UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

TESTIMONY OF BRIAN R. McCAFFREY FOR THE LONG ISLAND LIGHTING COMPANY ON SUFFOLK COUNTY CONTENTION 31 AND SHOREHAM OPPONENTS COALITION CONTENTION 19(g) -- ELECTRICAL SEPARATION

Purpose

This testimony establishes that electrical cables and raceways between equipment and panels are adequately separated at Shoreham in compliance with the applicable portions of Regulatory Guide 1.75 Revision 2, by use of cable trays, enclosed raceways, and in some areas separate rooms with three-hour fire-rated walls. Automatic CO2 flooding systems, smoke detectors, and a cable separation study further assure safe shutdown capability at Shoreham.

A program for dealing with deviations from the stated separation criteria contained in FSAR 3.12 has been developed. Approximately 85% of these deviations are for conduit-to-conduit separation, and result because the Shoreham criteria exceeds the IEEE-384 standards for separation. Therefore, the conduit-to-conduit installation deviations will be resolved by simply accepting those installations as-is, since the installed condition exceeds the IEEE requirements. For the few remaining deviations, compliance will be achieved by implementing one of four options suggested by the NRC to resolve these items.

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CONTENTION 19(g) -- ELECTRICAL SEPARATION

1. Q. Please state your name and business address.

A. My name is Brian R. McCaffrey; my business address is Long Island Lighting Company, 175 East Old Country Road, Hicksville, New York.

2. Q. What is your position with LILCO?

A. I am Regulatory Supervisor for LILCO, responsible for managing the Nuclear Regulation Division of the Nuclear Operations Support Department. In addition, I am responsible for managing and coordinating the Company's efforts in the ASLB licensing proceedings.

3. Q. Please state your professional qualifications.

A. The attached resume summarizes my professional qualifications. My familiarity with the electrical separation issue stems from my involvement in licensing and engineering matters concerning Shoreham, both as a Regulatory Supervisor and in my previous position as Manager of Project Engineering for the Shoreham Station. I have worked on Shoreham for nine years.

4. Q. Are you familiar with Suffolk County Contention 31 and Shoreham Opponents Coalition Contention 19(g)?

A. Yes. They are substantively the same.

5. Q. What issues are presented in those contentions?

A. The intervenors contend that LILCO has not adequately separated electrical cables and raceways at Shoreham in compliance with Regulatory Guide 1.75 Revision 2 and Section 3.12 of the FSAR.

6. Q. How is separation of cables achieved at Shoreham?

A. At Shoreham, cables between equipment and panels are run in cable raceways, that is, in conduits, duct and cable trays with short sections (less than 4 feet) not supported. Conduits are round galvanized rigid steel

enclosures, normally 10 feet long, with threaded ends and couplings. A duct is a round PVC enclosure encased in concrete and usually run underground between buildings. Cable trays are a means of supporting cables. The trays consist of channel sides with rungs between them similar to a ladder and are called open ladder-type cable trays. Some of these cable trays have been specified with solid bottoms to enclose the bottoms and the sides of the cables.

The major electrical divisions at Shoreham are denoted by the colors red, blue, and orange. These divisions are backed up by the respective red, blue, and orange diesel generators. Throughout the plant, the cable raceways are arranged to provide the greatest separation possible, with special attention to cable trays since they afford less protection than conduits. In plant areas where separate rooms with three-hour fire-rated walls have been provided for redundant equipment, safety-related raceways are separated to their corresponding rooms. When a redundant cable tray of necessity passes through these rooms, it is totally enclosed to provide greater protection.

In the Relay Room at elevation 44'-0" of the Control Building, which is also used as the cable spreading area for cables entering the Control Room, separate rooms could not be provided. Within the relay room, the Class 1E red cable trays and the Class 1E blue cable trays are laid out between each other, similar to interlocking fingers, such that the red and blue trays are never above one another and have a separation of at least 3 feet horizontally instead of the 1 foot required by IEEE Standard 384-1974 (IEEE-384). The Class 1E orange cable trays within the relay room are totally enclosed by the use of solid tray covers, top and bottom.

In the Reactor Building, safety-related equipment including cable raceways have been segregated with approximately half of the building containing Class 1E red trays and the other half containing Class 1E blue trays. Cables for the Class 1E orange equipment are installed within enclosed raceways throughout the Reactor Building. This affords greater protection to these cables that are redundant to both the red and blue cables.

7. Q. Does this cable-separation arrangement comply with Regulatory Guide 1.75 Revision 2?

A. Revised FSAR Table 223.12-3, appearing on page 12 of my testimony, provides a comparison of the Shoreham cable tray separation criteria with IEEE-384 and Regulatory Guide 1.75 Revision 2. (Revision 1 of 1.75 is substantively the same as Revision 2, with the exception of references to certain fire-protection measures.) As stated in Revision 2, "IEEE Standard 384-1974 . . . provides an adequate basis for complying with IEEE Standard 179-1971 and the Commission's General Design Criteria 3, 17 and 21 of Appendix A to 10 CFR Part 50 with respect to the physical independence of the circuits." Although in my opinion Revision 1 and Revision 2 are not applicable to Shoreham, separation of electrical cables and raceways between equipment and panels at Shoreham meets the Revision 2 and IEEE-384 criteria, as can be seen from the table on page 12 of my testimony. Additionally, while the IEEE-384 standard allows for reduction of spacing by use of enclosed trays and conduits, Shoreham conservatively applied the same separation requirements to conduits as to trays, thereby exceeding the Regulatory Guide requirements.

8. Q. Has the NRC reviewed the separation criteria for Shoreham?

A. Yes. The NRC Staff in Section 7.6.6 of the Safety Evaluation Report documented the review of the separation criteria to assure the physical independence of redundant instrumentation, control and electrical equipment. The Staff concluded that the Shoreham design is satisfactory.

9. Q. Does LILCO rely solely upon separation of electrical cables to assure safe shutdown capability at Shoreham?

A. No. Automatic CO_2 flooding systems, actuated by either products of combustion or temperature, are installed to protect the cable spreading and relay room, all three emergency switchgear rooms, the three safety-related battery rooms and the three emergency diesel generator rooms. To provide for early warning in the event of a fire, smoke detectors are located in these rooms in addition to temperature detectors. Both the smoke and temperature detectors alarm in the control room to alert the operators. An automatically activated halon fire suppression system is also installed in the Remote Shutdown Panel Room, and the entire Reactor Building is protected by a fire

detection system. All cable is fire retardant and will therefore not readily support or propagate a fire.

Additionally, LILCO has completed a two year Cable Separation Study (Separation Study) and submitted it to the NRC on December 31, 1980 (SNRC-536).

10. Q. Is such a Cable Separation Study required by Regulatory Guide 1.75 Revision 2?

A. No.

11. Q. Please describe the Separation Study.

A. This conservative evaluation separated the Reactor Building primary containment into 60° sectors and the secondary containment into 45° sectors, as shown in Figures 4.1.1-1 and 4.1.2-1 on pages 13 and 14 of my testimony. (These zones are significant when compared to the general 5' vertical and 3' horizontal separation criteria of IEEE-384.) The conservative assumption in the analysis is that an "exposure fire" destroys all cable and instrumentation contained in or passing through the assumed zone, with the zones extending from floor to ceiling. The analysis demonstrated that, even assuming loss of offsite power,

loss of any zone will not prevent safe shutdown of Shoreham. As part of this analysis, the zones were rotated 30° for the primary containment and 22 1/2° for the secondary containment, and the evaluation repeated.

12. Q. Did LILCO always comply with FSAR 3.12 in installing cables?

A. No. The Nuclear Regulatory Commission's Inspection and Enforcement Report 50-322/79-07, dated August 21, 1979, noted instances where the stated separation criteria contained in FSAR 3.12 were not achieved due to field conditions. Where the separation has not been achieved as required by the Work Specification, an Engineering and Design Coordination Report (E&DCR) is issued. The site practice for the Work Specification has been and continues to be to achieve the committed-to separation wherever possible.

13. Q. What does LILCO plan to do about the deviations from FSAR 3.12?

A. LILCO has discussed the possible solutions with the NRC. The Commission, in Mr. R. L. Tedesko's letter of August 31, 1981 to Mr. M. S. Pollock, suggested four options:

1. correct the deficiency by meeting the electrical equipment separation criteria set forth in Section 3.12 of the Shoreham Final Safety Analysis Report;

2. correct the deficiency by meeting Regulatory Guide 1.75, "Physical Independence of Electric Systems," Revision 2 dated September, 1978;

3. correct the deficiency by installing an acceptable barrier; or

4. justify the deficiency by performing a specific analysis for each cable or raceway where the minimum separation is not met to demonstrate that a failure will not propagate because of the insufficient separation.

14. Q. How has LILCO responded to these suggestions?

A. LILCO replied to the NRC letter in SNRC-670, dated February 18, 1982, advising the NRC that we have implemented a program applying one of the options to each deviation as documented on appropriate E&DCR's or Non-Conformance and Disposition Reports (N&D's). As noted in this letter, options 3 and 4 have been clarified in accordance with LILCO's understandings from previous technical meetings with the NRC staff on this matter. NRC responded on March 15, 1982 in a letter from Mr. A. Schwencer to M. S. Pollok. The Staff encouraged LILCO to strive to use either option 1, 2 or 3 since option 4 would require a substantial systems review by the NRC.

15. Q. What are the separation deviations present at Shoreham?

A. 85% of the separation deviations are for conduit to conduit, 13% for conduit to tray, and 2% miscellaneous.

16. Q. How will these deviations be resolved?

A. Shoreham's criteria per the Work Specification for separation between conduits exceeds IEEE-384. Therefore, the conduit-to-conduit installations will in general be accepted as-is, since the installed condition exceeds the IEEE requirements. For conduit to tray, compliance will be achieved by covering the exposed tray in the area where the required separation is not achievable. Approximately 2% of the deviations will be resolved by reworking raceways to conform to the IEEE-384 requirements.

17. Q. Mr. McCaffrey, please summarize your testimony on electrical separation at Shoreham.

A. The electrical cables and raceways between equipment and panels are adequately separated at Shoreham in compliance with the applicable portions of Regulatory Guide 1.75 Revision 2. In addition, automatic CO2

flooding systems, smoke detectors, and the Cable Separation Study further assure safe shutdown capability at Shoreham.

Deviations from the stated separation criteria contained in FSAR 3.12 and the associated Work Specification are being resolved using one of four options developed by the NRC.

Table 223.12-3 (Revised)
Cable Tray Separation in Nonhazardous Areas

Redundant Class IE Trays	IEE Std. 384-74 and Reg. Guide 1.75 (Rev. 1)	SNPS-1
Cable Spreading Area		
Vertical	3 ft (1)	3 ft (1)(3)
Horizontal	1 ft (1)	1 ft (1)(4)
Tray Covers	none required (1)	none required (1)
General Plant Areas		
Vertical	5 ft (1)	5 ft (1)(3)
Horizontal	3 ft (1)	3 ft (1)
Tray Covers	Non required (1)	None required (1)
Non-Class 1E & Class 1E Trays		
Cable Spreading Area		
Vertical	3 ft (1)	3 ft (1)(2)
Horizontal	1 ft (1)	1 ft (1)(4)
Tray Covers	none required (1)	none required (1)
General Plant Area		
Vertical	5 ft (1)	5 ft (1)(2)
Horizontal	3 ft (2)	3 ft (1)
Tray Covers	none required (1)	none required (1)
Cable Specification	no requirement except for associated circuits	Same as Class 1E
Fire Protection	none required	Auto CO_2 in Cable Spread. Area, Diesel Generator Rooms, Emergency and Normal Switch-gear Rooms.

Notes: 1) IEEE std. 384-1974 as imposed by Reg Guide 1.75 allows reduction of spacing requirement to 1 inch vertically or horizontally where solid tray covers or solid trays are utilized.

2) Vertical separation for SNPS-1 is measured from the bottom of the top tray to the bottom of the side rail of the bottom tray instead of the bottom of the top tray to the top of the side rail of the bottom tray as stated in IEEE std. 384.

3) Redundant trays are never in the same vertical stack.

4) Mostly three feet.

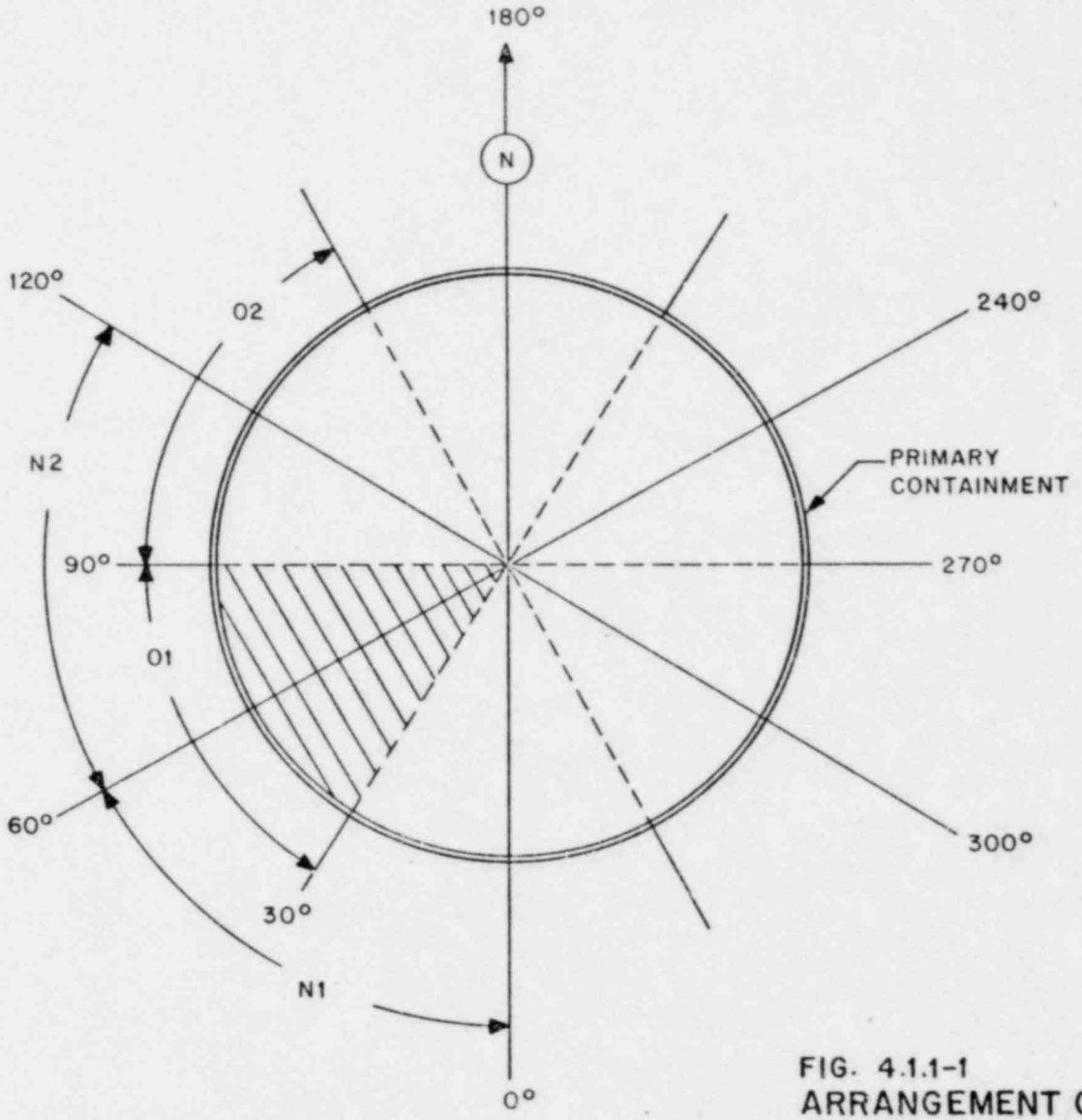

FIG. 4.1.1-1
ARRANGEMENT OF PRIMARY CONTAINMENT AREAS
SHOREHAM NUCLEAR POWER STATION-UNIT 1
CABLE SEPARATION ANALYSIS REPORT

OVERLAP SEGMENT

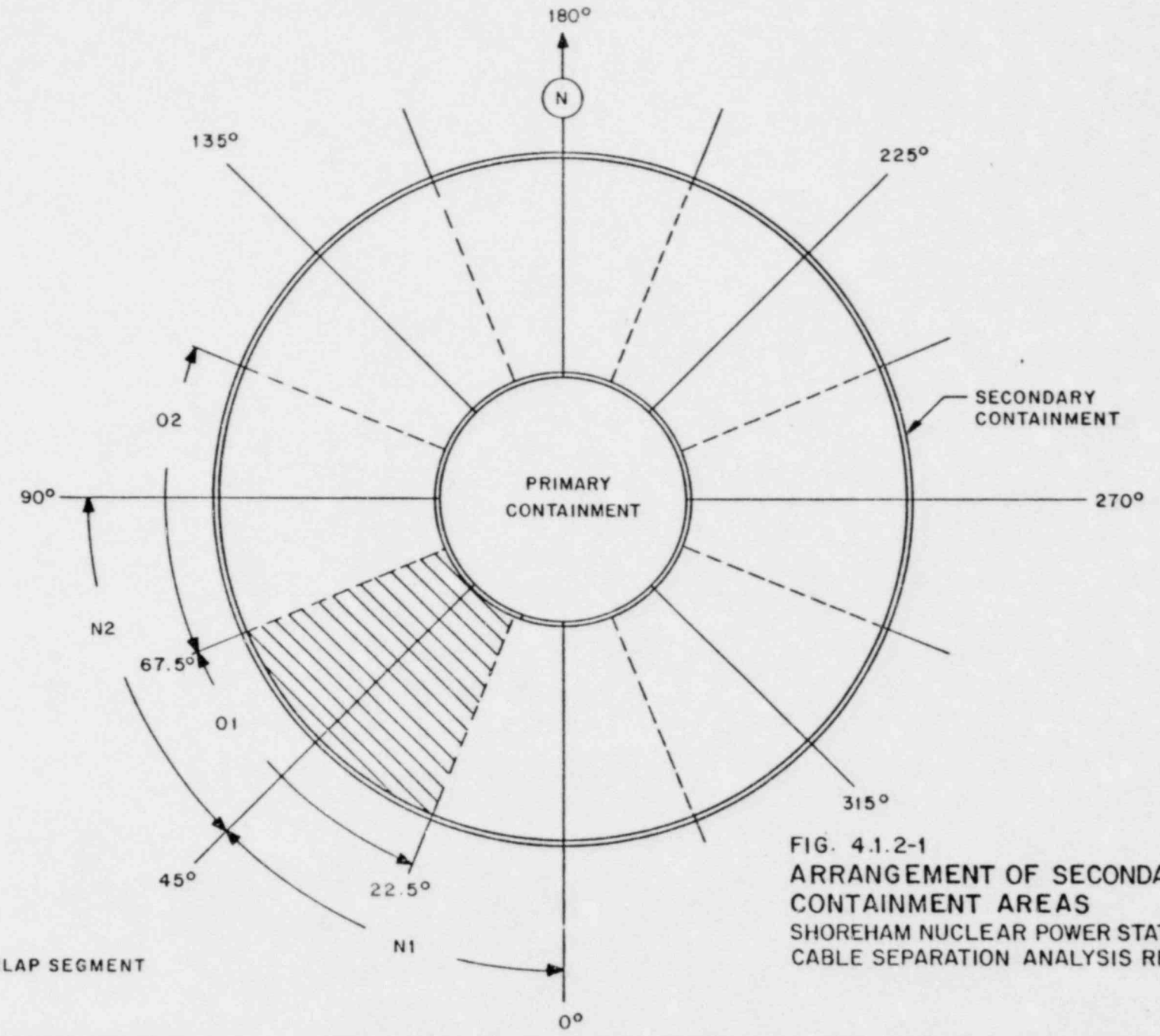

FIG. 4.1.2-1
ARRANGEMENT OF SECONDARY CONTAINMENT AREAS
SHOREHAM NUCLEAR POWER STATION-UNIT 1
CABLE SEPARATION ANALYSIS REPORT

PROFESSIONAL QUALIFICATIONS

Brian R. McCaffrey

Regulatory Supervisor

Long Island Lighting Company

My name is Brian R. McCaffrey. My business address is Long Island Lighting Company, 175 East Old Country Road, Hicksville, New York. I have been employed by Long Island Lighting Company (LILCO) since 1973, and have been Regulatory Supervisor for LILCO since November 1981, responsible for managing the Nuclear Regulation Division of the Nuclear Operations Support Department. In addition, I am responsible for managing and coordinating the Company's efforts in the ASLB Licensing Proceedings. The Nuclear Regulation Division will support the operation of the Shoreham Station in coordination of all NRC licensing activities, the Nuclear Review Board and the management of the Independent Safety Engineering Group.

I graduated from the University of Notre Dame in 1967 with a Bachelor of Science Degree in Aerospace Engineering. I received a Master of Science Degree in Aerospace Engineering in 1972 from the Pennsylvania State University and a Master of Science Degree in Nuclear Engineering in 1978 from the Polytechnic Institute of New York. I completed a General Electric BWR Design Orientation Course in 1978.

My professional experience began with my employment with Grumman Aerospace Corporation in 1966. My primary responsibilities were in the areas of aircraft aerodynamics and flight test stability and control.

I joined LILCO in 1973. I have held the positions of Associate Engineer and Engineer in the Power Engineering Department (1973-1975), where I was involved with plant engineering for both fossil and nuclear power stations. I then became Senior Engineer in the Power Engineering Department (1975-1977), with responsibilities as Project Coordinator for gas turbine installations and Lead Mechanical Engineer for nuclear projects; Senior Licensing Engineer for Shoreham Nuclear Project (1977-1978), with responsibility for the licensing activities leading to an Operating License; and Project Engineer for Shoreham (1979-1980), with responsibilities that included directing Project Engineering and the Architect Engineer in engineering and procurement for Shoreham.

I was assigned in 1980 as Assistant Project Manager for Engineering and Licensing (in July 1981, retitled Manager--Project Engineering) for Shoreham. In that capacity I was responsible for the overall engineering and licensing of the Shoreham Station. My organization directed and approved the engineering efforts of the Architect Engineer and Nuclear Steam Supplier, and was responsible for directing the activities leading to an Operating License from the NRC. I became Regulatory Supervisor in November, 1981.

I am a Registered Professional Engineer in the State of New York. In addition, I am a member of the American Society of Mechanical Engineers and the Long Island Section of the American Nuclear Society.