

February 16, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of

LONG ISLAND LIGHTING COMPANY

(Shoreham Nuclear Power Station,
Unit 1)

Docket No. 50-322
(OL)

AFFIDAVIT OF CARL BERLINGER

I, Carl Berlinger, being duly sworn, state as follows:

1. I am employed by the U. S. Nuclear Regulatory Commission and am currently assigned as the Manager of the TDI Project Group in the Division of Licensing. A copy of my professional qualifications is attached.

2. The purpose of this affidavit is to provide information concerning various matters raised in support of the NRC staff's response to Suffolk County's motion to admit supplemental diesel generator contentions.

3. As a result of the crankshaft failure at Shoreham in August 1983, the NRC staff began to look more closely at the manufacturing and performance history of emergency diesel generators manufactured by Transamerica Delaval, Inc. (TDI). The staff has compiled experience records from other nuclear power plants where TDI engines are installed and has been provided with information about the experience of TDI engines in several non-nuclear

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applications. Additionally, NRC staff members from the Vendor Inspection program performed two additional inspections of the TDI manufacturing facility in Oakland, California, in September and October of 1983.

4. The NRC staff has provided information regarding these activities to the Board via Board Notifications 83-160, 83-160a, 84-013, 84-018, 84-020, 84-021, and 84-024.

5. Members of the NRC staff also met with representatives of the TDI Owners Group on January 26, 1984. A transcript of that meeting was provided to the Board via Board Notification 84-020. During that meeting, Mr. Harold Denton, Director of the Office of Nuclear Reactor Regulation, presented the staff position regarding the acceptability of TDI diesel generators:

"And just so there is no doubt about where the staff stands on this issue, we are not prepared to go forth and recommend the issuance of new licenses on any plant that has Delaval diesels until the issues that are raised here today are adequately addressed."

6. The staff arrived at this position after considering the large number of operational problems experienced by TDI engines in both nuclear and non-nuclear service, the major crankshaft failure at Shoreham, and the history of TDI vendor inspections, especially the most recent ones. Taken together, these problems significantly reduce the staff's level of confidence in the reliability of all TDI diesel generators. The staff believes that the additional contentions proposed by Suffolk County closely parallel the concerns that the staff has, and that the contentions should be admitted.

7. In its pleading, LILCo argues that much of the information used to support the contentions has been available for some time. This cannot be denied, but it was only recently, after the crankshaft failure at Shoreham and the discovery of other significant problems like the piston failures, that a pattern of operational performance problems became apparent. The population of operating TDI diesel generators in service at licensed nuclear power plants is very small - two at San Onofre 1, and two at Grand Gulf 1. The engines at San Onofre were declared operational in 1977, but have accumulated only about 450 operating hours apiece since then. Most of the nuclear experience has been at Grand Gulf and Shoreham, during startup test programs within the last two years. Most of the problems with these engines have occurred or have been identified in the past year. Thus, even though some failures or problems may have occurred well before the Shoreham crankshaft failure, they are significant because they are links in the chain of operational problems.

8. LILCo also attempts to argue that matters concerning TDI diesels of different design at other nuclear stations or in marine service have no relevance to Shoreham. Ordinarily, it might not be reasonable to extrapolate the experience of one model of a particular manufacturer's machines to the remaining models. In the case of TDI diesel engines, however, the staff considers that some of the non-nuclear experience may be relevant to an evaluation of the suitability of the engines for nuclear service, and the

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experience of different engine types may be relevant to Shoreham. This is because the TDI approach to building these diesel engines utilizes a "building block" method. Components are standardized and combined in engines with varying numbers of cylinders to achieve the desired power output. For example, the San Onofre 1 EDGs are V-20 models; i.e., they each have two banks of 10 cylinders arranged in a V on a common crankshaft. The engines at Grand Gulf are V-16s. The engines at Shoreham are straight-8s. All of these engines use the same basic piston. The heads used on the V-type engines are interchangeable. Many other parts are common to all of the engines. It is therefore logical to conclude that piston problems identified at Shoreham may exist at other facilities and that problems at other facilities may exist at Shoreham. This is the basis for many of the Part 21 reports that have been issued by TDI.

Furthermore, the failure of a component which is machine-specific, such as a crankshaft, may still call into question the adequacy of other models of that component. If all of the crankshafts of TDI engines were designed by the same individual or design organization, and the failure of one crankshaft was determined to be attributable to inadequate design, then the design of the other crankshafts may reasonably be questioned.

LILCo admits the possibility of such common problems in its plans to consider non-Shoreham and non-nuclear TDI diesel engine problems during the design and quality review.

9. ~~The~~ results of the Vendor Inspection Program audits are directly relevant to the contentions, because there are direct correlations between quality problems at TDI and failures of original equipment and spare parts in the field. For example, a fuel oil line clamp had not been installed on a fuel line for each of the two engines at Grand Gulf, despite their being specifically identified on TDI drawings. As a result, the lines vibrated excessively and the lines failed, causing a fuel oil spray and a major fire. The inspector noted that the installation of the clamp had not been verified by a specific inspection procedure. A check of the current inspection procedure for another engine being built for nuclear service showed that the inspection procedure had not been modified to correct this problem. TDI continues to supply spare parts for the Shoreham engines, so until the Owners Group program addresses quality assurance questions independently, any reliance on TDI QA is questionable.

10. In its filing, the applicant also states that the need for reliable on-site emergency diesel generators is minimized by the reliability of the off-site sources of power. The applicant claims that this reliability arises from the several interconnections of its distribution system with other utilities, and the ability to "black start" gas turbine units located at nearby generating stations. An additional "black start" gas turbine is to be moved to the Shoreham site to add to this capability.

Unfortunately, the applicant makes no mention of the seismic or tornado resistance of these facilities or of the transmission lines into the plant. Without that information, the staff cannot determine what possible credit might be given for such capability in the staff's safety evaluation.

Similarly, until it receives the details of the applicant's analysis, the staff would not address the question of whether the emergency diesel generators are necessary to ensure safe operation at low power (below five percent).

11. To date, the staff has received final reports regarding the crankshaft failure, the connecting rod bearing failures, and the adequacy of the new crankshaft. We have also received a description of the Design Review and Quality Revalidation Program which LILCo is implementing in conjunction with the TDI Owners Group. Representatives of the Owners Group presented an overview of their program to the staff at the January 26, 1984 meeting.

12. With the exception of a list of the parts which LILCo intends to subject to design review and/or quality revalidation, the staff has received little from LILCo or the Owners Group regarding the details of the program and therefore has little hard information to balance against the operational and QA problems. The Owners Group has identified at least 16 significant known problems¹ which must be resolved. The staff understands that the remainder of the program is comprised of the following basic elements:

- (1) An independent design verification, to assure that critical engine parts are properly designed and that appropriate design requirements are established;
- (2) An independent verification of the as-manufactured quality of these parts for each engine (the extent of the verification effort would be commensurate with the importance of the particular part and its operational history); and

¹ See Board Notification 84-020, Enclosure 3, Slide IV-10.

- (3) A demonstration test program, with the number of tests and their extent reflecting the required reliability of the engines, and the uncertainty of the design and manufacturing process.

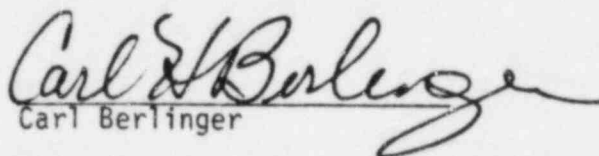
13. The staff believes that this proposal, if combined with a reassessment of the planned surveillance schedule for TDI diesel engines, can serve as a framework for a program to restore confidence in their reliability. Final approval of the engines would be contingent upon approval of the detailed program plan and its successful completion.

14. On February 10, 1984, the staff met with representatives of the Owners Group to discuss additional details of the program. As a result of that meeting, the Owners Group agreed to submit detailed task descriptions for all of the 16 known significant problems for Shoreham by February 17, 1984. The Owners Group also agreed to submit its overall detailed program plan by February 24, 1984. This represents a ten day delay from the February 14 date agreed upon during the January 26, 1984 meeting.

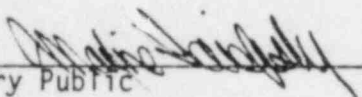
15. The staff intends to work very closely with the Owners Group during the development and implementation of the program. The staff plans to issue a safety evaluation report within 45 days of receipt of the detailed program plan. For each plant, a safety evaluation report will be issued regarding the 16 known significant problems within 45 days of the receipt of a plant-specific report addressing those problems.

16. Until the staff completes its review of the Owners Group program plan, it will not know when it will be able to support litigation of any of the contentions regarding the Shoreham diesel generators.

I hereby certify that the statements and opinions given are true and correct to the best of my personal knowledge and belief.


Carl Berlinger

Subscribed and sworn to before me
this 11 day of February 1984.


Notary Public

My commission expires: 2/1/84



Professional Qualifications of

Carl H. Berlinger

Division of Licensing

Office of Nuclear Reactor Regulation

United States Nuclear Regulatory Commission

My name is Carl H. Berlinger, I am the Group Manager of the TDI Project Group. In this position I manage the activities of the Project Group staff and coordinate the efforts of NRR and other offices, interface with industry and licensees and as appropriate keep the ACRS, hearing boards and the Commission informed regarding the status and resolution of this issue. I have held this position since January 16, 1984.

I received a Ph.D in Mechanical Engineering from the University of Connecticut in 1971, and a Bachelor of Science and a Master of Science degrees in Mechanical Engineering from Clarkson College of Technology in 1960 and 1962, respectively.

September 1981
to
January 1984
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UNITED STATES NUCLEAR REGULATORY COMMISSION

Division of Systems Integration - Core Performance
Branch

Branch Chief -

Duties included:

1. Management of the activities of a branch engaged in the review, analysis and evaluation of calculational methods used by applicants for the licensing of nuclear power plants in the fuel and core design areas of reactor plant engineering.
2. Responsible for development and application, in conjunction with consultants, of independent calculational methods including complex computer codes for the analysis of fuel and reactor core performance during steady-state, transient, and accident conditions.
3. Participates as a technical specialist on various NRC committees, subcommittees, panels, task force assignments, and on technical, industrial and professional society committees.
4. Represents the Commission in dealings with other governmental departments and agencies, national laboratories, industry and industry organizations in discussion of complex technical matters in the areas of new or proposed reactor systems.

November 1980
to
September 1981

USNRC

Division of Licensing - Systematic Evaluation
Program Branch

Section Leader - Systems Engineering

Duties included:

1. Supervised senior technical staff in the Systems Engineering section.
2. Responsible for the analysis, evaluation and safety reviews in the areas of thermal hydraulics, physics, site hazards, and safety analyses aspects of the reactor core, primary and secondary plant systems, electrical and auxiliary systems.

January 1980
to
November 1980

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USNRC

Division of Licensing - Operating Experience
Evaluation Branch

Branch Chief -

Duties included:

1. Organized newly formed branch; formulated goals and objectives.
2. Established procedures and significance criteria for systematic screening and technical review of domestic and foreign licensee event reports and operating experience reports, respectively.
3. Initiated staff reviews of significant licensee events.
4. Developed licensee event reporting requirements.
5. Managed and participated in the investigation of plant operating problems and identified generic reactor operating problems.

April 1976
to
January 1980

USNRC

Division of Operating Reactors - Reactor Safety
Branch

Section Leader -

Duties included:

1. Provided technical supervision and review of senior technical staff in the Reactor Safety Branch.
2. Planned, coordinated and reviewed safety design evaluations of reactor cores, reactor systems, and engineered safety features, and in accident analysis evaluations.
3. Acted as contract coordinator.
4. Served on the initial on-site response team sent to TMI.

5. Served as the team leader of the on-site response team sent to Oyster Creek following the 1979 plant transient.
6. Served as a reactor systems expert detailed to the Office of the Executive Director.

September 1973
to
April 1976

USNRC (AEC)

Division of Operating Reactors - Reactor Systems Branch

Senior Nuclear Engineer - Reactor Systems Section

Duties included:

1. Served as a senior reactor systems specialist.
2. Responsible for analyzing and evaluating proposed nuclear reactor designs in the areas of thermal hydraulics, nuclear and reactor system performance.
3. Represented the AEC before ACRS, licensee and industry meetings.
4. Responsible for making technical recommendations and formulating technical positions regarding standards, regulatory guides and codes as related to reactor safety.

August 1970
to
September 1973

COMBUSTION ENGINEERING CORPORATION

Nuclear Power Division - Accident Analysis Department

Principal Safety Engineer -

Duties included:

1. Responsible for the development of analytical tools for analysis of LMFBR maximum hypothetical accidents.
2. Performed quality assurance of complex computer codes and plant safety analysis (including LOCA and plant transients).
3. Presented testimony before ACRS regarding the San Onofre Units 2 and 3 plants.

February 1969
to
August 1970

4. Developed a transient steam generator/super-heater model for the once through steam generator with integral economizer.

UNIVERSITY OF CONNECTICUT

Mechanical Engineering Department

Graduate Teaching Assistant -

Duties included:

1. Taught undergraduate heat transfer course.
2. Designed, procured, constructed and operated all equipment and instrumentation required for Ph.D dissertation.
3. Administered a research budget of \$20,000.

August 1967
to
February 1969

PRATT AND WHITNEY AIRCRAFT

Advanced Power Systems

Senior Analytical Engineer -

Duties included:

1. Planning and coordinating research and development of advance engineering products.
2. Analyzed heat transfer, thermodynamic and aerodynamic problems.
3. Supervised the design, manufacture, testing and evaluation of new design concepts.

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NUCLEAR REGULATORY COMMISSION

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LONG ISLAND LIGHTING COMPANY	{	Docket No. 50-322
(Shoreham Nuclear Power Station,	}	(OL)
Unit 1)	}	

CERTIFICATE OF SERVICE

I hereby certify that copies of the executed "AFFIDAVIT OF CARL BERLINGER" and his Professional Qualifications in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class, or, as indicated by an asterisk, through deposit in the Nuclear Regulatory Commission's internal mail system, this 16th day of February, 1984:

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

Ralph Shapiro, Esq.
Cammer and Shapiro
9 East 40th Street
New York, NY 10016

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

Howard L. Blau, Esq.
217 Newbridge Road
Hicksville, NY 11801

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

W. Taylor Reveley III, Esq.
Hunton & Williams
P.O. Box 1535
Richmond, VA 23212

Jonathan D. Feinberg, Esq.
New York State Department of
Public Service
Three Empire State Plaza
Albany, NY 12223

Cherif Sedkey, Esq.
Kirkpatrick, Lockhart, Johnson
& Hutchison
1500 Oliver Building
Pittsburgh, PA 15222

Stephen B. Latham, Esq.
John F. Shea, III, Esq.
Twomey, Latham & Shea
Attorneys at Law
P.O. Box 398
33 West Second Street
Riverhead, NY 11901

Atomic Safety and Licensing
Board Panel*
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Atomic Safety and Licensing
Appeal Board Panel*
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Gerald C. Crotty, Esq.
Ben Wiles, Esq.
Counsel to the Governor
Executive Chamber
State Capitol
Albany, NY 12224

Fabian G. Palomino, Esq.
Special Counsel to the Governor
Executive Chamber
State Capitol
Albany, NY 12224

Herbert H. Brown, Esq.
Lawrence Coe Lanpher, Esq.
Karla J. Letsche, Esq.
Kirkpatrick, Lockhart, Hill,
Christopher & Phillips
1900 M Street, N.W.
8th Floor
Washington, D.C. 20036

Docketing and Service Section*
Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

James B. Dougherty, Esq.
3045 Porter Street, N.W.
Washington, D.C. 20008

Peter S. Everett, Esq.
Hunton & Williams
2000 Pennsylvania Avenue, N.W.
Washington, D.C. 20036

Bernard M. Bordenick
Bernard M. Bordenick
Counsel for NRC Staff

COURTESY COPY LIST

Edward M. Barrett, Esq.
General Counsel
Long Island Lighting Company
250 Old County Road
Mineola, NY 11501

Mr. Brian McCaffrey
Shoreham Nuclear Power Station
P.O. Box 618
Wading River, NY 11792

Marc W. Goldsmith
Energy Research Group, Inc.
400-1 Totten Pond Road
Waltham, MA 02154

Martin Bradley Ashare, Esq.
Suffolk County Attorney
H. Lee Dennison Building
Veteran's Memorial Highway
Hauppauge, NY 11788

Ms. Nora Bredes
Shoreham Opponents Coalition
195 East Main Street
Smithtown, NY 11737

Ken Robinson, Esq.
N.Y. State Dept. of Law
2 World Trade Center
Room 4615
New York, NY 10047

Chris Nolin
New York State Assembly
Energy Committee
626 Legislative Office Building
Albany, New York 12248

Mr. Jeff Smith
Shoreham Nuclear Power Station
P.O. Box 618
North Country Road
Wading River, NY 11792

MHB Technical Associates
1723 Hamilton Avenue
Suite K
San Jose, CA 95125

Hon. Peter Cohalan
Suffolk County Executive
County Executive/Legislative Bldg.
Veteran's Memorial Highway
Hauppauge, NY 11788

Mr. Jay Dunkleberger
New York State Energy Office
Agency Building 2
Empire State Plaza
Albany, New York 12223

Leon Friedman, Esq.
Costigan, Hyman & Hyman
120 Mineola Boulevard
Mineola, NY 11501

Copy to Mr. Smith
from Mr. Nolin