Webster had

Sim 13-10

engineers who are qualified in the analysis and design of piping walk down the current arrangement of the fuel oil lines. As a result of that walkdown, a recommendation was made to LILCO to bury the lines to ensure their survivability after or during an earthquake.

It is my understanding that LILCO has agreed to bury the lines in a seismically qualified configuration once an exemption is granted.

Q And, Dr. Christian, will you please summarize your direct testimony for the Board?

A (Witness Christian) Yes. My direct testimony deals with three areas.

We looked at the stability, the sliding stability of the EMD diesels and switch gear for sliding under the timbers that support it through the soil or the interface between the timber and the soil and found that there was more than adequate capacity to withstand the .2 G SSE.

We also looked at the potential for liquefaction of the soils underlying this area and found that the zone most susceptible to liquefaction, which is a zone of some 15 feet starting at a depth of around 10 feet below the ground surface, has a resistance to liquefaction that is at least adequate to take a .13 G earthquake.

We finally examined the relative frequency of occurrence of earthquakes in the Shoreham area and concluded

Sim 13-11

that the annual hazard of observing a .13 G earthquake, that is the probability that a .13 G earthquake would be seen in any one year is one/tenth of the probability that the .2 G safe shutdown earthquake will be observed during the 40-year life of the plant.

MR. EARLEY: Thank you, gentlemen.

Judge Miller, LILCO's panel is ready for cross-examination on its direct testimony.

JUDGE MILLER: Very well. Cross.

MS. LETSCHE: Yes, Judge Miller. The first thing I would like to do is move to strike the last piece of testimony summarized by Mr. Christian and the actual piece of testimony which I believe he was summarizing in his prefiled testimony which is on page 35 and 36 of that testimony. It is Question and Answer 49.

The basis for the motion to strike is the following:

This testimony sets forth a comparison by Dr. Christian of the probability of the occurrence of a .13 G earthquake in a one-year period of time compared to the probability of occurrence of a .2 G earthquake during a 40-year period of time.

This comparison of the probability of an earthquake during the low-power test period, which is one year, versus the probability of occurrence of in fact a

Sim 13-12

different level of earthquake, but an earthquake during full-power operation, that is the 40-year period of plant life, is not relevant to this proceeding.

The comparison which the Commission dictated in its May 18th order was the safety of operation at five percent power given the alternate proposed AC power configuration for which an exemption is required compared with operation with a qualified on-site AC power source.

Therefore, a proper comparison of probabilities, if a probability comparison were proper, and I will get to that in a minute, would be a comparison of probabilities during the low-power period of operation and not a comparison of a one-year low-power period versus a 40-year full-power period.

So the first basis to strike this testimony is that a comparison is not relevant to the comparison mandated by the Commission which is a comparison of operation at low power given the alternate configuration for which an exemption is required as it compared to operation at low power given a qualified AC power system. That is the first ground to strike this testimony.

The additional ground for striking this testimony is that the question of the probability of a seismic event occurring is also not relevant to the matter at issue in this proceeding.

Sim 13-13

Again, the Commission has mandated that what should be compared here is the safety of operation, that is whether, assuming the plant operates, it would be as safe operating with the alternate proposed system as it would be operating with a qualified system, both of those operations taking place during low power.

The probability of a seismic event occurring during that five percent power operation period is interesting and in fact may be relevant, but that in itself is not relevant to the question of the safety of operation.

The probability of that event occurring during low-power operation is going to be relatively speaking a constant whether that low-power operation occurs because an exemption has been granted or it occurs because in fact LILCO has complied with the regulations.

The probability of the event occuring is going to stay the same.

What is at issue is what happens if that event does occur. Is the operation going to be the same if the event occurs when there is this alternate system in place as it would be if the event were to occur with a qualified system in place.

Therefore, the second ground to strike this piece of testimony is that a discussion of purely the probabilities of the cccurrence of an event without looking

Sim 13-14

at the result on operation, that is whether or not the occurrence of that event would affect the safety of that operation, is not a relevant item of testimony in this proceeding as defined by the Commission.

JUDGE MILLER: Counsel?

MR. EARLEY: LILCO opposes the motion to strike.

With respect to the first ground that the testimony is not relevant because of the Commission's order, LILCO here is trying to put in perspective for the Board so they can understand the significance of the testimony that certain portions of EMD diesels, and particularly the soil liquefaction, we can predict with confidence it will not occur up to .13 Gs. And the fact that the low-power testing will be conducted during a limited period of time, it is important for the Board to understand the significance of that capability which exceeds the operating basis earthquake.

So that is one purpose for submitting this testimony.

end Sim
Sue fols

#14-1-SueT

JUDGE MILLER: Why is it the OBE operating basis earthquake rather than the safe shutdown of the earthquake?

MR. EARLERY: You mean, why are we addressing this? Because we have shown that we can confidently predict that the soil will not liquify up to .13 Gs. Given the state of the art, we don't know what's going to happen above .13 Gs. The soil may or may not liquify. Given that fact, the Board needs to know the significance of those seismic capabilities.

We are not claiming that the EMD diesels have the same level of qualification for seismic events that qualified diesel generator would have at a plant that would meet the safe shutdown earthquake. That's not LILCO's point.

In fact, as was summarized this morning, given the testimony that has already been admitted during a seismic event a significant amount of time is available to restore AC power, it is important for the Board to know that it's very unlikely you are ever going to have an event that would exceed the seismic capabilities of these particular EMD engines, and that you can have confidence that the public health and safety will be protected.

Again, the argument is similar with respect to the second ground. And I'm not sure I can distinguish

#14-2-SueT

between the two, but the County is saying the probability of a seismic event is not relevant. It is relevant in having the Board understand the significance of the seismic capabilities of these EMD engines.

We have given testimony on what their capabilities are, and this testimony let's the Board understand the significance of that in terms of risk to the public health and safety coupled with LILCO's overall position, and I think it's supported by the testimony that was given, that in a seismic event there are many days, and I think the Staff has indicated up to 30 days in their SER, to supply power.

JUDGE MILLER: Staff.

MR. PERLIS: Mr. Chairman, it seems that this motion is predicated on the definition of as safe as.

JUDGE MILLER: The definition of what?

MR. PERLIS: As safe as, as meant in the Commission's Order. And it would appear that the parties may well be in disagreement on that definition.

The Staff does not rely on the seismic qualification in its case, but we believe that the parties should be allowed to make their own record here.

And inasmuch as the definition of as safe is in some question here, we believe the better course would be to admit this evidence and if the County believes it not

#14-3-SueT

relevant to the as safe as standard, as they are defining it, they can then make that position clear in their findings.

JUDGE MILLER: Well, what position has the Staff taken in its proposed findings? It's about the same as your prepared direct testimony.

MR. PERLIS: Our position on that as safe as is the Commission is talking about a comparable level of safety with a qualified power source.

JUDGE MILLER: The same level of safety or comparable level of safety with what, now? A qualified --

MR. PERLIS: With a qualified source, and that --

JUDGE MILLER: You mean, seismically qualified?

MR. PERLIS: Seismically qualified as well as other standards, and that that definition, as safe as, can be viewed as whether fission fuel products would be released and affect the general public.

And we believe there is adequate assurance with both the qualified source and the source that LILCO is suggesting that fuel fission products will not be released. We believe that's the case regardless of seismic qualification.

JUDGE MILLER: Well, aren't the requirements in part of safe shutdown earthquake the ability to shut it down in case of a seismic event of the magnitude that is described, and doesn't that have some bearing upon an analysis

#14-4-SueT

of the comparable safety of various systems in operation?

MR. PERLIS: We believe our testimony will show that the only possible relevance to the seismic event is a seismic event that occurs simultaneous to a loss of cooling accident. And our testimony will also show that that event is of such low probability that it need not be considered.

JUDGE MILLER: That is the simultaneous occurrence?

MR. PERLIS: Correct. And --

JUDGE MILLER: Well, what about the occurrence of a seismic event of 0.2 G ground force velocity?

MR. PERLIS: As our testimony will show, if that does not occur simultaneous to a loss of coolant event, one doesn't need EMD diesels to work, one doesn't need to have AC power restored to the site I believe for a period --

JUDGE MILLER: Why?

MR. PERLIS: -- of around thirty days. Mr. Hodges will address that in his testimony. I wouldn't want to testify for him.

JUDGE MILLER: I will let you summarize his testimony. I think that would be proper.

(Laughter.)

You are not under oath, but you have professional obligations. Go ahead.

MR. PERLIS: The position is, as best I understand

#14-5-SueT

it, that if either the high pressure coolant injection system or the reactor -- I believe it's reactor isolation coolant system works, once within the first four days, and those -- both of those systems are seismically qualified, that the plant then would not need cooling water -- I'm sorry, would not need pumps to work for at least thirty days and possibly indefinitely.

In that pumps would not need to work again, one would not have to have AC power restored to the site for at least a month or possibly indefinitely.

JUDGE MILLER: That's Phase IV, for example, which would be up to five percent --

MR. PERLIS: That's cor ect, provided there is not a simultaneous loss of coolant accident.

JUDGE MILLER: What about the argument that Suffolk County makes that you are segmenting probabilities and going on a probabilistic basis, namely that you can't just look at a limited period of time and then in some fashion cut down the probability because of the short period of time?

MR. PERLIS: I don't quite understand Suffolk County's position there.

JUDGE MILLER: Well, you heard it.

MR. PERLIS: I've heard it, but I don't understand it. It seems to me that the Staff again is not depending

#14-6-SueT

upon the probability of the seismic event; however, it appears as if LILCO in their direct case is depending in part on the probability of a seismic event.

JUDGE MILLER: Is depending on what, now? In part upon what? I didn't hear you.

MR. PERLIS: On the probability of a seismic event of .13 G occurring, while the --

JUDGE MILLER: Well, why the OBE instead of the SSE, let's put it that way?

MR. PERLIS: I believe Mr. Earley stated that the significance of .13 G is that the studies estimate that soil liquefaction will not occur with less than a .13 G earthquake occurring. They are less certain if an earthquake greater than .13 G would occur.

JUDGE MILLER: Well, they are much less certain on 0.2 Gs which is your SSE level, aren't they?

MR. PERLIS: That would be true as well. But since --

JUDGE MILLER: Well, then why do you just overlook the possibility of liquefaction up to or approaching your safe shutdown earthquake level of ground force acceleration?

MR. PERLIS: Well, if liquefaction were to occur at .13 G I believe it would occur at .2 G as well, and since it would occur at a less severe earthquake I would believe

#14-7-SueT

that that earthquake would then be more probable since it --

JUDGE MILLER: Now, you are confusing me. What would be more probable?

MR. PERLIS: Well, an earthquake of -- as low as .13 G would include within it earthquakes of .2 G or greater severity; therefore, the probability that one should look at is that earthquake at which soil liquefaction may occur, which in this case is more frequent than just looking at earthquakes of .2 G severity.

JUDGE MILLER: Let me get these figures straight. What is the operating basis earthquake, OBE?

MR. PERLIS: It's .1 G. I believe it's .1 G. And the safe shutdown earthquake --

JUDGE MILLER: .1 G?

MR. PERLIS: .10.

JUDGE MILLER: .10. Now, that's a less severe seismic occurrence than 0.2 G.

MR. PERLIS: That's correct.

JUDGE MILLER: So why is there less risk when you get the higher value? I guess that's where you lost me.

MR. PERLIS: I didn't say there was less risk.

JUDGE MILLER: Less what?

MR. PERLIS: Less likelihood of a seismic event of .2 G occurring than one of .13 G occurring, because any seismic event of .2 G would automatically include the seismic events smaller than that.

The point I believe LILCO was trying to make is that at .13 G there is no assurance that liquefaction will not occur. So, therefore, they are considering the probability not of the OBE but of an earthquake at .13 G.

JUDGE MILLER: Where did we get the .13 G now? Where did that number come from?

MR. PERLIS: I believe Mr. Earley could tell you a lot better than I could, but I believe that's the number at which their studies indicate they are certain that liquefaction will not occur at a seismic event below that number, less severe than .13 G.

MR. EARLEY: Judge Miller, if the Board permits, it may be helpful if I try and explain LILCO's position and why we think this testimony is significant for the Board, and explain the .13 Gs.

MS. LETSCHE: Judge Miller, perhaps also it would be helpful, because I think it has been lost track of in this discussion, for me to restate what the County's objection is, because I think based on the Staff's comments I think we have lost track of it.

JUDGE MILLER: Do you think they didn't perceive or at least address your objection?

MS. LETSCHE: That's correct.

#14-9-SueT

JUDGE MILLER: All right, Staff. We will interrupt the caucus.

There is some belief on the part of counsel for Suffolk County that you didn't correctly perceive or understand or address their objection. So, they are going to restate for it.

I want you now to listen, and then we will give you a chance. Go ahead.

MS. LETSCHE: I'm not sure if there wasn't a perception or an understanding of what I said, although they indicated they didn't understand it.

Let me restate it. The objection of the County to this testimony is not the mere fact that it talks about probabilities. The objection is the two items that are being compared in this portion of the testimony.

The Commission's Order said that what needs to be compared is operation at low power under the exempt conditions.

JUDGE MILLER: Read that portion there, would you, please?

MS. LETSCHE: What the Commission stated was that --

JUDGE MILLER: What page are you on now?

MS. LETSCHE: This is on Page 3 of the Commission's May 16 Order.

#14-10-SueT

JUDGE MILLER: Okay.

MS. LETSCHE: That the Applicant should include -- and then this is the quote.

JUDGE MILLER: Hold it. Where are you?

MS. LETSCHE: At the top of Page 3 --

JUDGE MILLER: At the top of Page 3. I'm there.

MS. LETSCHE: It's basis for concluding that --

JUDGE MILLER: Wait a minute. You said the Applicant and I don't even see that. Oh, you are going back, aren't you?

MS. LETSCHE: Yes. On Page 2, the beginning is: The Applicant should include a discussion of the following:

JUDGE MILLER: All right. Hold it. The Applicant should include a discussion of the following.

Okay. Now, you are going to delete material and you are going over to the top of 3?

MS. LETSCHE: That's correct.

JUDGE MILLER: Okay. Go ahead.

MS. LETSCHE: And Number 2 is its basis for concluding that at the power levels for which it seeks authorization to operate, operation would be as safe under the conditions proposed by it as operation would have been with a fully qualified onsite AC power source.

Now, that's the end of the quotation. The

#14-11-SueT

comparison that the Commission has thus set forth is the comparison of operation up to five percent power under the conditions proposed in the exemption application with operation at five percent, at up to five percent power, with a fully qualified onsite AC power source.

JUDGE MILLER: It didn't say explicitly the latter, does it?

MS. LETSCHE: Well, it says -- the beginning of the sentence is at the power levels for which it seeks authorization to operate --

JUDGE MILLER: Yes.

MS. LETSCHE: -- comma.

JUDGE MILLER: That's your low power.

MS. LETSCHE: That's correct. Operation would be as safe under the conditions proposed by it, which are the exemption configuration conditions, as operation would have been with a fully qualified onsite AC power source.

JUDGE MILLER: Now, that doesn't limit it to five percent though on the latter.

MS. LETSCHE: Well, I believe, Judge Miller, that since the qualifier, which is at the power levels for which it seeks authorization to operate, which is set off by commas in the beginning of that sentence --

JUDGE MILLER: That's five percent, no doubt about that.

#14-12-SueT1

MS. LETSCHE: That's right. And what the Commission is saying should be compared is operation at five percent under the --

JUDGE MILLER: On the one hand, yes.

MS. LETSCHE: -- exempt conditions and under the fully conditions.

JUDGE MILLER: Now, wait a minute. See, you are gliding over in logic. You keep giving me all the things that are apparent to us from the onsite -- I mean from the low power operation.

But then when we get to what the comparison is, you are putting in, maybe correctly, I'm not questioning it at the moment, but I'm trying to get to the source of the comparison is with what operation would have been with a fully qualified onsite AC power source, which itself certainly could contemplate full power operation, couldn't it? Isn't that what the qualification, how you qualify for operation at full power?

Isn't that a description of it actually?

MS. LETSCHE: Judge Miller, the way I read this sentence with the grammatical construction that's included in it, the clause, at the power levels for which it seeks authorization to operate, which is set off by commas following the beginning which is its basis for concluding that, indicates that that qualifying clause is intended to apply

#14-13-SueT

to the two items of operation that are on either side of the comparison.

JUDGE MILLER: That's why I'm asking you why you say the two? We certainly agree with you as to the one to which it is applied and at which it is set off by the commas, embedded, and encapsulated, no question about that.

MS. LETSCHE: Well, the basis --

JUDGE MILLER: Then you leap over and you get past that. I'm trying to find out the basis of why the comparison in the latter clause could not be. Perhaps some other portion of the Order could shed light on that.

MS. LETSCHE: The basis, Judge Miller, is, number one, my reading of the grammatical construction of this sentence. The other basis is my understanding of the briefing and the argument that was made to the Commission which led up to the issuance of this Order in which --

JUDGE MILLER: You haven't seen the transcript of that now, have you?

MS. LETSCHE: I frankly don't remember, but I was present.

JUDGE MILLER: At the argument you were present, but not at the --

MS. LETSCHE: Not during the deliberation.

JUDGE MILLER: -- consideration of the Commission.

#14-14-SueT1

At least, somewhere it's stated that there weren't any transcripts available to anybody, including us on that.

MS. LETSCHE: I certainly was not present at the deliberations, but in answering your question --

JUDGE MILLER: My question was transcript.

MS. LETSCHE: Your question was my basis for my understanding of what this sentence says. My basis is twofold. Number one, the grammatical construction and the words that are stated here in the Commission Order, which I have referenced.

Number two is the briefings, the papers that were submitted by the parties, and the argument that took place to the Commission in which the question of what the comparison was, whether one was to compare low power operation versus full power operation or low power operation versus low power operation. That was the issue presented to the Commission.

And in light of that issue having been presented, and this statement in the Commission's Order, my understanding and reading of the Commission's Order is that the proper comparison is five percent power operation with the alternate system compared to five percent operation with a fully qualified onsite AC power source.

And in light of that statement by the Commission, it is the County's belief and basis for this motion to

#14-15-SueT

strike that a comparison of the probability of a particular earthquake occurring during the relatively short period of time, which would be low power testing, compared to the probability of an earthquake occurring during a 40 year period, that is the full life of the plant at full power, is not a relevant comparison. And that was the point that I intended to make in the first basis for my motion to strike, not a discussion or a consideration of the meaning of as safe as, or the criteria, but what were the two items of comparison.

The second argument I made, and the second basis for my motion to strike, was that the question of probabilities while relevant is not relevant in a vacuum, that what again the Commission mandated be considered was operation, the safety of the operation, not the probability of the occurrence of an event.

So, even if you had a proper comparison of probabilities, that is you were comparing apples and apples, probabilities during one year versus probabilities during one year, that is not pertinent to the question of the relative safety of operation. What you have to look at is the operation, the effect of that -- the occurrence of that event, given whatever probability it is, under the two operating conditions that you are comparing.

And this testimony which we are seeking to strike

#14-16-SueT

does not do that. It deals only with the bare probabilities in a vacuum without addressing the effect or the impact of those probabilities or the occurrence of the event on the safety, the relative safety, of the operation of the plant which is what is at issue here, not the bare probability.

JUDGE MILLER: Your reasoning is interesting. Somewhere it has been said in the papers that have been filed here by the various parties that it was argued to the Commission and that a ruling was asked for as to summary disposition of Phases I and II.

Were those matters argued?

MS. LETSCHE: By LILCO?

JUDGE MILLER: By anybody. Yes, probably by LILCO.

MS. LETSCHE: I believe -- as I recall, LILCO did request the Commission to grant it summary disposition on Phases I and II, yes, that's correct. The Commission didn't do so.

JUDGE MILLER: And then I think that your client is arguing the subsequent fact that the fact that the Commission didn't do so meant that the Commission was ruling against that request for summary disposition.

Hasn't your client taken that position?

MS. LETSCHE: Well, what we have stated was that the Commission did not grant those motions, which is

#14-17-SueT1

a fact.

JUDGE MILLER: And you from there reason that they, by not granting it, that they in effect denied it.

MS. LETSCHE: I frankly don't recall if we used those words. It's certainly true that they didn't grant them.

JUDGE MILLER: In substance. I'm curious as to your reasoning of what the Commission considered that it had before it by virtue of the argument, that's part of your argument. And I'm interested. Of course, we will hear more about that later I'm sure.

All right. Have you concluded now?

MS. LETSCHE: Yes, I have. That's my motion to strike.

JUDGE MILLER: Okay.

MR. EARLEY: Judge Miller, let me run through five points. I'm not going to presume to argue what the Commission did or did not mean by this particular statement. I don't think it's necessary to reach that to decide that this testimony can be admitted.

JUDGE MILLER: Let me be clear about that now. The Staff seemed to intimate, if I was following them correctly, that this did have some bearing of some type on the as safe as discussion.

MR. EARLEY: Well --

#14-18-SueT

JUDGE MILLER: Well, let's find out. You may disregard but if somebody else --

MR. EARLEY: Well, my --

JUDGE MILLER: I'm going to let you be heard, but I want to clarify that. I'm very much interested in this question as safe as versus substantially as safe as. I want your views on that, and you will brief it later.

MR. EARLEY: Judge, the County's position, and it seems to be that you need to make a point by point comparison of what a qualified diesel generator would have and what the EMD diesel generators would have and what LILCO's present configuration has and what a plant with qualified diesel generators would have.

That position -- if that's the correct interpretation of what as safe as means, LILCO wouldn't need an exemption from the regulations. If we could show that we met everything, then we wouldn't need to get an exemption from GDC-17. We would have the qualified power source.

LILCO has acknowledged that it needs -- that it has requested the exemption from GDC-17 because it doesn't meet everything point by point.

The comparison is in light of what LILCO does have and the capabilities of what LILCO has. And in light of the increased time you have available during low power, in light of the other things, commitments that LILCO

#14-19-SueT

has made and other sources of offsite power that LILCO has for low power. In toto, in the overall view of this, is operation of the plant essentially as safe if you had qualified diesels as LILCO's proposal is now.

JUDGE MILLER: Wait a minute. Let me be sure I understand you. Looking at the overall view, are you putting in some different perspective now, some overall view concept implicit in your argument?

I want to be sure --

MR. EARLEY: That has been LILCO's view consistently in this, that you don't look point by point. You look at the overall, the risk to the public.

JUDGE MILLER: Of what?

MR. EARLEY: Of operation of the plant.

JUDGE MILLER: At what?

MR. EARLEY: At five percent power.

JUDGE MILLER: With what or without what?

MR. EARLEY: Comparing that in LILCO's present configuration at five percent power. And if you compare that to operation of the plant with -- operation of a plant that meets the regulations with qualified diesels at five percent power, we believe we can show and have established that there is an equivalent level of safety.

JUDGE MILLER: Do you feel that you have answered the rephrased contentions as counsel has twice

#14-20-SueT

made?

MR. EARLEY: That's the first point.

JUDGE MILLER: Oh, okay.

MR. EARLEY: Second point, we agree with the Staff that it is not necessary to reach the question of seismic qualification or seismic capabilities of the EMD diesels because we agree with the Staff, and we presented testimony as well, that showed that in a seismic event you have up to thirty days and maybe even beyond before you need to restore AC power.

LILCO's witnesses testify that because of the multiplicity of power sources and the number of ways you can route power to the site, plus LILCO's capabilities to repair power sources and transmission lines, that in that thirty day period there is assurance you are going to get power back from some source.

So you really don't need to address whether the EMDs have any seismic capabilities. I believe that's the Staff's position. We agree with that.

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JUDGE MILLER: You don't need to address what?

MR. EARLEY: The seismic capabilities of the EMD diesels.

JUDGE MILLER: Isn't that what you are doing by these witnesses?

MR. EARLEY: We have gone a step beyond that to give the Board even further assurance.

JUDGE MILLER: But if you don't need to, why are you assuming possibly a burden that you wouldn't have to meet, just as on the, 'as safe as,' versus, 'substantially as safe as.'

Are you assuming a certain burden. Explain it to me.

MR. EARLEY: I think what LILCO is doing here is trying to answer the County's allegations that they had made a number of times, and beyond showing that we don't need to have these things seismically qualified because of the time available, we are going to give added assurance, above and beyond what we think we need to, to show they do have significant seismic capabilities.

JUDGE MILLER: Wait a minute, wait a minute. Significant seismic capabilities. Now, perhaps there lies the difference between your analysis and that of the County's motion.

MR. EARLEY: Well, I think that is exactly right.

We are not trying to show, and have not claimed in our testimony that these machines are completely seismically qualified.

Again, if we could do that, we might not need an exemption from the regulations. We had a completely qualified power source --

JUDGE MILLER: Well, there is a lot more to completely qualified power source than just this one aspect. That also might explain why you don't have what you wish you had. Go ahead.

MR. EARLY: The point is, Judge, that we are trying to give you this added confidence that the Board can have that there will be power by showing that the machines have significant seismic capability.

Now, this testimony is trying to give the Board some perspective on what capabilities they have. We could leave it and say that they have the capability of withstanding, at least for soil liquefaction purposes, .13 G earthquake.

JUDGE MILLER: Well, why don't you?

MR. EARLY: That may or may not -- that doesn't give a good perspective on what does that mean in terms of risks to the public?

JUDGE MILLER: Well, why do you get involved then in this going up to the .2 G, for example, on the liquefaction question, or why do you get involved in this one-tenth of the probability of a .2 G earthquake occurring in 40 years, such as we see at the bottom of page 35.

MR. EARLY: Clearly, the Commission and the NRC has found that meeting the safe shutdown earthquake, .2 G's, and there is some finite likelihood that that might be exceeded during the life of the plant, but there has been a judgment that that is an acceptable level of safety.

The public should be willing to accept that level of risk.

JUDGE MILLER: Let's look at that, then. How does that tie in with your .13 G for liquefaction purposes, and how does it tie in this question of one-tenth of the probability in forty years. I guess it is the probability segmentation that I would like to have you meet.

MR. EARLEY: What we are showing here is the risk is in order of magnitude lower than the risk that you would accept for the forty year life of the plant, because we have a shortened period of time that we are going to be relying on.

The one year is very conservative.

JUDGE MILLER: You are not looking at forty years, are you. Aren't you looking instead at the one-tenth of the probability of the forty year risk probability?

MR. EARLEY: That is the result of the comparison. What we said is in the life of a normal plant, the Commission has said it is acceptable to have a level of public risk that the plant will withstand .2 G earthquake.

JUDGE MILLER: Yes.

MR. EARLEY: And whatever probability associated with that earthquake, we are willing to accept the probability you might exceed that level.

JUDGE MILLER: What does that have to do with low power operation at five percent?

MR. EARLEY: At five percent we have demonstrated that the diesels can withstand at least the .13 G earthquake.

JUDGE MILLER: But not a .2 G.

MR. EARLEY: That is right.

JUDGE MILLER: Why are we looking at .2 G at all?

MR. EARLEY: Because we are only going to be using these EMD diesels for a short period of time, and the probability of exceeding that .13 G earthquake in the limited period of time is an order of magnitude less than the risk we are already willing to accept for the plant.

So, we are trying to put it into perspective.

JUDGE MILLER: What would be the risk factor, the probability factor of a .2 G earthquake, and the ability of the plant to meet such ground force acceleration upon a full term basis? That is to say fully qualified onsite with a contemplated life of thirty-five to forty years, or whatever?

MR. EARLEY: That number, that probability, we looked at. In fact, the witnesses can tell you the number. He used that number in comparing the probability of this smaller earthquake in the smaller period of time.

And came out with the conclusion that the comparision, the probabilities for the fact that you have a lower capability in the EMD diesels, but a shorter period of time, that that probability is one-tenth in order of magnitude less than the probability of the forty year life of the plant with the .2 G earthquake, a risk that people are willing to accept.

So, what we are saying is we have demonstrated a much lower level of risk with the EMD diesels, even though they are not qualified to the point -- we cannot predict with confidence that they will withstand a .2 G earthquake.

We are looking at the remoteness of the event, and indeed, we are talking about the Commission's order and Footnote 3 of the Commission's May 16th Order, on page 3, one of the items that they wanted to have considered, and it is down towards the bottom of the footnote, is the safety significance of the issues involved.

If the County is claiming that LILCO is deficient because its EMD diesels don't meet the .2 G earthquake, the Board ought to know what significance that has, and what we are saying is in terms of risks that people are willing to accept, it is not particularly significant.

JUDGE MILLER: Because of the shorter period of time.

MR. EARLEY: Because of the shorter period of time involved. That everyone recognizes that we are not going to be in a low power configuration for the forty year life of the plant. The testimony in the proceeding says it may only be two to three months, in which case the one year assumption is conservative.

JUDGE MILLER: Then if an Applicant came in and said: Look, I don't want to operate thirty-five or forty years; I only want to go twenty years, then he could get by with a lower ground force acceleration, I suppose, for a safe shutdown earthquate under that reasoning, couldn't he?

MR. EARLY: That may well be, and that would be something --

JUDGE MILLER: Isn't that the logic of it? If you can't meet a heavier burden, cut down your time. And then you say, my gosh, so much less probability.

MR. EARLEY: That is right, and that may be a perfectly acceptable approach.

JUDGE MILLER: It might be. Go ahead.

MR. EARLEY: Judge, just to say one thing. The safe shutdown earthquake is not the same for every plant.

JUDGE MILLER: Oh, no. The operating life is assumed to be the same, every one that I have seen, and then it depends on the seismic, the tectonic and all the rest, but the period of time is about the same. You are changing that period of time and saying, my goodness, we get a different result.

MR. EARLEY: That is right. But it is the same principle because there are different probabilities in different areas of the country in getting certain sizes of earthquakes. And the probability has lots of different factors that go into it, and we are just adjusting one of the factors.

The difference between a plant in New York and a plant in California, they have different safe shutdown earthquakes because they are different probabilities of having earthquakes.

JUDGE MILLER: But not on a time basis. There are a series of distinctions, I grant you, between the eastern tectonic provinces in California, but not because of thirty-five or forty year period of time you are looking at.

MR. EARLEY: I think that is true, because everyone expects to operate the plant about the same period of time. If there were significant life histories of plants and people designed twenty year plants, and thirty year plants, and forty year plants, it would be logically consistent to take that into account in establishing the safe shutdown earthquake.

JUDGE MILLER: Then if you have greater risk of earthquakes in California because of the physical nature of things, and the solution there is not to battle through and try to build plants that will withstand whatever the magnitude is, which is admittedly greater, just cut down the time.

Say, okay, let us have a ten year Diablo Canyon, or whatever. Is that the logic?

MR. EARLEY: That is the logic. I am not going to argue whether that would be feasible financially, but the logic is consistent, I think.

JUDGE MILLER: I didn't mean to cut you off in the conclusion, so if you had other points, you may address them.

MR. EARLEY: I think I made all the points I need to make.

JUDGE MILLER: Staff? Now, you heard the arguments, didn't you?

MR. PURLIS: Yes, I did. And I am still somewhat mystified by it. I think I understand it now. But if I understand it, the County's position is that we should be focusing on safety of operation as opposed to the probability of certain events taking place.

JUDGE MILLER: No connection between those two concepts?

MR. PERLIS: I believe that was the County's position, and that is why I am somewhat mystified, because I don't understand how one can focus on safety of operation without also addressing the probability of events taking place.

Especially when one is dealing with comparable safety standard or substantially as safe a standard, which I believe is the one we are dealing with here.

I don't think you can close your eyes to both factors in the equation; safety of operation depends upon the probability of events. I don't think you can separate the two, and I believe the County is attempting to separate the two and to say that we are only concerned with one, safety of operation, and not concerned with probability of events.

I believe that is what their Motion is predicated upon, and I disagree with the position.

JUDGE MILLER: Okay. Do you have anything further?

MR. REIS: Further, Your Honor, it -- relative to words, 'as safe as,' as we started out it is a comparable standard, and it is looking at all systems and all things in the plant. And in order to look at, 'as safe as,' you have to consider the whole scope of what is there, particularly in the alternate power systems, and put it into perspective.

And, therefore, the likelihood of soil liquefaction occurring at a rate of one-tenth of the probability of a .2 G earthquake, or the SSE earthquake over the life of the plant becomes material, because as safe as is not looking at a narrow thing, but a broad picture, and in order to get that broad picture you have to look at this.

JUDGE MILLER: Wait a minute. Spell it out for me a little bit. The broad picture in terms of its nexus with, 'as safe as,' that kind of slipped past me a little.

MR. REIS: As safe as, is giving the public as safe as --

JUDGE MILLER: I am trying to find out the concept, you see, rather than just the terminology. I am trying to get beyond terminology. That is why you say look at the broad picture. Okay, I am going to look at the broad picture, but I want to know what the connection between the broad picture is and the, 'as safe as' concept that has become to be known as the Shoreham concept, I guess.

MR. REIS : Okay. As safe as can only be looked at in terms of -- again, the likelihood of something happening and happening to the public at large.

JUDGE MILLER: Now, where do we get that concept of probability, I guess, is what you are getting at, isn't it? Aren't you looking at probability now when you say that?

MR. REIS: I am not looking at probabilities in the sense of a probabalistic risk assessment, but I am looking at --

JUDGE MILLER: The odds. The racetrack.

MR. REIS: And if we are talking of something happening, for instance, 'as safe as,' we could consider something as safe as if something is likely to happen thirty-five times in a trillion years, or thirty-six times in a trillion years, there might not be any difference in the concept, 'as safé as.'

JUDGE MILLER : Now give me a little narrower concept here.

MR. REIS: I don't know whether I can narrow it, but I think we have to take these things back --

JUDGE MILLER: I can't comprehend trillion years, and a difference of one hundredth of one percent or whatever it is. Let's get it down to something in proportion to what --

MR. REIS: Okay. If I say whether it is one times ten to the minus seven, or one point one times ten to the minus seven, they may be both as safe as, and one may be as safe as the other, because of --

JUDGE MILLER: What is the odds, by the way, one to the minus --

MR. REIS: It is one out of -- I am trying to think -- one out of a million, or one out of ten million.

JUDGE MILLER: One chance in ten million.

MR. REIS: One chance in ten million.

JUDGE MILLER: You wouldn't go to a race track with odds like that, would you?

MR. REIS: No, no, no.

JUDGE MILLER: Of course not.

MR. REIS: But that is the odds the Commission deals with, and whether it is one to the minus six, or minus seven, and that is what we are talking about.

And we talk about, 'as safe as.' What we say, and you have to look at it in context in order to know whether these things are as safe as. Now, we can talk theoretically. There is a difference between one point one and one times ten to the minus seven.

There is -- you know -- but does that mean that one is not as safe as the other in the context of this order?

JUDGE MILLER: I would be willing to say it is a safe edge. You get your odds that astronomical, I would go with you. But I am looking at things that are a heck of a lot shorter than that. Both in the periods of time, and in the probabilities, and in the odds.

MR. REIS: I am not quite -- well, I don't know what the likelihood is --

JUDGE MILLER: Look at page 35.

MR. REIS: I am looking at page 35, and I look at the probability of a .2 G earthquake.

JUDGE MILLER: Look at the last sentence. This turns out to be less than one-tenth of the probability of a 0.2 G earthquake occurring in forty years.

Now, what does that mean to you?

MR. REIS: The likelihood of the SSE earthquake, and I am trying to remember the basis upon which an SSE earthquake is likely to occur, and if I go to the definition in Part 100, Appendix A to Part 100 of our regulation, as to an SSE earthquake, it means is that earthquake which is based on evaluation of the maximum earthquake potential considering the regional and local geological and seismological characters -- in other words, anything that could possibly happen there, and what they are saying is -- and I think it is relevant to see as safe as, to compare what is the likelihood of the 1.3 earthquake -- 1.3 G --

JUDGE MILLER: .13.

MR. REIS: .13 rather, earthquake, to that earthquake. And I think that is material. Further someplace, and I wish I was a little more acquainted with this, they define how to -- determination of the earthquake and again --

JUDGE MILLER: Not very fascinating reading, is it?

(Laughter)

MR. REIS: No, it is not.

JUDGE MILLER: You don't take it to bed with you, I bet. We are going to take a recess if you are substantially through.

MR. REIS: Yes, I am.

MR. EARLEY: Judge Miller, if it would help the Board, Dr. Christian can tell you what the probability numbers are he used, if you would like me to ask him.

JUDGE MILLER: Yes, please do.

BY MR. EARLEY: (Continuing)

Q Dr. Christian, in your calculation that concluded that the probability of the .13 earthquake for one year was one-tenth the probability of the .2 G earthquake, could you explain to the Board what the actual probabilities you were using were?

A (Witness Christian) First, let me say that the termination of the safe shutdown earthquake, according to 10 CFR Part 100, Appendix A, does not include probabalistic calculations.

What we actually did was to take a report which had been prepared by others, where the probabilities had been calculated for ten different assumptions. The way one does these calculations is that one makes a number of assumptions about tectonic models and tectonic provinces and so forth, and there are large methodologies evolved over the last several years, and these probabilities have quite a range of values that you get, depending on the assumptions.

In fact, in the particular case here, if you look at the maximum and the minimum probabilities that are -- absolute probabilities that are calculated for the .2 G earthquake, they are in the radio of sixteen.

So there something like close to, in the order of magnitude and a half there between the lowest calculated probability for the .2 G earthquake and the highest calculated probability.

In my written testimony I make the point that for this reason one should not rely too heavily on the absolute values of those probabilities.

Another reason is that intelligent, well meaning, honest people making these calculations will come out with different numbers, and so they really cannot be relied on very greatly.

What can be relied on is the relative probability between the .2 G earthquake and the .13 G earthquake, or the .1 G or any other earthquake.

Another way of putting it is the slopes of these lines tend to be fairly well defined, but their position on the page is not very well defined.

With that as a preference -- as a preface, let me look at the numbers. In the report that I have, the probabilities for .2 G earthquake range from a low of .18 times ten to the minus four -- these are annual probabilities, to a high of .29 times ten to the minus three.

Now, those do not all have the same credibility, and the way one uses these numbers is that one assigns believability to them based on the knowledge of the seismologist and how much one believes in him and that sort of thing.

But that is the range of numbers that one would obtain for that -- that have been obtained for that. Not by us, I should emphasize.

JUDGE MILLER: Yes. And you took those givens in a sense in making your own analysis, then.

WITNESS CHRISTIAN: That is correct, sir.

JUDGE MILLER: What is the significance of looking at a much shorter period of time in which a low power operation could conceivably occur, and relating that to your overall theory of probabilities in this sense?

WITNESS CHRISTIAN: I really don't feel comfortable speaking about the operation of the plants, since that is not an area that I am expert in.

JUDGE MILLER: Five percent of low power -- operation at not more than five percent low power for a limited period of time. I understand that to be part of the argument that is being made here.

WITNESS CHRISTIAN: Well, the -- whatever the calculated probability of having a .2 G earthquake occur during any one year, the probability of seeing that earthquake any time during the forty year life of the plant is approximately forty times that. Not exactly. It is an exponential function, and you have to do some things to it. But approximately forty times.

That is the probability. The hazard --

JUDGE MILLER: Forty, or whatever given period.

WITNESS CHRISTIAN: We use forty years -- whatever the period the plant is going to be in existence, that is what the plant has got to be prepared to resist, and that convolved with whatever the fragility of the plant is, is the hazard to which the public is exposed.

JUDGE MILLER: Well, what if twenty years has passed uneventfully. What does that do to the probability of the remaining twenty?

WITNESS CHRISTIAN: Well, you know, there is -- the way these calculations are done, it is assumed that they are poisson distributed, which means that they, in fact, do not have a history, and that means that, therefore, if you have gone for twenty years without the earthquake, the clock has yet to start, and the next twenty years are the same as the first.

So, you have shortened the time. However, there are arguments on the other side of that. One argument is that, look, earthquakes are caused by physical processes, and clearly whatever the physical process is , is run for another twenty years.

And secondly, the plant is twenty years old, and presumably something has happened to the fragility of components. That might enter into your calculations as well.

JUDGE MILLER: All right.

WITNESS CHRISTIAN: Now, the other side of that is that we are talking now about operating this plant at five percent of power for some short time. We assumed a year. I think it is actually supposed to be less, but for the purpose of calculations we assumed a year.

Now, if we really want to talk about comparable hazards, you ought to compare the hazard of living through that one year period with -- which you know is not going to last more than a year, with the hazard you are already prepared to meet of living through the forty year period, and protect yourself against a somewhat larger hazard.

I guess it is comparable to the sort of thing you might do when you are buying life insurance for the long haul versus the short haul.

JUDGE MILLER: Well, the insurance company would give up at age eighty or ninety.

WITNESS CHRISTIAN: Yeah, I know.

JUDGE MILLER: What is your give up point?

WITNESS CHRISTIAN: So, what we were looking at -- these risks, -- these hazards, excuse me. Risks means something a little different. Now,these hazards have to be taken in perspective. You have to look at what is a hazard during the time that the plant is going to be operating at five percent power, with the EMD diesels, versus what is the hazard if the plant is going to be operating over the life of the plant, which we take to be forty years, with a much more fully qualified set, and that was the reason for the calculations.

JUDGE MILLER: We need another set of numbers. 0.13.

WITNESS CHRISTIAN: Okay. I can tell you -- what I did was look at all the curves, and I gave you the range of those curves. It turns out that the probability of seeing the .13 G earthquake during one year -- excuse me. Let me back off a minute on that. Let me state that another way.

If you -- for every one of the ten curves that are available to us, if we take the forty year probability of observing a .2 G earthquake, then we take one-tenth of that, go back into the curves, and figure out what the acceleration level would be that would have an annual probability of one-tenth the probability of seeing the .2 G in forty years.

That number turns out to be something slightly less than .13 G. I can dig it out of my notes.

JUDGE MILLER: That is close enough.

WITNESS CHRISTMAN: And I should also point out that the coefficient of variation of that number is .1. It is very, very tightly bound by the statistics.

XXXX INDEX

BOARD EXAMINATION

BY JUDGE BRIGHT:

Q I am afraid I didn't understand -- I understood very little of what you were saying there. You compared the probability of a .2 G occurrance, and I would like to find out what probability, on an annual basis is, of a .13 on the same basis as we got the .2?

A (Witness Christian) Okay. The number varies a little bit from curve to curve, but the number -- the annual probability of seeing the .13 G earthquake is very close to one-tenth of the forty year probability of seeing the .2 G earthquake which means it is -- I have to do this in my head. It is about two and a half times the annual probability of seeing the .2 G earthquake.

JUDGE BRIGHT: About two and a half times? Thank you.

End 15.
Mary fols.

Sim 16-1

(Pause.)

WITNESS CHRISTIAN: I am sorry. Sir, I am wrong on that. It is about four times.

JUDGE MILLER: Four times.

(Board conferring.)

JUDGE MILLER: We will take a 15-minute recess.

(Recess.)

JUDGE MILLER: All right. Let's have your motion stated for the record and a very short statement of the basis for it.

MS. LETSCHE: Let me find it again here.

JUDGE MILLER: What do you mean, that you wrote it down?

MS. LETSCHE: No. I was just finding the page number of the testimony.

The County moves to strike the testimony which is the answer to Question 49 on pages 35 and 36 of the testimony of Messrs. Meligi, Christian and Wiesel on the basis that ---

JUDGE MILLER: How far down?

MS. LETSCHE: Well, it is the entire answer. It is all of page 35 and down to Question 50 on page 36.

In addition, and I should have noted this earlier, but the next to the last paragraph on page 37, which is the conclusion and restates the discussion in Answer

Sim 16-2

49 ---

JUDGE MILLER: Now wait a minute. What are you modifying here?

MS. LETSCHE: Yes. I am modifying it by adding the paragraph on page 37, the next to the last paragraph which is the summary of conclusions statement that summarizes the answer that I am moving to strike.

JUDGE MILLER: Which portion of it?

MS. LETSCHE: The paragraph that begins "The probability of an earthquake," and ends with "during the 40-year life of the plant" on page 37, as well as the oral summary which Dr. Christian made during the direct testimony.

And the basis for the County's motion is that this testimony does not address the comparison mandated by the Commission's order because it does not compare operation at five percent power with the alternate AC power system to operation at five percent power with a qualified power source, and the additional ground that ---

JUDGE MILLER: Is that comparing the five percent power source with and without qualified diesels?

MS. LETSCHE: That is correct.

JUDGE MILLER: Five percent for one-year periods, are you putting that factor in or not?

MS. LETSCHE: Well, that would be, if you were talking about five percent operation ---

Sim 16-3

JUDGE MILLER: Compared to what?

MS. LETSCHE: Compared with five percent operation during any given period of time that would be an appropriate comparison.

Dr. Christian defines the time period for low-power operation, five percent operation as a relatively short period and he, for purposes of his calculation, uses a year.

JUDGE MILLER: For purposes of your motion what are you using?

MS. LETSCHE: My motion, Judge Miller, goes to Dr. Christian's testimony, and the basis for my motion is that his testimony compares five percent operation, that is the probability of an earthquake during a one-year period, which he assumes to be the time period for five percent operation, with the probability of an earthquake over a 40-year period, which is full-power operation of the ---

JUDGE MILLER: Pardon me. The extent of power, five percent or a hundred percent for those two different time periods is totally immaterial under your theory.

MS. LETSCHE: Say that again.

JUDGE MILLER: The question of five percent or thereabouts power, on the one hand, compared with a hundred percent operation, on the other hand, for the periods of one year versus forty years, the extent of power

Sim 16-4

of five percent or a hundred percent is wholly immaterial, is it not?

MS. LETSCHE: The basis of my motion is that what is being compared here are apples and oranges.

JUDGE MILLER: Well, I am trying to get apples to apples and oranges to oranges. Now what about the five percent and the hundred percent? Are they not immaterial and, hence, can't we throw those factors out or not?

MS. LETSCHE: Well, I am not sure I understand your question, which is why I am hesitating to answer it.

JUDGE MILLER: Well, my question is looking at apples and apples and oranges and oranges, they have got different kinds of skins and different kinds of color and you keep saying five percent and a hundred percent and so forth.

I am trying to say the factors that you say in your motion should not be compared.

MS. LETSCHE: All right ---

JUDGE MILLER: Now I have started off because I notice each time you say the five percent and then you wander off to whether it is a year or more, and I don't care, five percent versus a hundred percent for forty years.

Now I suggest to you that your logic, if I am understanding your correctly, is that it doesn't matter what percent of power; isn't that correct?

Sim 16-5

MS. LETSCHE: I think you are right. My argument is that what is being compared here is a probability for a one-year period with a probability for a forty-year period.

JUDGE MILLER: Now so far we are in agreement. Don't rock the boat. Actually the basis of your objection is the attempt to compare the probability of a seismic event occurring over a 40-year period versus a seismic event occurring over a one-year or less period. Now isn't that correct?

MS. LETSCHE: Yes, that is part of the basis for my motion.

JUDGE MILLER: Well, isn't that the major basis? Isn't that your total basis?

MS. LETSCHE: No, it is not the total basis. That is part of it.

JUDGE MILLER: If you want to hazard it, go head. Now tell me more.

MS. LETSCHE: Well, I stated a couple of grounds each time I have stated my motion.

JUDGE MILLER: Now we want apples to apples now. Go ahead.

MS. LETSCHE: Well, the one comparison that you just mentioned, the 40-year versus the one-year is an improper comparison.

Sim 16-6

JUDGE MILLER: Well, I got it from you.

MS. LETSCHE: That is right, but we just agreed that we were talking about the same thing.

JUDGE MILLER: Okay, good.

MS. LETSCHE: That comparison is an improper comparison and is not relevant and is not a comparison that is mandated by the Commission's order.

JUDGE MILLER: Okay. That portion that says as safe as and so forth you are referring to, that comparison that the Commission ---

MS. LETSCHE: The portion that I read into the record before, that is right.

JUDGE MILLER: All right. Go ahead.

MS. LETSCHE: The additional ground of the motion is that a discussion of probabilities of the occurrence of an earthquake in a vacuum without the discussion of the hazard, that is the impact of the occurrence of that probability on the plant's systems ---

JUDGE MILLER: Pardon me. That is consequences though. If I understood you now, your motion is based upon the illogical comparison on a probabilistic basis. Now if you start going into consequences, you are injecting other matters. Now do you want to do that?

MS. LETSCHE: I am not talking about consequences I don't believe in the sense that you are using the term, Judge Miller. I am stating what I believe I have stated two or three times before, which is the discussion of a probability, just a probability in a vacuum without the discussion of the hazard, which I heard Dr. Christian define as the probability of the earthquake times the fragility of the plant, that without a disucssion of the hazard, the discussion is not pertinent.

JUDGE MILLER: Pardon me. The fragility of the plant would have absolutely nothing to do with the probability or a comparison of probabilities of a seismic event in one year or forty years.

MS. LETSCHE: That is correct, and a discussion of the probability without linking it to the hazard, that is the probability times the fragility of the plant is irrelevant because the discussion of the probability in that kind of vacuum is not probative or material of anything that is addressed in the Commission's order.

It doesn't go to the relative safety of the plant's operation. To deal with that you have to look at the hazard which goes beyond the mere probability.

JUDGE MILLER: No. You have to look at the probability of the occurrence of a seismic event as postulated, don't you?

MS. LETSCHE: The impact of that probability upon the plant and not just the probability in a vacuum.

JUDGE MILLER: When we are looking at probabilities, we are only looking at probabilities.

MS. LETSCHE: My point and the basis of the motion, Judge Miller, is that looking at the probability without looking beyond that at the impact of that probability on the plant is not relevant.

JUDGE MILLER: I see. Well, then are you willing to have the results of looking at the probability of a seismic occurrence on a one-year or less period of time versus the probability of a seismic occurrence over a 40-year period of time to be qualified in some fashion by the fragility of the plant or these other things that you have been mentioning?

MS. LETSCHE: I don't think a comparison of one year versus 40 years is relevant period. That is No. 1.

No. 2, any discussion of probabilities, assuming you are talking about apples and apples, in order to be relevant to this proceeding has to also include the impact of those probabilities upon the operation of the plant's systems.

JUDGE MILLER: So that if you look then at No. 2, the impact of the probability of occurrence of a seismic event, then it would be proper to look at the qualities and the characteristics of the system, if I understand you,

Sim 16-9

fragility or whatever else.

MS. LETSCHE: Of the two systems.

JUDGE MILLER: Yes, of the two systems in comparing.

MS. LETSCHE: That is correct. That would be a meaningful comparison.

JUDGE MILLER: I see. So you would look then at two things to determine whether or not it is a meaningful, logical and admissible in an evidentiary sense comparison?

MS. LETSCHE: Yes.

JUDGE MILLER: Am I understanding you?

MS. LETSCHE: Yes. The absence of either one of those conditions is ground to strike this testimony and neither condition is present with respect to this testimony.

(Board conferring.)

JUDGE MILLER: The motion is granted.

INDEX

CROSS-EXAMINATION

BY MS. LETSCHE:

Q Mr. Meligi, I would like to direct your attention to page 13 of your testimony, please.

(Pause.)

Have you got that?

A (Witness Meligi) Yes.

Q Now the answer that is on that page is the answer to Question 23 in which you are discussing the

Sim 16-10

difference between seismic survivability and seismic qualification; is that right?

A Yes.

Q And you have a statement in roughly about a third of the way down page 13 which says "Verifying the seismic survivability is usually a backfit effort for an already installed piece of equipment," and then you go on to describe the use of engineering judgment and other information obtained from documents and walk-downs and communications; is that right?

A Yes.

Q Would you agree that this description of verifying seismic survivability is a fair description of what the Sargent and Lundy study was that was done for LILCO that you testified about here?

A Yes.

Q I would like to direct your attention to page 20 of your testimony, please, in particular the answer to Question 31.

Now you are describing in this answer the approach that you used or that Sargent and Lundy used to evaluate the LMD engines, right?

A Yes.

Q And the first thing you talk about is the test portion of that evaluation. Do you know, Mr. Meligi,

Sim 16-11

when the EMDs at Shoreham were manufactured?

A The date of manufacturing?

Q Yes.

A No.

Q Do you know when they were installed in their first home?

A No.

Q Do you know whether or not the testing that you are referencing and discussing on pages 20 and 21, the Navy tests, were performed before or after the manufacture of the EMDs at Shoreham?

A No, I can't exactly compare dates.

Q The testing that you discuss on these pages, this Navy test I will refer to it as, do you know whether or not the engines that were the subject of that test had been subjected to aging before they were subjected to the shock testing?

A The purpose of the testimony is to discuss the seismic qualification of the diesel engines. When you talk about the aging, you are talking about the environmental qualification and you are introducing a new parameter in the qualifications which have not the basis for the seismic qualification of that specific piece.

Q I understand that, Mr. Meligi. Could you answer my question, do you know whether or not the engines that

Sim 16-12

were the subject of the shock testing you discuss had been subjected to aging before that shock testing?

A We have already established for previous work that the aging is not significant for the purpose of the seismic qualification.

JUDGE MILLER: You were asked a rather more direct question of did you or did you not. I think you can answer that.

WITNESS MELIGI: What age?

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Sue fols

#17-1-SueT

BY MS. LETSCHE: (Continuing)

Q Do you know whether those engines that were the subject of that test were subject to any aging prior to --

A What aging?

Q Any aging? Do you understand the meaning of the term aging?

A Aging is a very complicated --

JUDGE MILLER: A simple fact. Were they or were they not as far as you know subject to some aging? Yes or no.

WITNESS MELIGI: Because without some sort of aging --

JUDGE MILLER: No. Answer directly. You were asked whether or not you knew that they were the subject of some aging. Now, you can say yes, you can say no, I don't know.

WITNESS MELIGI: Vibration aging was included.

COURT REPORTER: Excuse me?

WITNESS MELIGI: Vibration --

JUDGE MILLER: Vibration aging was included.

BY MS. LETSCHE: (Continuing)

Q Do you know, Mr. Meligi, the date of manufacture of the engines that were the subject of these Navy tests?

A No. All I know that we have it checked and they are very similar to the ones installed in Shoreham.

#17-2-SueT

JUDGE MILLER: The latter part of the answer will be striken. Now you were asked a direct question. You are starting to qualify your answers. You are not an advocate. You are not trying to prove anything.

You are an expert, and just answer the questions directly.

WITNESS MELIGI: No, I don't know the date.

JUDGE MILLER: Okay.

BY MS. LETSCHE: (Continuing)

Q And am I correct, Mr. Meligi, that these Navy shock tests only covered the engine block and its internals, it didn't cover any of the auxiliary equipment affiliated with the EMDs; is that right?

A That's correct.

Q Now, on Page 22 of your testimony, you talk about an analysis performed by General Motors for EMD diesels. Do you know when that GM, General Motors, analysis was performed?

A Yes. That was in a report to which has been submitted previously to Sargeant and Lundy.

Q Do you know when the analysis was performed by General Motors?

A A few years ago, in the middle 70s or the late 70s.

Q Do you know when the components that were the

#17-3-SueT

subject of that analysis were manufactured?

A No. We have all this data for the other plants. But I don't recall it off memory.

Q I would like to direct your attention, gentlemen, to Page 27 of your testimony. This will go to Dr. Christian or Mr. Wiesel, whoever can best answer it.

There is a statement in the answer to Question 39 which says LILCO asked Stone and Webster to perform an analysis of any aspects of the seismic capabilities of the machines not covered by Sargent & Lundy that might be pertinent to their ability to operate under seismic conditions.

Was the determination of what capabilities might be pertinent to the ability to operate under seismic conditions determined by Stone and Webster or by LILCO?

A (Witness Wiesel) It was determined by LILCO. The request was quite direct.

Q Did Stone and Webster or did -- let me rephrase that.

Do you know what criteria LILCO used to make that determination? Do you know that?

A Offhand, I don't.

Q Dr. Christian, do you know?

A (Witness Christian) No, I don't.

(Witness Wiesel) If I can just add one thing.

#17-4-SueT

Q Well, maybe your counsel can ask you on redirect if you have something else you would like to add.

I think you have answered my question for me.

MR. EARLEY: Judge Miller, if I may make one point. I will be perfectly willing to do it on redirect. Counsel is asking questions in areas that are complicated areas, and it may be more efficient to permit the witnesses to explain answers. Sometimes it is difficult to answer questions in a yes or no fashion.

JUDGE MILLER: The questions I was referring to were capable of yes or no, I don't know. Now, it's true that all such answers are not always capable of being given. That is true.

However, we don't want to start with a windup and an explanation. Now, if it becomes apparent that some explanation is indicated that would be helpful, we would allow it. But we would allow it for a particular reason.

Now, we will just have to take these things as the particular subjects come up. Now, what was your question?

MS. LETSCHE: My question was, did he know how LILCO had made the determination, and his answer was no.

JUDGE MILLER: Well, that seems like a perfectly straightforward question and answer. You can pick that up

#17-5-SueT

in redirect. Go ahead.

MS. LETSCHE: (Continuing)

Q Mr. Wiesel, on Page 29 of your testimony you state that your analysis determined that the resisting force exceeds the sliding force with an adequate safety factor to ensure that sliding of the EMD diesels would not occur during an SSE.

Can you tell me what the adequate safety factor is that you are referring to there?

A I can give you the exact number.

Q Okay.

A (The witness is going through documents.)

The sliding factor of safety is 1.38. This exceeds the factor of safety as designated in the FSAR, the minimum factor safety as designated in the FSAR of 1.1.

JUDGE MILLER: What was this, now? The 1.1 is what, sir?

WITNESS WIESEL: The 1.1 is the minimum factor of safety for sliding as designated in the FSAR.

JUDGE MILLER: Okay.

BY MS. LETSCHE: (Continuing)

Q Mr. Wiesel, would you turn to Page 30 of your testimony, please?

A (Witness complying.)

Q In the answer to Question 42, you are discussing

#17-6-SueT

your analysis of the switchgear mounting, in particular the sliding and overturning potential of that piece of equipment. And you state that your analysis indicates that adequate factor of safety exists to prevent sliding or overturning for a minimum ground input oı 0.13 G.

Am I correct, sir, that you cannot say with the same degree of confidence that an adequate factor of safety exists to prevent sliding or overturning for a ground input of .2 G?

A That's a correct statement.

Q Now, Mr. Wiesel, in the answer to Question 43, which talks about the diesel fuel oil line analysis, you talk about a Stone and Webster engineer who performed a walkdown.

I take it that was not you; is that right?

A That's correct.

Q And I guess it wasn't you either, Dr. Christian?

A (Witness Christian) No.

Q Why didn't you do that?

A (Witness Wiesel) I'm not qualified in the area of piping analysis.

Q Well, I take it then that you also aren't able to, ‿r qualified to, explain the basis for the engineer's judgment that is discussed in this testimony based on that piping review?

#17-7-SueT

A That's correct. I'm not qualified to reiterate the basis for his judgment. That's correct.

Q Is the basis for your testimony here in the answer to Question 43 a report or some sort of conversation or discussion that you had with this engineer with piping experience?

A The basis for the testimony is that the request to have the piping evaluated came through myself directly from LILCO. And it was my responsibility to obtain the response to that.

I personally organized the piping engineers, stress engineers, to go down to the site and take a look at the configuration. And it was a personal report back to myself from these individuals that is expounded here in the testimony.

Q Now, you state in the next answer to Question 44 that if LILCO's exemption request is approved so that LIL^ would bury the fuel line that Stone and Webster would then review that modification.

Is that a review that you would perform?

A This is a review that our engineering mechanics division would perform, which is the division that the stress analysts, stress engineers, are assigned to.

Q That's not you?

A That's not -- personally, it would not be myself.

#17-8-SueT

That's correct.

Q Okay. I take it then that you cannot testify as to the criteria that those engineers would use in deciding whether that modification ensured appropriate seismic capability?

A I could not testify directly to their criteria, the direct criteria they would apply to the analysis. I could testify though that the criteria that they would apply would ensure the proper level of seismic qualification.

Q Now, this review that you believe is going to ensure appropriate seismic capability is something that will only happen after the modification is done, right?

A That's not correct. The appropriate way to do it would be just in reverse. It would be to design a piping arrangement and layout such that your mathematical models would result in acceptable stress levels to meet the committed code requirements, and then to make the installation based on that analysis.

Q But doesn't your testimony say that Stone and Webster is going to review the modifi tion which is -- presumably you are not going to revie t until they have made it; is that right?

A That's not correct.

Q Okay. You are going to review some sort of a

#17-9-SueT

design when they come up with the design; is that what you are saying?

A Either LILCO would come up with a design or we would pose it or a modification to the existing installation.

Q Okay. LILCO has not yet come up with a design; is that right?

A To the best of my knowledge, that's correct.

Q And Stone and Webster has not yet proposed a modification or a design; is that right?

A That's correct.

Q And to the best of your knowledge, that sort of proposal, whether by LILCO or by Stone and Webster, is not going to be made unless or until LILCO's exemption request is approved; is that right?

A This is correct.

MS. LETSCHE: Judge Miller, I move to strike the answer to Question 44 on Page 31 on the basis that again this is a nonspecific, nonexistent, non-defined modification being discussed here. This witness is not able to identify what the modification is, or what criteria would be used to review its adequacy, because he is not even the one who is going to be doing the review whenever the proposal or the design might be made.

And as a result, this answer is not probative or relevant and should be striken.

#17-10-SueT

JUDGE MILLER: Any response?

MR. EARLEY: Judge, LILCO objects to the motion. First of all, the witness indicated he is the direct contact at Stone and Webster for the work involving the seismic analysis for this particular installation.

As with any project on a nuclear power plant, there may be other individuals actually doing the work, but it is Mr. Wiesel's responsibility to make sure that that work does in fact get done. I think if the witness is permitted to testify further, he will indicate that burying of piping is a routine way of enhancing the seismic capabilities and that Stone and Webster does that routinely. That is not an abnormal installation of any sort. So, he can testify to that.

Further, he has testified LILCO has indicated to him they have made the commitment to go ahead and do that. So, I think it is pertinent and probative and indicates LILCO's intent to seismically qualify that particular line.

And counsel for the County in cross-examination hasn't asked whether it's a routine matter, but if you permit me to ask the question I can establish that this is not a unique --

JUDGE MILLER: No. We are taking the direct testimony as it comes. Are you through?

MR. EARLY: Yes, sir.

#17-11-SueT1

JUDGE MILLER: Staff.

MR. PERLIS: The Staff also opposes the motion.

JUDGE MILLER: The Staff does what?

MR. PERLIS: Opposes the motion to strike. I think one has to look at the question that was asked, and that was whether LILCO has implemented a recommendation from Stone and Webster.

The answer is: Yes, they have. And this witness would, I believe, be competent to testify that --

JUDGE MILLER: I thought that the answer was no.

MR. PERLIS: No, I believe --

JUDGE MILLER: They haven't implemented that recommendation, have they?

MR. PERLIS: I believe the answer is LILCO has decided to accept the recommendation and will bury the fuel line.

JUDGE MILLER: Isn't that we promise, we are going to and all the rest of it, and the Easter Bunny?

The question is has. Isn't the answer clearly no, according to the Staff's information?

MR. PERLIS: The answer is no, they have not yet and --

JUDGE MILLER: Well, why didn't they just say no?

MR. PERLIS: The answer is more than that.

JUDGE MILLER: The motion is sustained. The answer

#17-12-SueT

and the question will be striken.

JUDGE MILLER: Mr. Wiesel, who prepared this particular line of testimony? Do you recall?

WITNESS WIESEL: I prepared it personally, sir.

JUDGE MILLER: Did you have it reviewed by any attorney?

WITNESS WIESEL: Yes, I did.

JUDGE MILLER: Who?

WITNESS WIESEL: Mr. Earley.

JUDGE MILLER: Thank you. Proceed.

We are waiting for the next question, counsel.

BY MS. LETSCHE: (Continuing)

Q Dr. Christian, on Page 33 of your testimony, you are discussing the borings that were done in your soil analysis, and you mention at the very -- in the last line, four borings near the EMD diesels.

How close to the EMDs were those borings, or how close was the closest, let's say?

A (Witness Chritian) The closest was right under them.

Q Right underneath them?

A Yes.

MS. LETSCHE: That's all the questions I have.

JUDGE MILLER: Thank you. State.

#17-13-SueT

MR. PALOMINO: No questions.

JUDGE MILLER: Thank you. Staff.

MR. PERLIS: The Staff has a few questions.

CROSS EXAMINATION

BY MR. PERLIS:

Q I would direct these questions to the panel, so any gentleman who believes he could answer please feel free to jump in.

Could any of you gentlemen testify as to how seismically active the Shoreham site is?

A (Witness Christian) I can probably say a few words on that. It's very inactive.

end #17

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Q Could you testify not comparing it to a .2 G earthquake at a hundred percent power but just as to how probable a .13 G earthquake is at the site?

MS. LETSCHE: Judge Miller, I object to this line of questioning. I don't think it is proper cross examination.

JUDGE MILLER: What difference does it make? Does it matter whether the probability is great or small?

MR. PERLIS: I believe it does.

JUDGE MILLER: In what respect? Isn't that the whole theory of relevance?

MR. PERLIS: Yes, because if it can withstand an earthquake of that magnitude, then it automatically follows that it will not fail at earthquakes up to that probability?

JUDGE MILLER: So?

MR. PERLIS: And that gets into when the system will fail because of seismic events, and I believe that that evidence may be relevant.

JUDGE MILLER: I am intersted in your backdoor approach. Where is the issue -- factual issue fairly set forth that we are going to go into the probabilities of earthquake occurrence, since we take as given the OBE and SSE. Isn't that sufficient for the purposes of this inquiry?

MR. PERLIS: I don't believe so. The witness has testified that certain equipment would withstand a seismic event up to .13 G. I think under those circumstances it becomes relevant to know how frequent that occurrence might be.

JUDGE MILLER: How often it can withstand it?

MR. PERLIS: No, how often the event would occur that it can withstand.

JUDGE MILLER: Well, what difference does it make? I understand what you are saying, but I am saying what is the relevance in a legal sense how many times it successfully withstands it.

MR. PERLIS: It is not a question of how many times it would successfully withstand it. It is a question of how often an event would occur that might threaten it, and as an example, if a .13 G earthquake were to occur every hour, that would make a great difference than whether it would occur every one thousand years.

JUDGE MILLER: It would make a difference to all of us, I guess. Standing back and vibrating our tuning fork; here we are.

MR. PERLIS: It would make a difference to the plant as well. And the question is how frequently that would occur. We don't know whether it would occur every hour or every thousand years. This witness can answer that question, I believe. Or should be allowed --

JUDGE MILLER: Are you, Staff, going to put on some testimony along those lines?

MR. PERLIS: No.

JUDGE MILLER: It is so important that you are not going to even call a witness?

MR. PERLIS: No; there is evidence in the record now as to whether equipment will withstand an earthquake of a certain frequency.

What we don't have in the record is that frequency.

JUDGE MILLER: Oh, I see. You want to put in the fact that there is evidence that will stand the .13 G down force acceleration really might not be sufficient to go ahead and license this particular plant because if it happened frequently, it might have a different result.

MR. PERLIS: I believe to make the record clear that is correct.

JUDGE MILLER: Go ahead. Cross examine.

MS. LETSCHE: Excuse me. Is my objection overruled.

JUDGE MILLER: I don't know. It is sort of in limbo at the moment. I am curious to see his cross examination on this. I guess it is overruled at the moment.

MR. PERLIS: Thank you. I will repeat the question.

BY MR. PERLIS : (Continuing)

Q Could you please explain how frequent an earthquake of .13 G ground acceleration at Shoreham would be likely to occur.

MS. LETSCHE: I just want to reiterate my objection. I am not sure if that was the same question. I want to preserve it for the record. I object to the relevancy of that question.

JUDGE MILLER: And what is the basis of your relevancy objection to that question? That is a little different.

MS. LETSCHE: Well, I am not sure if it is different, but the basis is the same, because when we have here a safe shutdown earthquake defined of .2 G for this plant, the probability of the occurrance of an earthquake of .13 G is not relevant.

JUDGE MILLER: Well, then, why did you not make motions to strike all these references to .13 G when you carefully went through and made your Motions to Strike?

MS. LETSCHE: No. Judge Miller, I am not saying it is not relevant for these witnesses --

JUDGE MILLER: Well, then, I misunderstood you.

MS. LETSCHE: I am not saying that it is not relevant for these witnesses to state, as they have in their testimony, that according to their analysis certain equipment will survive a .13 G earthquake. That is perfectly relevant and proper testimony.

My point is that when there is a defined safe shutdown earthquake for this plant of .2 G, the probability of an earthquake occurring at a ground acceleration less than that simply is not relevant.

JUDGE MILLER: That can be as relevant in one case or the other. We will overrule the objection. We will let the witness answer.

MR. CHRISTAIN: Excuse me. Could you repeat the question?

MR. PERLIS: I didn't mean the difference between the two questions, so I will try again.

BY MR. PERLIS: (Continuing)

Q Could you please explain how probable th occurrence of a .13 G earthquake at Shoreham would be or an earthquake with that ground motion?

A (Witness Christian) I think I can answer t in two ways. First is that on the basis of the seismic hazard studies that have been done for this plant, the annual probability of occurrence of a .13 G earthquake in the neighborhood of .27 times ten to the minus three. Those numbers may vary a little bit, depending upon which of the assumptions you make.

That is approximately correct.

The second answer is that if you look at the 10 CFR Part 100, Appendix A procedures for determining the design earthquakes for nuclear power plants, this plant was designed for an intensity -- a modified Mercalli intensity seven earthquake. That is in the licensing document.

Because of the shape of the spectrum, the acceleration was raised to .2 G. However, if the procedures which have been standard by the NRC for relating intensities to peak ground acceleration, and then tying them to the Reg Guide 160 spectrum, which is not the procedure that was used here, but if that procedure were followed, you would find an intensity seven earthquake corresponds to .13 G.

JUDGE MILLER: Point one what?

WITNESS CHRISTIAN: Intensity seven earthquake, for which this --

JUDGE MILLER: Yeah, but corresponds to what?

WITNESS CHRISTIAN: .13 G on the Trifunac and Brady curves.

MS. LETSCHE: Judge Miller, I move to strike that answer unless LILCO is presently intending to apply for an exemption or to change the .2 G SSE earthquake, I don't think it is relevant for this witness to be essentially arguing or challenging the regulations concerning safe shutdown earthquakes by saying that a .13 G earthquake is equivalent to a .2 G earthquake, and I move to strike that answer on that basis, and renew my objection to the relevance of the question about the probability of a .13 G earthquake that I made in the first place.

JUDGE MILLER: Overruled. Proceed.

MR. PERLIS: Thank you. I have no further questions.

JUDGE MILLER: Is there anything further before we ask our colleague to ask a few questions?

MR. EARLEY: I have some redirect questions. I can ask them before or after the Board.

JUDGE MILLER: Go right ahead.

XXX INDEX

REDIRECT EXAMINATION

BY MR. EARLEY:

Q Mr. Meligi, in doing your study of the EMD diesels, did you make any determinatiin about whether the EMD machines at Shoreham were comparable to the machines that were subject to the tests described on pages 20 through 22 of your testimony?

A (Witness Meligi) Yes, I did. We have gone through an extensive walk down to inspect the machines. To see the individual components and the devices. We went back to our offices to compare it to the devices and the components which we had in similar machines that have been installed in other utilities.

We have contacted General Motors Electromotive

Division, which manufactured the machines, and we got a clear indication that they -- that the machines at Shoreham are exactly of the same types of the machines we have qualified previously.

Q You were also asked some questions about aging. Is aging pertinent to the seismic analysis of the EMD diesels that you performed?

A There is a great deal of research which has addressed the issue of aging, and whether aging equipment before seismic test is required or not, and there is aging for harsh environment, or mild environment; but the environment of these machines installed is what we qualify as mild environment, and it has been established that -- there is a lot of literature and research that aging for mild environment does not affect the seismic capability of the engines.

Q You indicated that Sargent & Lundy did take steps to ensure the comparability of the engine. Is that information included in your report that is attached to your testimony, and it is Attachment 4 to your testimony?

A In more than one location we went through a device-by-device throughout the whole assembly, and we did not look over a single device, and every one of them is identified and compared to the data bank we have in Sargent & Lundy, and those ones which have not been compared to the ones we have in our data bank has been addressed separately.

Q Mr. Wiesel, you were asked questions about the criteria used by LILCO when they asked Stone & Webster to perform certain seismic analyses.

In your professional opinion, is the scope of work performed by Stone & Webster an adequate scope of work to determine the seismic capabilities of those machines, coupled with the Sargent & Lundy work?

A (Witness Wiesel) Yes, the scope of work that was performed by Stone & Webster results in a complete evaluation of the installations. The work that we performed in addition to the Sargent & Lundy efforts constitutes a complete evaluation.

MR. EARLEY: We have no further questions, Judge.

JUDGE MILLER: Anything further?

(Note: No response.)

JUDGE MILLER: Judge Bright?

XXX INDEX

BOARD EXAMINATION

BY JUDGE BRIGHT:

Q I guess for Dr. Christian. I thought I had a pretty good education on this seismic stuff from Dr. Sede and Bolt and a few others, but it turns out that all we talked about were rocks.

I wonder if I could get you to very briefly describe the liquification process and the results? What happens? So it liquifies.

A (Witness Christian) Well, first, let me say that there has been for the last twenty years a large argument in the geo-technical research community over the precise definition of some of these terms, so you may get slightly different stories from different people.

In a nutshell, what happens is that when granular soils, sands in particular, clean sands, are shaken by an earthquake, the pressure in the pour fluids, usually water, increase as a result of the cycle straining, and these pressures can build up over the course of a large earthquake to the point where one or more of several things can happen.

Perhaps the most catastrophic thing that can happen is that the pour pressures can become so large that there is no longer any effective stress as it is called in the geo-technical community, which means there is essentially no longer any contact stress between the particles.

And then the material is literally a very dense liquid, and this can cause all sorts of motions. Foundations resting on such material could settle.

Large amounts, they could overturn. Another thing that can happen and is quite commonly observed in large earthquakes, is that these excess pressures have to go some place after they have built up, and so for quite a period after the earthquake has occurred, maybe as much as half an hour later, you can get water running out of the ground.

This often is given the term, 'sand boils,' because the water comes up to the surface, carrying with it particles of sand and silt and it looks a little bit like a geyser. It spews up, and of course then the sand falls out and you get something that looks like a cone, like a volcano, on the surface of the sand.

I think that pretty well sums up the phenomenon.

Q So, you are saying that the effects we are talking about here, liquefaction, could mean the thing -- the diesels could sink, or they could be skewed in some dimension or other?

A Yes, I think that is true. It is very difficult to predict exactly what is going to happen. You could have something as minor as a few sand boils, or you could have something that involved much more motion.

It is very hard to predict exactly what would happen, or for that matter, even that liquefaction would occur.

JUDGE BRIGHT: Thank you.

JUDGE MILLER: I think that concludes, then, the questions that the Board has. And the witnesses, thank you, may step down.

(Panel stands aside.)

JUDGE MILLER: May I inquire now who your next witnesses are?

MR. EARLEY: Judge, before we go to the next witness, I would like to move into evidence the testimony of John T. Christian, Ahmed E. Meligi, and Robert C. Wiesel on behalf of Long Island Lighting Company, subject to the Board's rulings.

JUDGE MILLER: Any objection subject to the disposition made on Mòtions?

MS. LETSCHE: No objection.

JUDGE MILLER: State, or Staff?

MR. PERLIS: No objections.

JUDGE MILLER: Very well. The Motion will be granted. The testimony, subject to the rulings the Board has made in the course of the testimony will be admitted into evidence and will be part of the transcript and continuously numbered.

(Testimony follows.)

LILCO, July 16, 1984

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-4
	)	(Low Power)
(Shoreham Nuclear Power Station, Unit 1)	)	
	)	

TESTIMONY OF JOHN T. CHRISTIAN,
AHMED E. MELIGI AND ROBERT C. WIESEL
ON BEHALF OF LONG ISLAND LIGHTING COMPANY

I. Witness Qualifications

Q.1. Please state your name and business address.

A. (Christian) My name is John T. Christian and my address is Stone & Webster Engineering Corporation, 245 Summer Street, Boston, Massachusetts.

(Meligi) My name is Ahmed E. Meligi and my address is Sargent & Lundy, 55 East Monroe, Chicago, Illinois.

(Wiesel) My name is Robert C. Wiesel and my address is Stone & Webster Engineering Corporation, 245 Summer Street, Boston, Massachusetts.

Q.2. Dr. Christian, what is your position with Stone & Webster?

A. (Christian) I am a senior consulting engineer in Stone & Webster's consulting group.

Q.3. How long have you been in this position?

A. (Christian) Since October 1980.

Q.4. What are your duties and responsibilities as a senior consulting engineer?

A. (Christian) At SWEC a senior consulting engineer provides technical advice, guidance, analysis, and leadership across one or more disciplines. He is not assigned to a particular engineering division and works on a variety of projects and assignments as his services are needed. I serve as such a consultant on problems involving geotechnical engineering, earthquake engineering, numerical modeling, computer applications, seismic hazard studies, and related areas. I provide consulting service to various clients and to projects within SWEC. I also serve on several internal committees and boards dealing with computer matters at Stone & Webster and am involved in development of offshore technology.

Q.5. Prior to your appointment as a senior consulting engineer, what other positions have you held with Stone & Webster?

A. (Christian) I began work with Stone & Webster in June 1973 as a consultant to the Geotechnical Division. In November 1976, I was appointed as a consulting engineer and in October 1980 I was appointed to my present position, Senior Consulting Engineer.

As a consultant in the Geotechnical Division, I provided consulting services within Stone & Webster and to outside clients on matters relating to geotechnical engineering, earthquake engineering, numerical modeling, and computer applications. My responsibilities as a Consulting Engineer were substantially similar to my present ones.

A list of projects in which I have participated and a brief description of those projects is included in my resume which is attached (Attachment 1).

Q.6. What positions did you hold prior to your employment with Stone & Webster?

A. (Christian) From July 1966 through July 1973, I was employed as an assistant professor and associate professor of civil engineering at the Massachusetts

Institute of Technology, Cambridge, Massachusetts. I was responsible for research and teaching, primarily in the areas of geotechnical engineering and computer application. Specific topics included the application of finite elements methods to problems in geotechnical engineering, including consolidation, behavior of braced excavations, stability of slopes, inelastic deformation of soil, earthquake problems, and flow through soils. I also performed research on the behavior of levees on the Atchafalaya River, development of computer-aided slope stability analysis, and earthquake engineering. During my tenure at MIT, I provided consulting services to Stone & Webster Engineering Corporation (July 1969 - July 1973) and T. William Lambe and Associates, Cambridge, Massachusetts (July 1966 - July 1969). This consulting work generally involved field, laboratory, and analytical work on a variety of geotechnical projects, including nuclear power plants, earth dams, foundations, and slope stability analyses.

From September 1963 to July 1966, I earned a Doctor of Philosophy degree in civil engineering from the Massachusetts Institute of Technology as a National Science Foundation graduate fellow. Prior to that time, I had performed work for T. William Lambe and Associates as both an employee and a consultant in the area of geotechnical engineering. I also served as an officer in the United States Air Force. A complete description of my employment history is included in my resume.

Q.7. Dr. Christian, what is your educational background?

A. (Christian) I hold a Doctor of Philosophy, Master of Science and Bachelor of Science in Civil Engineering from the Massachusetts Insti :te of Technology.

Q.8. Do you belong to any professional societies?

A (Christian) Yes. I am a member of a large number of professional societies, including the American Society of Civil Engineers (ASCE). I am a member of the Executive Committee of the Geotechnical Engineering Division of ASCE and a past or present member of several committees of that division, including those on Soil Dynamics, Safety and Reliability, Computer Applications and Numerical Methods, and Publications. I am a member of the Sei:mological Society of America, the Earthquake Engineering Research Institute, in which I have served on the research committee, the International Society of Soil Mechanics and Foundation Engineering, the British Geotechnical Society, and the Boston Society of Civil Engineers. A complete list of the professional societies to which I belong and the honors and awards which I have received are included in my resume. I am a Registered Professional Engineer in the Commonwealth of Massachusetts and the State of Maine.

Q.9. Mr. Meligi, what is your position with Sargent & Lundy?

A. (Meligi) My title is Head, Component Qualification Division.

Q.10. How long have you been in this position?

A. (Meligi) Since September, 1981.

Q.11. What are your duties and responsibilities as Head of the Component Qualification Division?

A. (Meligi) I am responsible for developing and implementing comprehensive qualification programs for assuring the operability, functionability and structural integrity of power plant components and component supports during all postulated loading (dynamic and static) and environmental plant conditions. The components include equipment (mechanical; electrical; heating, ventilation and air conditioning (HVAC); controls; instrumentation; HVAC ducts; and penetration assemblies) for nuclear and fossil plants. I also direct and review the activities related to optimal design/analysis methods for the reliability of components, special analysis of fluid mechanics, heat transfer, creep-fatigue, fracture mechanics, structural dynamics, vibrations, and material problems. A copy of my resume is attached (Attachment 2).

As Head of the Component Qualification Division, I am in charge of over 130 qualified individuals devoted to all activities related to the qualification of nuclear plant components. The scope of work of this division includes writing seismic test plans, witnessing seismic tests, performing analytical seismic qualifications, and reviewing seismic qualification reports. In the course of conducting our assignments we have been in charge of seismically qualifying more than 12 GM-EMD diesel generators for several other utilities that are similar to the 2.5 MW sets installed at Shoreham. We have also performed seismic qualification for other types of diesels. These assignments provided us with the knowledge and experience to respond to LILCO's request to perform a seismic survivability study on the EMD diesels.

Q.12. What previous positions have you held with Sargent & Lundy?

A. (Meligi) I was hired in April, 1971 as a seismic analyst in the Engineering Mechanics Division (EMD) of

Sargent & Lundy. My assignments were to establish the seismic qualification criteria for nuclear power plant equipment, to specify the seismic requirements in the procurement specifications, and to review vendor's seismic qualification reports. I was promoted to Assistant Supervisor in 1972, to Supervisor in 1973, and to the Head of the Component Analysis Section in 1974. In this capacity I was in charge of over 40 engineers who handle all seismic qualification activities for safety-related components in the nuclear plants designed by Sargent & Lundy. In 1979 I was promoted to be an Assistant Head of the Engineering Mechanics Division. Later in 1981, the Component Qualification Division was formed, drawing from the Component Analysis Section of EMD, electrical engineers from our Electrical Department, and other control and HVAC engineers. I was appointed Head of this Division.

Q.13. What is your employment experience prior to Sargent & Lundy?

A. (Meligi) I worked as a Project Engineer in Helwan Aircraft factories in designing automatic control systems for three years (1965-1968). Then, I joined Strato Engineering Company, a consultant firm for aerospace engineering in Burbank, California, as a Senior Engineer in charge of flutter and vibration analysis and flight tests evaluations for one and a half years (1968-1969). In 1970-1971, I taught engineering mechanics courses in Michigan Tech.

Q.14. Mr. Meligi, what is your educational background?

A. (Meligi) I hold a Bachelor of Science in Aeronautical Engineering from Cairo University, Egypt, and a Master of Science in Engineering Mechanics from Michigan Technological University.

Q.15. Do you belong to any professional societies?

A. (Meligi) I am a Registered Professional Engineer in Illinois, member of the American Society of Mechanical Engineers (ASME), American Nuclear Society (ANS), Institute of Environmental Sciences (IES), and Egyptian American Scholars. I am the Secretary of the Special Working Group on Dynamic Analysis and member of the Working Group on Component Supports Committees of the ASME Section III. I am also a member of the ANSI Committee on Operability of ASME Class 2 and 3 pumps.

Q.16. Mr. Wiesel, what is your position with Stone & Webster?

A. (Wiesel) I am a Senior Structural Engineer in the Structural Division.

Q.17. What are your duties and responsibilities as a Senior Structural Engineer?

A. (Wiesel) I am currently the Supervisor of Projects for the Structural Division. My duties and responsibilities include the technical supervision of the structural engineering staff assigned to the Shoreham Nuclear Power Station project and other Stone & Webster nuclear projects. I am directly involved in the establishment of the technical methods and procedures utilized by the structural engineers assigned to our current nuclear projects. Based on the licensing requirements involved, such activities typically include seismic analysis and the design of nuclear plant structural elements.

Prior to my February 1, 1984 appointment as Supervisor of Projects, I held the position of Lead Structural Engineer for the Shoreham Project. In this position, I was directly responsible for the analysis and design of structural elements and development of construction drawings and specification for Shoreham. Included in this area would be the seismic analysis and design of structures, cable tray supports, conduit supports, and equipment foundations. I assumed this position in March of 1980.

Q.18. What other positions have you held for Stone & Webster?

A. (Wiesel) I joined Stone & Webster in June 1972 as an Engineer in the Structural Division. In that position, I was assigned to a number of nuclear and fossil fueled power projects. During such assignments, I was involved in the seismic analysis and design of nuclear safety related structures and equipment supports. A copy of my resume is attached (Attachment 3).

Q.19. Mr. Wiesel, what is your educational background?

A. (Wiesel) I hold a Master of Science in Civil Engineering from Northeastern University and a Bachelor of Science in Civil Engineering from the University of Massachusetts.

Q.20. Are you a member of any professional organizations?

A. (Wiesel) I am a Registered Professional Engineer in the Commonwealth of Massachusetts and the State of New York.

Q.21. Gentlemen, what is the purpose of your testimony?

A. (Christian, Meligi, Wiesel) The purpose of this testimony is to describe the seismic capabilities of the General Motors EMD diesels currently installed on site. Sargent & Lundy was engaged to study the seismic capability of the machines themselves and their associated mechanical and electrical equipment. LILCO asked Stone & Webster to review several other aspects of seismic capabilities of these machines, including the integrity of the mountings for the diesel generators and its associated switchgear, seismic capability of the fuel line for the diesel generators, and the stability of the soil upon which the diesel generators rest.

II. Sargent & Lundy Study

Q.22. You mentioned earlier that Sargent & Lundy performed a seismic survivability study on the EMD diesels at Shoreham. What do you mean by the term "seismic survivability"?

A. (Meligi) Seismic survivability is defined as the ability of a mechanical or electrical component to undergo a seismic event and remain structurally intact and be capable of performing its intended function subsequent to the event.

Q.23. How does seismic survivability differ from seismic qualification?

A. (Meligi) The seismic qualification of a piece of equipment is an effort which starts at the early stages of the equipment design. This is done by defining the seismic qualification requirements: the level, directions, and the frequency contents of the seismic input. The designer in turn attempts to incorporate these requirements in the design. Later, a qualification program (test, analysis, or combination of both) is conducted to demonstrate that the equipment is capable of performing its intended function. The program is usually rigorous, conservative, detailed, and well documented. Verifying the seismic survivability is usually a backfit effort for an already installed piece of equipment. It utilizes good engineering judgment backed up by sufficient engineering evidence and calculations. The information used in the calculations and the judgment is obtained from the available documents, accessible as-built data from walk-downs, and communications with the manufacturer. The objective of both techniques is to demonstrate and verify the seismic capability of a piece of equipment.

Q.24. Please describe how Sargent & Lundy conducted the study of the seismic survivability of the GM EMD diesels.

A. (Meligi) The seismic survivablity study of the GM EMD diesels was conducted in three phases:

Phase I consisted of a site visit and gathering of essential information to provide the basis of the evaluation and analyses for the study.

Phase II consisted of preparation of the base and elevated response spectra curves, as well as the analyses, review and comparative studies addressing the structural integrity and operability of engine, generator, components and devices. A report was prepared at the end of this phase and is included as Attachment 4 to this testimony.

Phase III consisted of the confirmatory work.

Q.25. Would you please describe the activities conducted during Phase I in more detail?

A. (Meligi) The purpose of Phase I was to gather the information we needed to conduct our study. Among the activities involved were:

1. Obtaining the acceleration time history for the foundation below the engine skid assembly and electrical switchgear assemblies.

2. Obtaining information concerning the EMD diesel generator system, including identifying information for all electrical and mechanical equipment found on the engine assembly.

3. Obtaining mounting details for items known to be different from those with which Sargent & Lundy was already familiar.

4. Investigating and recommending simple modifications for the electrical switchgear panels, cooling piping system, and radiator, as well as diesel generator enclosures which, based on our experience, would simplify and improve the results.

In the course of site visits and discussions with LILCO, we gathered any other pertinent information that would aid in the study.

Q.26. Please describe activities conducted in Phase II.

A. (Meligi) The objective of the activities performed in Phase II was to investigate the structural integrity and operability of (1) the diesel engine, (2) its accessory items, and (3) electrical equipment. These activities included:

1. Collecting additional technical information and data as required, based on the field trip in Phase I.

2. Performing a comparative study of all LILCO's diesel generator components and devices with those stored in the Sargent & Lundy data base. Because Sargent & Lundy has previously qualified diesel generators very similar to the Shoreham engines for nuclear service, we already had available significant information about the seismic capabilities of many of the components of these engines.

3. Determining the bounding acceleration levels for the electrical devices (switchgear) to ensure that the acceleration levels produced by the design basis earthquake at Shoreham are bounded by the data already available to Sargent & Lundy.

4. Reviewing the structural integrity and operability of equipment on the Shoreham engines that Sargent & Lundy had not previously analyzed in its prior work on EMD diesel generators.

5. Reviewing the structural integrity and operability of the generator using analytical techniques.

6. Reviewing the structural integrity of the large metal enclosure around the engine.

7. Reviewing the structural integrity of the common switchgear housing panels.

8. Reviewing the structural integrity of the electric start system.

9. Demonstrating the operability of the engine and associated components.

Q.27. Please explain how you make the comparison mentioned in items 2 and 3 above.

A. (Meligi) LILCO supplied Sargent & Lundy with the ground motion acceleration as a function of time for the safe shutdown earthquake (SSE) that was developed by Stone & Webster for Shoreham. Based on this ground motion acceleration time history data, base response spectra curves were developed. A base response spectrum curve is a plot of the maximum responses of simple equipment over a wide range of frequencies when subjected to the acceleration time history. Different damping values for this simple equipment produce a different response and, consequently, different response spectra curves. These base spectra curves were compared with curves previously developed by Sargent & Lundy which were used to qualify similar engines and components. This comparison revealed that the LILCO curves are bounded by the Sargent & Lundy curves throughout in the frequency range of interest. In other words, the response spectra for the Shoreham plant at the location of the EMD engines is less severe than the response spectra used by Sargent & Lundy to qualify similar diesels. Thus, if the Shoreham engines have components that are similar to components on previously qualified machines, we can conclude that these components would withstand an SSE at Shoreham.

Response spectra for different elevations on electrical panels were also developed for Shoreham because the response at these elevations may be amplified from the response at the base of the equipment. These elevated spectra curves were compared to existing Sargent & Lundy elevated spectra. This comparison demonstrated that the Shoreham elevated spectra are bounded by the Sargent & Lundy curves. Details of these comparisons and the analyses for the extraction of elevated spectra curves are given in Appendices A.1, C.1(a) and C.1(b) of our report (Attachment 4).

Q.28. In describing your Phase II activities, you indicated that you checked the structural integrity of the engine and its components. What do you mean by structural integrit,?

A. (Meligi) Structural integrity is the ability of a y structure (including equipment and components) to sustain postulated loads without exceeding the allowable stresses set by the applicable codes, standards, and good practices. Our review of the EMD diesels ensured that equipment and components (active and nonactive) that are needed for diesel operation, as well as equipment whose failure could degrade the integrity of these equipment and components, have the appropriate structural integrity.

Q.29. You also indicated that you investigated the operability of equipment. What do you mean by operability?

A. (Meligi) Operability is the ability of a piece of equipment to perform its required function after the time it is subjected to the postulated loads. Only active mechanical equipment and electrical equipment essential to the operation of the diesels are required to have their operability verified.

Active mechanical equipment is equipment that must perform a mechanical motion during the course of accomplishing a system function. Nonactive mechanical equipment (such as piping) must maintain its pressure boundary and/or structural integrity but does not have to perform mechanical motion.

Q.30. You indicated that you analyzed three categories of components: (1) accessory items, (2) the diesel engine and (3) electrical equipment. With respect to accessory items, please describe how you conducted your analysis.

A. (Meligi) Accessory components are those items that are not an integral part of the engine assembly. This includes all of the components that are not directly bolted to the engine. These components were analyzed by performing calculations using an upperbound response spectrum that would cover the spectra for Shoreham. These calculations are found in Appendix B of our report (Attachment 4). These calculations demonstrated that the stresses and deflections are within allowable limits. Therefore, we concluded that the structural integrity and operability of the equipment will be maintained during a seismic event of the magnitude of the SSE.

All accessory items, with some exceptions, were found to be suitable to withstand an SSE level earthquake and remain operable following the event. These conclusions are based on our analysis or evaluation of each accessory item in the system. For the exceptions noted above, Sargent & Lundy has made recommendations for modifications which, if implemented, will result in those components being able to withstand the SSE. Our recommendations are discussed in response to questions 35 through 37 below.

Q.31. With respect to the diesel engine itself, please explain how you performed the seismic analysis.

A. (Meligi) The evaluation of the EMD engines was performed using a combination of analysis and test results. Our evaluation is set out in Appendix D of the attached report (Attachment 4). I will summarize our approach here.

1. Test. The engine block and all of its internal components were qualified in conformance with IEEE-344 (1975), Section 7, paragraph 7.5, "Shock Testing." This standard states that shock testing performed in conformance with various military standards, "for example MIL-S-901C," that can be shown to have sufficiently high

accelerations, "far higher than earthquake levels," and that can be shown to be of sufficient duration can be used for qualification purposes. General Motors EMD diesels of the type in use at Shoreham have been subjected to shock tests by the U.S. Navy. These tests were carried out in conformance with MIL-S-901C. The acceleration levels measured during the test far exceed the zero period acceleration (ZPA) levels that would be experienced at Shoreham during an SSE. Zero period acceleration levels are acceleration levels associated with high frequency response. (The period is the inverse of the frequency; as frequency increases the period approaches zero.) Equipment that has a natural frequency above 33 cycles per second is considered a rigid structure because it does not have an amplified response; it experiences only the ZPA. Since the engine (including the block and all internal components) is a rigid structure, the fact that the shock test levels far exceed the ZPA levels at Shoreham allows us to reach conclusions about the seismic capabilities of the engine. Combining the shock test results with analysis showing the magnitude of inertial loading imposed on the diesels during operation, we concluded that the engine block and internal components would withstand the SSE at Shoreham.

2. Analysis. In order to supplement the shock test data and address any external components attached to the engine which may have predominant frequencies in the flexible range (below 33 Hz), we used an analysis performed by General Motors for EMD diesels. In this analysis, detailed frequency calculations were performed and correlations made between the shock levels and given responses to an input of 3 g in the horizontal and 1 g in the vertical. This was done for each item found to have a fundamental material frequency in the flexible range (below 33 Hz).

It should be noted that in order for the engine and engine components to survive the loads induced by normal operation of the engine, they have been designed to have natural frequencies outside the engine vibration range and well above the seismic frequency range. This means that the engines and components have inherent seismic capabilities.

Q.32. Please summarize the results of your analysis of the seismic capabilities of the diesel engine.

A. (Meligi) The engine assembly and all of its integral components were found to be able to experience an SSE level earthquake and function properly following the event. All of the components that were considered to be part of the engine assembly are listed on pages D.1.34 through D.1.42 in Appendix D of our report.

Q.33. With respect to electrical equipment, please describe how you performed your analysis.

A. (Meligi) A detailed finite element analysis was performed on the worst case electrical panel to prove the structural integrity of the panels. The worst case panel was selected based on the geometric configuration and careful inspection which led us to believe that it will have the weakest dynamic characteristics of all of the engine panels.

To verify the operability of electrical equipment, elevated response spectra were obtained at device locations. These elevated response spectra were shown to be bounded by the similar spectra used by Sargent & Lundy in qualifying other EMD diesels. Sargent & Lundy's data base was reviewed to obtain seismic information for those electrical devices installed on Shoreham that were similar to devices previously analyzed by Sargent & Lundy.

The seismic survivability of the remaining electrical equipment was addressed using confidence levels for the NUREG/CR-2405, "Subsystem Fragility." This study makes use of statistical techniques to obtain confidence levels in the equipment's ability to survive an earthquake on a generic basis. Using the study and applying it to the remaining components on the Shoreham EMDs, we found a 99% confidence level that both structural integrity and operability of the components would be maintained. A list of electrical devices and the method of analysis used can be found on pages C.2.3 through C.2.15 of our report.

In addition to the above evaluations, a detailed check of the mounting bolts on many of the instruments was performed. All of the bolts were found to be acceptable and would remain intact during an SSE event.

Q.34. What were the results of your analysis of electrical equipment?

A. (Meligi) Electrical components and devices on the Shoreham EMD diesels will withstand the SSE.

Q.35. Your report contains a number of recommendations. Please explain those recommendations.

A. (Meligi) The recommendations made by Sargent & Lundy fall into two categories. First, as noted in response to question 30 above, we made recommendations that were necessary to ensure the structural integrity and operability of the EMD diesel generator units. These recommendations are found on pages 5-7 (Recommendations A through F) of our report. Second, we recommended that certain confirmatory calculations be made to give added confidence in the seismic capabilities of certain components that were addressed in the report using engineering judgment or conservative assumptions. These recommendations are found on page 7 (Recommendation G) of our report.

Q.36. Has any action been taken on the first set of recommendations?

A. (Meligi) With respect to the first category of recommendations, Sargent & Lundy has prepared detailed construction and installation drawings for the modifications that were found to be required. The modified components have been analyzed and found to be within accepted allowable limits. LILCO has accepted our recommendations and intends to implement them once LILCO's exemption request has been approved.

Q.37. What is the status of the second category of recommendations?

A. (Meligi) With respect to the second category of components, confirmatory calculations have been performed and the results confirm the conclusions stated in our report. All of the equipment was found to remain structurally intact and operable following an SSE level earthquake.

Q.38. Please summarize your overall conclusions with respect to the seismic survivablity of the four GM EMD diesels installed at Shoreham.

A. (Meligi) Once the recommendations discussed above are implemented, the diesel generators at Shoreham will survive an SSE level earthquake and remain operable following the event. From our past experience with equipment qualifications, diesel generator equipment in particular, the required seismic levels at Shoreham are much less severe than at many other plants. Although the units were not seismically qualified when built, the high vibration environment created by the normal operation of the engines results in inherent seismic capabilities being designed into the units. The EMD units were also structurally designed to be moved from location to location without sustaining any appreciable damage. This means that the units are much stronger than a comparable stationary unit would be. Based on our study of the Shoreham EMD diesel generators, the equipment is adequate to withstand an SSE level earthquake.

III. Stone & Webster Analysis

Q.39. Dr. Christian and Mr. Wiesel, on what basis were the areas of your analysis selected?

A. (Christian and Wiesel) As already described, LILCO engaged Sargent & Lundy to perform an analysis of the seismic capabilities of the diesel generators themselves, including their ability to operate after an earthquake. LILCO asked SWEC to perform an analysis of any aspects of the seismic capabilities of the machines not covered by Sargent & Lundy that might be pertinent to their ability to operate under seismic conditions. We looked at the mounting of the EMD diesels and associated switchgear, the fuel line connection, and the soils beneath the diesels.

Q.40. How are the EMD diesels mounted?

A. (Christian and Wiesel) Each of the EMD diesels is mounted on a steel frame or skid. This skid provides support for the diesel engine, the generator, and all associated equipment. The skid in turn rests on wooden timbers (similar to railroad ties) that are sunk into a bed of crushed stone which is approximately 24 inches deep.

Q.41. How did you perform the analysis of the mounting of the diesel generators?

A. (Wiesel) A static analysis of the support of the EMD diesels was performed. The analysis consisted of two parts: a sliding analysis and overturning analysis.

The sliding analysis was performed to determine whether the steel skid supporting the diesels would slide on the timbers upon which it rests in the event of an earthquake. This analysis was done by comparing the earthquake-induced forces that would cause the unit to slide to the support systems' capability to resist those sliding forces. The forces that would cause sliding were determined by multiplying the appropriate accelerations caused by an earthquake by the various weights included in the system. Since the Shoreham plant uses a design basis earthquake (Safe Shutdown Earthquake or SSE) with a 0.2 g horizontal acceleration, the weight of the diesel was multiplied by the ground acceleration of 0.2 g. For example, the weight of the enclosure structure was multiplied by 0.35 g to reflect the amplification of the ground acceleration through the enclosure structure. This amplified acceleration was obtained from the Sargent & Lundy analysis.

The system's capability to resist sliding was determined by multiplying the coefficient of friction for steel on timber by the normal force applied to the support. To provide a conservative analysis, the normal force was reduced by an amount equal to the component weight multiplied by the vertical acceleration. The ratio of the resisting force to the sliding force results in the factor of safety against sliding. Our analysis determined that the resisting force exceeds the sliding force with an adequate safety factor to ensure that sliding of the EMD diesels would not occur during an SSE.

In a similar analysis, the factor of safety against overturning was determined. The inertia forces, which were determined as outlined above, were applied through the component center of gravity to determine the system overturning moment. The resisting moment was calculated by multiplying the system weight by the distance from the center of gravity to the assumed point of overturning. The ratio of the resisting moment to the overturning moment provides the factor of safety against overturning. Again, to be conservative, the component weight was reduced by an amount equal to the weight multiplied by the vertical acceleration. Our analysis concluded that the EMD diesels would not overturn in the event of an SSE.

Q.42. How did you perform your analysis of the capabilities of the switchgear mounting?

A. (Wiesel) The analysis of the diesel switchgear mounting was the same type of analysis as performed on the EMD diesels. It included an assessment of the potential for the sliding and overturning of the switchgear. The analysis indicates that adequate factor of safety exists to prevent sliding or overturning for a minimum ground input of 0.13 g.

Q.43. How did you perform your analysis of the capabilities of the diesel fuel oil line?

A. (Wiesel) A Stone & Webster engineer experienced in the analysis and design of piping systems performed a field walkdown of the fuel oil line installation. The scope of the field walkdown was to evaluate the piping arrangement and support system. This initial evaluation of the piping system's ability to withstand earthquake effects was based on the engineer's judgment and experience in dealing with the analysis and support of piping systems. As a result of this evaluation, a recommendation was made to bury the piping system to improve its ability to withstand a seismic event.

Q.44. Has LILCO implemented this recommendation?

A. (Wiesel) LILCO has decided to accept SWEC's recommendation and will bury the fuel line. Stone & Webster will review this modification including the connection to the diesel to ensure that the installation has the appropriate seismic capability. This modification will be made once LILCO's exemption request is approved.

Q.45. You also mentioned that Stone & Webster performed an assessment of the stability of the soil upon which the EMD diesel generators rest. What steps did this involve?

A. (Christian) In the soils area, we looked at two issues. First, we analyzed the potential for the sliding of the diesel generators on the ground under seismic conditions. Second, we assessed the potential for soil liquefaction.

Q.46. How did you perform your assessment of the potential for the sliding of the diesel generators?

A. (Christian) We considered two possible modes of sliding: one with the failure surface at the contact between the wooden beams and the gravel, and the other with the failure surface passing below this through the gravel and soil. The coefficient of friction was taken as 0.5 for the first case, and friction angles of 35 degrees and 40 degrees were used for the soil and gravel, respectively. Psuedo-static analyses were done using the horizontal and vertical seismic coefficients computed from the analysis of the diesel generators and their associated switchgear discussed by Mr. Wiesel.

These analyses demonstrated an adequate factor of safety against sliding in all cases in the event of an SSE.

Q.47. How did you assess the potential for soil liquefaction under the diesel generators during a seismic event?

A. (Christian) This analysis used soil information obtained from borings made in the vicinity of the EMD diesel generators. Seed's procedure, which is the commonly accepted method of analyzing soil data for liquefaction potential, was used. This starts from the results of the Standard Penetration Tests (SPT) that were performed in each boring. In the Standard Penetration Test, a standard sampling tube (called a "split spoon") is attached to the bottom of the drill rod and the assembly of drill rod and sampler is driven into the soil at the bottom of the boring by repeatedly dropping a 140 pound weight through 30 inches to impact on the top of the drill rod. The number of blows required to drive the sampler one foot into the soil is called the SPT value or the blow count. After the test has been done at one depth in the boring, the boring is advanced to a new depth, and a new SPT is done on the soil at that depth.

In Seed's method the blow counts are modified to account for the depth of the test and location of the water table. The prescribed peak accleration, magnitude of the earthquake, and depth of the sample are then used to find the shear stresses that the earthquake will induce in the soil.

Based on observed behavior in previous earthquakes in various parts of the world, Seed has developed criteria whereby the combination of the modified blow count and induced earthquake loading can be used to determine whether liquefaction is likely.

In the present case the Seed analysis was done for each SPT in each of the four borings near the EMD diesels.

As a check on the Seed analysis, an independent analysis, based on Dobry's method, was done. In this approach, the shear strains caused by the earthquake are compared to limits derived from empirical observation of past earthquakes. The method does not have as large an empirical data base and is not as widely accepted as Seed's.

Q.48. What are the results of your soil liquifaction analysis?

A. (Christian) The soil has a substantial ability to resist liquefaction. The weakest region is a zone extending from the groundwater table at a depth of about 10 feet to a depth of 15 to 20 feet. The calculations indicate that these soils can withstand up to 0.13 g without liquefaction. The check calculation using the threshold strain approach (Dobry's method) indicated the soils at a depth between 10 feet and 26 feet could resist between 0.10 g and 0.16 g. These results indicate that we can predict that liquefaction will not occur in earthquakes up to 0.13 g. This does not mean that above 0.13 g liquefaction will occur; it only means that we cannot predict with confidence that it will not occur. This level of seismic capability is significant because it exceeds the Operating Basis Earthquake for Shoreham, which is 0.1 g.

Q.49. Is it significant that you cannot predict that soil liquefaction or sliding of the switchgear will not occur above 0.13 g?

A. (Christian) No. Let me explain my answer by putting the risk of exceeding a 0.13 g earthquake in perspective.

It is our understanding that the EMD diesels will be relied upon for a relatively short period of time. Therefore, it is appropriate to evaluate the hazard that an earthquake with ground acceleration exceeding 0.13 g will be felt at the site during that short period of time. For analysis purposes, we have conservatively assumed that time to be one year. Based on existing estimates of annual return periods for earthquakes of different sizes for the Shoreham area, we can find the annual probability of occurrence of an event with a peak horizontal acceleration of 0.2 g or greater. This probability is then used to find the probability of observing such an event during the 40 year life of the plant. From the same estimate of annual return period we can find the annual probability of observing an event with acceleration of 0.13 g or greater. This turns out to be less than one-te h of the probability of a 0.2 g earthquake occurri r in 40 years.

As noted in FSAR § 2.5.2.5.7, Shoreham is in an area of low seismicity. The seismic hazard posed by operating the plant during low power testing as proposed by LILCO is an order of magnitude lower than this already low hazard.

It should be noted that the absolute values of the probabilities for earthquakes of various sizes can be affected by different assumptions made in performing the original calculations of seismic hazard, but the relative probability between the 0.2 g event over 40 years and the 0.13 g event over one year is affected very little by these factors. In other words, the statement that the probability of a 0.13 g event in one year is less than one-tenth the probability of a 0.2 g event in 40 years is valid even if different assumptions and calculations are made in estimating the annual probabilites themselves.

Q.50. Gentlemen, could you please summarize your testimony concerning the GM EMD diesels?

A. (Christian and Wiesel) The diesel generator installation has a resistance to sliding and overturning well in excess of that needed to resist the Safe Shutdown Earthquake. The switchgear installation has a resistance to sliding and overturning in excess of that needed to resist earthquakes at least 0.13 g. The soils in the vicinity of the temporary diesel generators and switchgear will resist liquefaction for earthquakes up to 0.13 g.

The probability of an earthquake of 0.13 g or more occurring at the Shoreham site during the time the EMD diesels will be relied upon is less than one-tenth the probability of the Safe Shutdown Earthquake occurring during the 40 year life of the plant.

We conclude that there is adequate seismic resistance of the foundations and underlying soils for the EMD diesel generator installation. Once Stone & Webster's recommendation for the fuel line is implemented, it will also have adequate seismic resistance.

February 1984

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EDUCATION

Massachusetts Institute of Technology - Bachelor of Science in Civil Engineering 1958
Massachusetts Institute of Technology - Master of Science in Civil Engineering 1959
Massachusetts Institute of Technology - Doctor of Philosophy in Civil Engineering 1966

LICENSES AND REGISTRATIONS

Professional Engineer - Massachusetts, Maine

EXPERIENCE SUMMARY

Dr. Christian has had extensive experience in foundation engineering, earth dam analysis and design, engineering mechanics, and earthquake engineering and is one of the leading authorities in the use of computer methods in geotechnical engineering. His activities in geotechnical engineering have ranged from the preliminary design stage to the construction stage. He has done geotechnical and seismological work on nuclear power plants in a variety of locations, including probabilistic assessments of seismic hazard. In addition to nuclear power plants, Dr. Christian has worked on offshore caissons, offshore mooring facilities, earth dams for storage of fuel oil and water, offshore piplines, underground rock openings, slope stability studies, highway embankments, oil field subsidence, and foundation investigations for conventional buildings. He has done seismological evaluations and analytical studies of earthquake effects including soil amplification, liquefaction, and soil structure interaction. He has conducted earthquake studies of earth and rock fill dams. He has developed finite element programs for a variety of applications. He has conducted studies of flow of water through dams and other geological structures. He has also had experience in the interpretation of field data from soil instrumentation. He is the co-editor of a book on Numerical Methods in Geotechnical Engineering. He has developed standards for documenting computer programs and has implemented procedures for controlling the quality and accuracy of computerized calculations at Stone & Webster. He is a member of the Corporate Computer and Software Oversight Committee and Chairman of the Computer Disaster Recovery Committee.

Dr. Christian has taught and done research in geotechnical engineering at the graduate level. He developed several computer programs and has published numerous papers and reports based on his research and practical experience. He has been a Visiting Lecturer at the Massachusetts Institute of Technology.

Prior to joining Stone & Webster Engineering Corporation, Dr. Christian was Associate Professor of Civil Engineering at the Massachusetts Institute of Technology and a private consultant. He has worked in the U.S.A., Brazil, Malaysia, Canada, The Netherlands, Finland, and Venezuela and has been involved in projects in Italy, Libya, and Turkey.

PROFESSIONAL AFFILIATIONS

American Society of Civil Engineers - Fellow

Executive Committee, Geotechnical Engineering Division - Secretary

National Convention, Boston, 1979 - Technical Program Committee and Session Allocation Board - Chairman

Committee on Coordination within ASCE, Technical Council on Computer Practices - Member

Committee on Computer Applications and Numerical Methods, Geotechnical Engineering Division - Member and Past Chairman

Awards Committee, Geotechnical Engineering Division - Member

Committee on Definitions and Standards, Geotechnical Engineering Division - Member

Session Programs Committee, Geotechnical Engineering Division - Past Chairman

Publications Committee, Geotechnical Engineering Division - Past Member

Committee on Reliability and Probabilistic Concepts, Geotechnical Engineering Division - Past Member

Committee on Soil Dynamics, Geotechnical Engineering Division - Past Member

Past Geotechnical Engineering Division Correspondent - ASCE News

Boston Society of Civil Engineers Section/American Society of Civil Engineers - Past Chairman Computer Group and currently Member of Computer Group Executive Committee

Boston Society of Civil Engineers Section/American Society of Civil Engineers - Seismic Design Advisory Committee - Member

International Society of Soil Mechanics and Foundation Engineering - Member

U.S. Committee on Large Dams of International Commission on Large Dams - Member

Committee on Methods of Numerical Analysis of Dams - Member

American Association for the Advancement of Science - Member

Seismological Society of America - Member

Universities Council on Earthquake Engineering Research - Member

Earthquake Engineering Research Institute - Member

Committee on Research - Past Member

Joint Committee on Tall Buildings - IABSE/ASCE - Past Editor for Committee 11 - Foundations

Transportation Research Board - Committee A2K05 - Mechanics of Earth Masses and Layered Systems - Past Member

International Committee on Numerical Methods in Geomechanics - Member

International Journal for Numerical and Analytical Methods in Geomechanics - Member of Advisory Board

Accreditation Board for Engineering and Technology - ASCE Member of Engineering Accreditation Visiting Committee

Association for Computing Machinery - Member

British Geotechnical Society - Member

Institute of Electrical and Electronic Engineers - Computer Society - Member

Advisory Committee for the Department of Civil Engineering, University of New Hampshire - Chairman

HONORS AND AWARDS

Chi Epsilon, National Civil Engineering Honor Society - M.I.T. - 1955

Tau Beta Pi National Engineering Honor Society - M.I.T. - 1956

Sigma Xi National Scientific Research Honor Society - M.I.T. - 1966

U.S. Air Force Commendation Medal - 1963

Desmond Fitzgerald Medal - Boston Society of Civil Engineers Section, American Society of Civil Engineers - 1973

Outstanding Correspondent Award - ASCE News - 1978

BOOK

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PUBLICATIONS

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"Janbu, Bjerrum, and Kjaernsli's Chart Reinterpreted," Canadian Geotechnical Journal, Vol. 15, No. 1, February 1978, pp. 123-128. (Co-author W. D. Carrier III).

"Dynamic Behavior of Soil-Structure Systems," lecture 2 in BSCES/ASCE Geotechnical Lecture Series on "Design of Foundations for Dynamic and Repeated Loads," March 1978.

"Professional Viewpoint on Documentation Standards," Conference on Computing in Civil Engineering, Atlanta, Georgia, June 1978.

"Seismically Induced Sliding of Massive Structures," ASCE National Convention and Exhibit, Conference on Civil Engineering and Nuclear Power, Boston, Massachusetts, April 1979, also Journal of the Geotechnical Engineering Division, ASCE, Vol. 105, No. GT12, December 1979, pp. 1471-1488. (Co-authors E. A. Kausel, A. S. Lucks, L. Edgers, W. F. Swiger).

"Probabilistic Soil Dynamics: State-of-the Art," ASCE National Convention and Exposition, Boston, Massachusetts, April 1979, Session on Reliability and Geotechnical Engineering, pp. 136-16[illegible], also Journal of the Geotechnical Engineering Division, ASCE, Vol. 106, No. GT4, April 1980, pp. 385-397.

"Soil Mechanics of Offshore Permanent Displacements," presented at ASCE National Convention and Exposition, Boston, Massachusetts, April 1979. (Co-authors W. A. Marr, Jr., J. Hedberg, J. W. Boehmer).

"Permanent Displacement Analysis for Oosterschelde," presented at ASCE National Convention and Exposition, Boston, Massachusetts, April 1979. (Co-authors W. A. Marr, Jr., T. Y. Chang, J. W. Boehmer).

Foundation Design, (editor and partial author) Chapter SC-7, Planning and Design of Tall Buildings, Council on Tall Buildings and Urban Habitat, Volume SC, "Tall Building Systems and Concepts," 1980, pp. 257-340.

"Flow Nets from Finite Element Data," International Journal for Numerical and Analytical Methods in Geomechanics, Vol. 4, No. 2, April-June 1980, pp. 191-196.

"Flow Nets by the Finite Element Method," Ground Water, Vol. 18, No. 2, March - April 1980, pp. 178-181.

"User Needs: A View from Industry," Workshop on Limit Equilibrium, Plasticity and Generalized Stress - Strain in Geotechnical Engineering, Montreal, Quebec, May 1980, published by ASCE, pp. 61-67.

"Report on Working Group One," Workshop on Limit Equilibrium, Plasticity and Generalized Stress - Strain in Geotechnical Engineering, Montreal, Quebec, May 1980, published by ASCE, pp.93-101.

"A Summary of Generalized Stress - Strain Applications," presented at ASCE National Convention, Hollywood-by-the-Sea, Florida, October 1980, to be published by ASCE in 1982.

Discussion of "State of the Art: Laboratory Strength Testing of Soils," by A.S. Saada and F. C. Townsend, Symposium on Laboratory Shear Strength of Soil, Chicago, Illinois, June 1980, published as ASTM STP740, R. N. Yong and F. C. Townsend, editors, 1981, pp. 638-640.

"Comparison of Japanese Design Earthquake Response Spectra with those Prescribed by U.S. NRC Regulatory Guide 1.60," Nuclear Engineering and Design, Vol. 61, 1980, pp. 369-382.

"The Use of Computers in Practice," Proceedings, 22nd U.S. Symposium on Rock Mechanics, Cambridge, Ma., June 1981, pp. 493-500.

"Permanent Displacements Due to Cyclic Wave Loading," Journal of the Geotechnical Engineering Division, ASCE, Vol. 107, No. GT8, August 1981, pp. 1129-1149. (Co-author W. A. Marr, Jr.).

"Instrumentation Corrections to Wave Velocity Data," Journal of the Geotechnical Engineering Division, ASCE, Vol. 107, No. GT10, October 1981, pp. 1419-1423. (Co-authors J. R. Hall, Jr., E. A. Kausel, and J. C. Wolfgang).

"The Application of Generalized Stress-Strain Relations," Application of Generalized Stress-Strain in Geotechnical Engineering, ASCE symposium, October, 1980, pp. 182-204.

"Seismic Hazard in Northeastern United States," International Conference on Soil Dynamics and Earthquake Engineering," Southhampton, England, July, 1982. Revised version published in Soil Dynamics and Earthquake Engineering, Vol. 3, No. 1, 1984, pp. 8-18. (Co-Authors H. K. Acharga and A. S. Lucks).

"Finite Element Analysis of Permanent Settlements Due to Storm Loadings on Offshore Structures," Proceedings, International Conference on Finite Element Methods, Shanghai, China, 1982, Volume II, pp. 16-22 (Co-Author T. Y. H. Chang).

"Soil-Structure Interaction Problems," Proceedings, Fourth International Conference on Numerical Methods in Geomechanics, Edmonton, Alberta, 1982, Volume III. (Co-Author J. R. Hall, Jr.)

"Geotechnical Use of Finite Element Analysis", presented at ASCE Convention, Houston, Texas, October 1983.

LANGUAGES

Portugese
Some Spanish, French, and German

DETAILED EXPERIENCE RECORD
CHRISTIAN, JOHN T. 13488

STONE & WEBSTER ENGINEERING CORPORATION, BOSTON, MA (June 1973 to Present)

Appointments:

Senior Consulting Engineer - Oct 1980
Consulting Engineer - Nov 1976
Consultant, Geotechnical Division - June 1973

Engineering Department Staff (Nov 1976 to Present)

Directly responsible to Chairman of the Board for developing and carrying out program to qualify and document engineering software. Responsible for budget review and control of computer related development, maintenance, and documentation in Engineering Department. Member of group reviewing, sponsoring, and recommending developments in interactive computer graphics.

Member of Corporate Computer Software and Hardware Oversight Committee responsible for reviewing all hardware and software development and purchases. Chairman, Computer Disaster Recovery Committee, responsible for developing policies for recovery from computer disasters.

Deputy Manager, Strategic Business Plan for Offshore development.

Teollisunden Voima Oy (Industrial Power Co.) - Finland (Oct-Dec 1983)

Analysis of probabilistic seismic hazard at Alkiluoto, Finland, for existing nuclear power plant and proposed additions.

Puget Sound Power and Light Company (Nov 1982 to Present)

Upper Baker and Lower Baker Dams

Geotechnical consultant on seismic reanalysis of two concrete dams and rock fill West Pass Dike. Responsible for geotechnical and analytical work on West Pass Dike.

Trengganu Gas Processing Plant, Petronas, Malaysian National Oil Company (March 1982 to Present)

Geotechnical review and study of alternative schemes for marine structures to export liquid petroleum gas. Participate in review of computer systems and pipeline specifications.

Surry Power Station - Units 1 and 2, Virginia Electric and Power Company (March 1979-Dec 1979)

Seismic risk studies and dynamic soil structure interaction studies for reevaluation of pipe stresses due to earthquakes. Justification of analytical methodology to U.S. NRC.

Beaver Valley Power Station - Unit 1, Duquesne Light Company (March 1979-Dec 1979)

Seismic risk studies and dynamic soil structure interaction studies for reevaluation of pipe stresses due to earthquakes. Justification of analytical methodology to U.S. NRC.

Commonwealth of Massachusetts - Metropolitan District Commission/Hansen, Holley, & Biggs (1980)

Study of possible damage to adjacent structures during construction of sewer and pumping stations.

Dravo - Van Houten Consulting Engineers, Bintulu Port Development (1981-1982)

Evaluation of soil densification designs and proposals and consulting advice on densification. Consulting on remedial action to remedy soft foundation conditions under break water.

Lawrence Livermore Laboratory (Jan 1979-Dec 1979)

Study of methods of soil-structure interaction analysis.

Nine Mile Point Nuclear Power Station - Unit 2, Niagara Mohawk Power Corporation (1975 to Present)

Evaluation and review of rock squeeze hazard, field geophysical measurements, and other geological problems.

Power Authority of the State of New York, Greene County

Review of soil structure interaction.

Wisconsin Electric Power Company, Koshkonong, Wood County, and Haven Sites

Seismicity analysis and seismic risk analysis in addition to review of geotechnical work.

San Diego Gas & Electric Company, Sundesert Nuclear Plant

Review of geotechnical work and engineering mechanics analyses.

Atomic Energy Organization of Iran, Rud-e Karun Site Study

Geotechnical and seismological studies.

Yankee Atomic Power Company, Charlestown Nuclear Power Plant

Review and consulting on liquefaction analysis and seismicity studies.

Stone & Webster Standard Nuclear Power Plant Project

Lead Geotechnical Engineer; developed geotechnical design consideration and parameters.

Rijkswaterstaat Deltadienst, The Hague, Netherlands

Consultation, analytical studies, evaluation of design, and selection of soil properties for large caisson in North Sea. Consultant on evaluation of test section and final design. Member of Consultants Group.

North Anna Nuclear Power Station - Units 1, 2, 3, and 4
Virginia Electric and Power Company

Seismic stability analysis of intake structures and pump houses. Participated in study of fault at North Anna, investigation of effects of reservoir filling, and studies of settlement of stuctures and embankments.

Surry Power Station - Units 3 and 4, Virginia Electric and Power Company

Site investigation, soils evaluation, and seismic studies for Surry Units 3 and 4, including liquefaction studies and defense of safe shutdown chosen for design. Work included preparation of appropriate sections of SAR.

Millstone - Unit 3, Northeast Utilities Service Company

Study of soil amplification of earthquake effects for Millstone, Unit 3 and statistical evaluation of earthquake risk at same site.

Montague Nuclear Power Plant, Northeast Utilities Service Company

Participation in development of safe shutdown earthquake for Montague nuclear power plant and in foundation design of cooling towers.

Jamesport and Shoreham Sites, Long Island Lighting Company

Liquefaction study for Jamesport nuclear power plant including earthquake amplification effects. Review of geotechnical studies. Review of seismic analysis.

Design of embedment requirements for offshore pipelines for Shoreham nuclear power plant, including evaluation of wave effects on liquefaction of sand and flotation of pipes. Liquefaction and stability studies for intake structures and canal slopes.

Beaver Valley Power Station, Duquesne Light Company

Evaluation of liquefaction potential for Beaver Valley Power Station and justification of design before U.S. NRC. Study of relative motion of building during earthquakes.

Continuing Education - Stone & Webster Engineering Corporation

Continuing education in geotechnical engineering, including continuing education of personnel in Geotechnical Division as well as explanation of geotechnical concepts to persons in other fields. Responsibilities include presentation of lectures, arrangement for lectures by others, and development of programs.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MA (July 1966-July 1973)

Assistant Professor and Associate Professor of Civil Engineering

Research and teaching are primarily in the areas of geotechnical engineering and computer application. Specific topics include the application of finite element methods to problems in geotechnical engineering, including consolidation, behavior of braced excavations, stability of slopes, inelastic deformations of soil, earthquake problems, and flow through soils. Other research was done into the field behavior of levees on the Atchafalaya River, development of computer aided slope stability analysis, and earthquake engineering. Teaching has included running and participating in special short courses for engineering. Recent work included participation in seismic design studies for urban areas.

CONSULTANT IN GEOTECHNICAL ENGINEERING (July 1969-July 1973)

Stone & Webster Engineering Corporation, Boston, Massachusetts

Investigation and analysis of earthquake effects on stability and performance on North Anna Dam, then under construction.

Implementation of computerized stability and finite element analysis for geotechnical projects.

Investigation of surge pressures on inlet tunnels at Northfield Mountain Pumped Storage Project, Massachusetts.

Analysis of motions at Upper Baker Dam, Oregon.

Development of Preliminary Safety Analysis Report for extension of Surry Nuclear Power Station for presentation to AEC.

Consultation on numerous aspects of seismic risk and seismic design for power plants.

Dames & Moore, Cranford, New Jersey

Design and analysis of breakwater for offshore nuclear power plant.

Woodward-Moorhouse & Associates, Clifton, New Jersey

Study of effects of underwater embankment in reducing damage to liquid natural gas pipeline as the result of ship collision. Development of artificial time-history of design earthquakes.

Development of computerized slope stability analysis of rock slopes.

Joseph S. Ward & Associates, Caldwell, New Jersey

Prediction of deformations in foundation of float-glass plant.

Goldberg-Zoino & Associates, Newton, Massachusetts

Seismic amplification and soil liquefaction studies for additional structures at Vermont Yankee Nuclear Power Plant.

Geotechnical Engineers, Inc., Winchester, Massachusetts

Finite element study of deformations and possible cracking in proposed earth dam.

Panama Canal Company, Canal Zone

Study of stability of proposed rock cut.

Hansen, Holley, & Biggs, Cambridge, Massachusetts
Analysis of soil-structure interaction for ENEL No. 4 Nuclear Power Plant at Piacenza, Italy, for Gibbs & Hill. Development of soil parameters for soil-structure interaction for Aquirre nuclear power plant structures for Jackson & Moreland.

Weston Geophysical Research, Weston, Massachusetts

Soil amplification effects on earthquake for proposed Hanford nuclear power plant addition.

Haley & Aldrich, Cambridge, Massachusetts

Analysis of movement of sheeting at excavation for John Hancock Tower, Boston.

New England Concrete Pipe Corporation, Newton, Massachusetts

Expert witness on lateral movement of retaining wall in garage.

C. A. Maguire & Associates, Waltham, Massachusetts

Review of analysis of static soil-structure interaction for proposed Charles River Dam Locks and development of new computer methods of performing analysis.

T. WILLIAM LAMBE & ASSOCIATES, CAMBRIDGE, MA (July 1966-July 1969)

Consulting Soil Engineer

Creole Petroleum Corporation, Caracas, Venezuela

Studies of the subsidence of oil field at Lake Maracaibo, Venezuela, and of means of predicting the ultimate magnitude of settlement.

Analysis and design on proposed dam for storage of fuel oil, including deformation, seepage, and stability analyses.

Borden Chemical Company, Plant City, Florida

Investigation of behavior of tailings dams for gypsum wastes including seepage and stability analyses and model tests. Recommendations for new embankment design.

Esso Libya, Libya

Analysis of thermal flow patterns for storage tanks for liquid natural gas and recommendations for design.

NATIONAL SCIENCE FOUNDATION, WASHINGTON, D.C. (Sept 1963-July 1966)

National Science Foundation Graduate Fellowship at Massachusetts Institute of Technology

Earned Doctor of Philosophy degree in Civil Engineering.

T. WILLIAM LAMBE & ASSOCIATES, CAMBRIDGE, MA (Sept 1964-July 1966)

Part-time Employment as Soils Engineer

Creole Petroleum Corporation, Caracus, Venezuela

Laboratory testing of soil for proposed earth dam for storage of fuel oil, including triaxial tests and fuel oil permeability tests. Also design studies for same dam.

Esso Libya, Libya

Thermal flow studies for storage tank for liquid natural gas.

CREOLE PETROLEUM CORPORATION, CARACAS, VENEZUELA (June 1964-Sep 1964)

Soils Engineer (Through T. William Lambe & Associates)

Field supervision of borings and soil exploration at Amuay, Venezuela, for proposed earth dam for storage of fuel oil.

Field investigation of failure of Siburua Dam.

Field investigation of failure of cooling and settling tank at Quiriquire, Venezuela.

U.S. AIR FORCE (Sept 1959-Sept 1963)

Second Lieutenant and First Lieutenant

Goodfellow Air Force Base, San Angelo, Texas

Assistant base civil engineer.

Headquarters, European Security Region, Frankfurt Am Main, Germany

Staff civil engineer in charge of maintenance and minor construction projects for region extending from Scotland to Pakistan, preparation of military construction programs and minor construction programs, coordination with U.S. Army and with German engineers on problems arising in Germany, and general staff supervision of civil engineering operations.

OTIS ELEVATOR COMPANY, NEW YORK, NY (Sept 1957-Jan 1958)

Design Draftsman

Designed elevator installations for international operations division.

HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO, TORONTO, ONTARIO (June 1955-Sept 1955)

Surveyor on St. Lawrence Seaway Project.

BRAZILIAN TRACTION LIGHT AND POWER, SAO PAULO, BRAZIL (June 1954-Sept 1954)

Surveyor on Cubatao hydroelectric power project.

SARGENT & LUNDY — **Resume** **Ahmed E. Meligi**

Title	Head Component Qualification Division
Education	Michigan Technological University - M.S. Engineering Mechanics - 1971 Cairo University, Egypt - B.S. Aeronautical Engineering - 1965
Registration	Professional Engineer - Illinois Appointed Associate - 1984

Responsibilities

Mr. Meligi is responsible for developing and implementing comprehensive qualification programs for assuring the operability, functionability and structural integrity of power plant components and component supports during all loading and environmental postulated plant conditions. The components include equipment (mechanical, electrical, and HVAC), controls, instrumentation, HVAC ducts and penetration assemblies for all nuclear and fossil plants. He directs and reviews the activities related to optimal design/analysis methods for the reliability of components, special analysis of fluid mechanics, heat transfer, creep-fatigue, fracture mechanics, dynamics, vibration and material evaluations.

Experience

Mr. Meligi has extensive experience in component qualifications by testing and/or analysis for steam-electric generating stations. He has been involved in numerous projects, all nuclear- and some fossil-fueled, within Sargent & Lundy. He has written and supervised the writing of technical standards that established the design criteria and procedures for handling the divisional assignments. Mr. Meligi also is actively participating on various ASME and ANSI committees for the design and qualification of nuclear components and component supports.

Mr. Meligi has in-depth experience in dynamic and vibration analysis, fracture mechanics, stress analysis and material sciences. Prior to joining Sargent & Lundy in 1971, he taught engineering mechanics, performed and reviewed stress analysis calculations for aircraft structures, and worked as an aeronautical engineer in the areas of flight testing, cycle calculations and thermal analysis. Mr. Meligi also has conducted project maintenance, surveillance, and spare parts procurement and replacement activities. These activities covered areas such as planning, scheduling, inventory control, shelf life, and storage conditions.

Memberships

American Society of Mechanical Engineers
ASME Section III, Working Group on Component Supports (Subsection NF)
ASME Section III, Special Working Group on Dynamic Analysis (Appendix N)
ANSI-N45 - Area IVX N551 "Project Pumps": Member of TF #1 (Pump) and TF #3 (Motor), Chairman of Operability - Qualification Group (Part of TF #1)
Institute of Environmental Sciences

Publications

Mr. Meligi has written and coauthored ten technical papers in the areas of equipment qualifications, dynamic testing and analysis, operability verifications, etc., that were presented and/or published in technical conferences and magazines of ASME, ASCE, SMIRT, IES, ASI and the Shock and Vibration Symposium.

January 1984

WIESEL, ROBERT C.

SENIOR STRUCTURAL ENGINEER
STRUCTURAL DIVISION

EDUCATION

Northeastern University - M.S. in Structural Engineering 1978
University of Massachusetts - B.S. in Civil Engineering 1972

LICENSES AND REGISTRATIONS

Professional Engineer - Massachusetts and New York

EXPERIENCE SUMMARY

Mr. Wiesel joined Stone & Webster Engineering Corporation (SWEC) as an Engineer in the Structural Division in June 1972. He has been assigned responsible positions on both fossil-fueled and nuclear-powered projects. His experience includes Project Engineering, Field Engineering, and Construction Coordination of power generating facilities. Mr. Wiesel is currently assigned to a nuclear power station as Lead Structural Engineer.

Mr. Wiesel has provided responsible leadership and has actively participated in both fossil-fueled and nuclear project site selection, engineering, design, and construction of power plant structures, offshore intake and discharge facilities, marine and waterfront structures, and major equipment rigging and installation.

PROFESSIONAL AFFILIATIONS

American Society of Civil Engineers

DETAILED EXPERIENCE RECORD
WIESEL, ROBERT C. 97046

STONE & WEBSTER ENGINEERING CORPORATION, BOSTON, MA (June 1972 to Present)

Appointments:

Senior Structural Engineer - Feb 1982
Structural Engineer - Aug 1978

Shoreham Nuclear Power Station, Long Island Lighting Company
(Jan 1978 to Present)

Assigned as LEAD STRUCTURAL ENGINEER, responsible for all Structural Engineering and design activities on the project and within the site engineering office. Also responsible for the interface and coordination of construction activities in the structural area.

Oswego Unit 6, Niagara Mohawk Power Company (Feb 1977-Jan 1978)

Assigned as an ENGINEER, responsibilities included specification preparation, resolution of construction problems, and engineering and design coordination of plant structures, offshore intake structure, and concrete stack.

North Anna Units 3 and 4, Virginia Electric and Power Company
(Sept 1976-Feb 1977)

Assigned as an ENGINEER, responsibilities included engineering and design coordination of the fuel building and intake tunnels, specification preparation, and resolution of construction problems.

Shoreham Nuclear Power Station, Long Island Lighting Company
(Feb 1975-Sept 1976)

Assigned as HEAD OF THE SITE ENGINEERING OFFICE, responsibilities included the authority of the Project Engineer for all engineering and design work performed on the Shoreham Jobsite. Prior to the establishment of the site engineering office, was the project liaison between the construction site and the project group and functioned as the project engineer's representative in the field.

River Bend Station, Gulf States Utilities Company (Mar 1974-Feb 1975)

Assigned as an ENGINEER, was responsible for a range of project specifications and their associated contracts. Also, responsibilities included coordination of engineering and design efforts for the waterfront structures, cooling tower area, and site development preparations.

Career Development Program (June 1972-Mar 1974)

Assigned to the Structural Design Division for a period of 12 months. Gained structural design experience on both nuclear and fossil power facilities. Major areas of concentration were in the computer analysis and design of precipitator structural steel, seismic analysis of the service building for North Anna Unit 3, and finite element analysis of a stack liner.

Assigned to the Construction Department and to the North Anna Nuclear Power Station, Mineral, Virginia. While in the field was involved with the following activities: reactor vessel installation, concrete placement for the reactor containment and internal structures, concrete batch plant operations, and the installation of rock anchor bolts, structural steel, and cadwelded joints.

During an assignment to the Geotechnical Division, was a field inspector on both on-shore and off-shore drilling rigs. During this period, activities consisted of determining boring locations, and logging and classifying samples.

MR. EARLEY: Judge, if I may make one request or suggestion for the ease of everyone. This particular piece of testimony has as Attachment 4 this two volume set, and rather than bind that in, I suggest that we designate that as LILCO Exhibit LP-1.

JUDGE MILLER: To tell you the truth, I didn't know you were offering it. I thought you were offering the testimony. I was looking at the testimony. I was not looking at the exhibits, or the notebooks.

MR. EARLEY: Judge Miller, in the introduction I discussed the fact that the testimony consisted of a certain number of pages plus four attachments, and in fact referenced this particular study, and parties I think are all aware of that.

JUDGE MILLER: I know you referenced it, but I am just wondering about encumbering the record. Is all this really necessary?

MR. EARLEY: The material is necessary to establish the scope of the work that was done by Sargent & Lundy, and if the County doesn't intent to contest the fact that the EMD diesels within the scope of Sargent & Lundy's work will in fact withstand an earthquake of .2 G's, then we don't need to put all the detail into the record. It was offered because we didn't know exactly what the County was going to say about the EMD diesels.

End 18
Mary fols.

Sim 19-1

JUDGE MILLER: Well, what does the County say?

MS. LETSCHE: Well, Judge Miller, our testimony has been prefiled and Mr. Earley is going to have to make the judgment as to whether or not he wants to put that in or not.

JUDGE MILLER: He wants to. I am just deboggling encumbering our record with all these numerous t volumes of exhibits.

MS. LETSCHE: I don't have any objection to it being an exhibit rather than being part of the testimony.

JUDGE MILLER: We do not intend to make it par of the testimony nor to go into the transcript. That is r intended. At most it would simply be numbered appropriately as exhibits and the exhibits could be admitted, but they would not be included in either the transcript nor anything I have to pay for.

MR. EARLEY: That certainly is acceptable to LILCO is the exhibit is admitted but not included as part of the transcript.

JUDGE MILLER: All right. The exhibits, these two volumes, ho do you describe them? Do you have numbers on them?

MR. EARLEY: It is ---

JUDGE MILLER: Now, remember, you didn't want

Sim 19-2

to have any exhibit numbers on the testimony. But you go ahead and unnumber it and unshread it and all the rest. So identify it for the record so we know what we are talking about.

MR. EARLEY: All right. LILCO Exhibit LP-1 is a document entitled "Seismic Survivability Study For MP-45 Diesel Generators," prepared by Sargent and Lundy. It is designated as Attachment 4 to the testimony of John Christian, Ahmed Meligi and Robert C. Wiesel and consists of two volumes.

JUDGE MILLER: Any objection?

MS. LETSCHE: No objection.

JUDGE MILLER: The Staff?

MR. PERLIS: No objection.

JUDGE MILLER: All right. These documents thus identified, and what numbers did you give them, exhibit numbers?

MR. EARLEY: It is LILCO Exhibit LP-1.

JUDGE MILLER: LP-1? Don't you have any other exhibits?

MR. EARLEY: We have not had any other exhibits in the low-power proceeding yet.

JUDGE MILLER: All right. Congratulations. You have got your first exhibit.

Sim 19-3

(LILCO Exhibit LP-1 was marked
for identification.)

JUDGE MILLER: It will be admitted. However, in view of our discussion, it will not become part of the transcript, nor otherwise be reproduced, but will be available to all the parties who I assume have received copies, right?

MR. EARLEY: Yes, sir.

JUDGE MILLER: Okay. It is admitted.

(LILCO Exhibit LP-1, previously
marked for identification, was
admitted into evidence.)

INDEX

JUDGE MILLER: Now your next witnesses are whom?

MR. EARLEY: LILCO's next witness panel will be Mr. Thomas W. Iannuzzi and Mr. Kenneth A. Lewis.

JUDGE MILLER: And what subjects do they intend to address?

MR. ROLFE: Judge Miller, they intend to address the history and reliability of the EMD diesels.

JUDGE MILLER: And do they have exhibits lurking?

MR. ROLFE: They have attachments to their testimony, but there is nothing comparable in magnitude.

JUDGE MILLER: All right. Well, we will address them in the same fashion.

I think now we have covered a lot of ground and had a lot of discussion this first day. So, there being

Sim 19-4

no objection, I think we may suspend proceedings here and resume at 9 in the morning with the witnesses that you have indicated.

JUDGE MILLER: Does anybody object?

(No response.)

JUDGE MILLER: See you tomorrow.

We will stand in recess.

(Whereupon, at 4:40 p.m., the hearing recessed. to reconvene at 9:00 a.m., Tuesday, July 31, 1984.)

* * * * * *

CERTIFICATE OF PROCEEDINGS

This is to certify that the attached proceedings before the NRC COMMISSION

In the matter of: LONG ISLAND LIGHTING COMPANY

Date of Proceeding: July 30, 1984, Tuesday

Place of Proceeding: Hauppuage, New York

were held as herein appears, and that this is the original transcript for the file of the Commission.

GARRETT J. WALSH, JR.
Official Reporter - Typed

Garrett J. Walsh, Jr.
Official Reporter - Signature

MYRTLE H. TRAYLOR
Official Reporter - Typed

Myrtle H. Traylor
Official Reporter - Signature

MARY SIMONS
Official Reporter - Typed

Mary C Simons
Official Reporter - Signature