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 RICHARD A. HILL FOR THE LONG ISLAND LIGHTING COMPANY ON SUFFOLK COUNTY CONTENTION 10 -- ECCS CORE SPRAY

Purpose

This testimony establishes that Shoreham meets the requirements of 10 CFR 50.46 and Appendix K. The recent Japanese test data indicating that uneven, low or no core spray distribution may occur during a LOCA do not alter the conservative results of the ECCS analysis performed for Shoreham. GE test results, consistent with the subsequent Japanese test results, demonstrate that adequate core cooling is assured at Shoreham by the multiple cooling mechanisms present in the core following a postulated LOCA.

LILCO, May 13,1982

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TESTIMONY OF RICHARD A. HILL
FOR THE LONG ISLAND LIGHTING
COMPANY ON SUFFOLK COUNTY
CONTENTION 10 -- ECCS CORE SPRAY

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

A. My name is Richard A. Hill; my business address is General Electric Company, 175 Curtner Avenue, San Jose, California.

2. Q. What is your position with the General Electric Company?

A. I am the Manager of Systems Evaluation Programs in the Safety and Licensing Operation for the General Electric Company.

3. Q. Please state your professional qualifications.

A. The attached resume summarizes my professional qualifications. My familiarity with the core spray issue

stems from my work in my present position. I am responsible for resolution of generic technical issues regarding ECCS performance and conformance to the regulations.

4. Q. Are you familiar with Suffolk County Contention 10?

A. Yes.

5. Q. What issue is presented in that contention?

A. Suffolk County contends that recent Japanese test data described in BN-81-49 indicate that Shoreham does not meet the requirements for emergency core cooling systems in 10 CFR 50.46 and Appendix K with regard to core spray distribution and countercurrent flow.

6. Q. What is the Shoreham ECCS Core Spray System?

A. A General Electric boiling water reactor such as Shoreham has multiple safety systems that provide water to cool the core in the event of a loss-of-coolant accident (LOCA). One of these systems is called the low-pressure core spray (LPCS) system. It consists of two fully-redundant loops, each of which feeds several thousand gallons of water per minute to the top of the core in the event of a LOCA. The function of the LPCS system is to prevent fuel cladding heatup in the event the core is uncovered by a LOCA.

The core is cooled in part by directing jets of water down into the fuel bundles from spray nozzles mounted in a sparger ring located above the reactor core. The LPCS system is automatically triggered when there is a low reactor water level and/or high drywell pressure, indicating a loss of coolant to the core. Water is supplied to the vessel from the suppression pool. The system begins injecting water into the vessel only after the reactor vessel pressure has been significantly reduced, and continues to operate until it is manually stopped by the operator.

7. Q. Are there core spray distribution and countercurrent flow requirements in 10 CFR 50.46 and Appendix K?

A. No. There are no specific requirements in 10 CFR 50.46 and in Appendix K regarding core spray distribution and countercurrent flow. Section 50.46 requires that ECCS cooling performance be calculated for a number of different kinds of LOCA's using an acceptable evaluation model. Appendix K sets forth certain required and acceptable features of evaluation models. In particular, Appendix K specifies the value of the convective heat transfer coefficients that are to be used for BWR loss-of-coolant accident analyses. See 10 CFR Part 50 Appendix K, Section I.D.6.b. These convective heat transfer coefficients are used to calculate heat removal capability from the time the spray

systems reach rated flow until core reflood is predicted to occur.

8. Q. Does the current GE LOCA evaluation model meet the requirements of 10 CFR 50.46 and Appendix K?

A. Yes. GE's model uses the required Appendix K convective heat transfer coefficients.

9. Q. Are you familiar with the recent Japanese test data described in BN-81-49 concerning core spray distribution?

A. Yes.

10. Q. What do those tests suggest?

A. The information received thus far on the Japanese test results indicates that the central bundles may receive uneven or low spray flow (1 gallon per minute) during a LOCA event. Preliminary results from additional such tests indicate that the central bundles may receive no core spray distribution. This information is consistent with results obtained by GE in tests performed in the United States.

11. Q. Do the BN-81-49 and other test results indicate that Shoreham will not have the capability to adequately cool the core in the event of a postulated LOCA?

A. No. Appendix K specifies that convective heat transfer shall be calculated using coefficients based on appropriate experimental data. The GE tests that have been performed show little degradation in heat

transfer for spray flows as low as 1 gallon per minute per bundle. Even at zero direct core spray flow to the central bundles there is adequate coolant from water that has accumulated above the core. The convective heat transfer coefficients used in the GE ECCS evaluation model are based on the specified Appendix K values and are adequately conservative, relative to the GE test data.

12. Q. Are there any other phenomena that provide cooling to the core during this core spray period of LOCA?

A. In the Shoreham BWR, heat transfer during the spray period is also provided by a multiplicity of other phenomena independent of the heat transfer due to vaporization of the core spray fluid. Three of the phenomena that contribute to lower core temperatures are (1) steam cooling from the uprush of steam through the core, (2) fast core reflood from spray water moving down through quenched bundles to the lower plenum and (3) the holdup of water in the bundles due to countercurrent flow limiting (CCFL) at the side entry orifice. These mechanisms together provide much greater convective heat transfer than that prescribed by Appendix K convective heat transfer coefficients, even with uneven or reduced core spray distribution.

13. Q. In summary, how would you describe the effect of the current Japanese test data on the adequacy of the Shoreham ECCS calculations?

A. The Japanese test data do not alter the conservative results of the ECCS analysis performed for Shoreham. GE tests have verified that the GE ECCS model, which uses the coefficients prescribed by Appendix K, is sufficiently conservative to assure adequate cooling of the core following a LOCA. Adequate cooling is accomplished by the multiple cooling mechanisms present in the core during the spray period. Therefore, Shoreham complies with 10 CFR 50.46 and Appendix K.

PROFESSIONAL QUALIFICATIONS

Richard A. Hill

Systems Evaluation Programs Manager

General Electric Company

My name is Richard Hill. My business address is 175 Curtner Avenue, San Jose, California. I am employed by General Electric Company (GE) as Systems Evaluation Programs Manager and have held this position since September 1980. In this capacity, I supervise technical program managers for several licensing issue topics.

I received a Bachelor of Arts in biochemistry from the University of California at Berkley in 1969, and a Master of Science in engineering management from the University of Pittsburg in 1977. I have also completed a continuing education course in reliability and risk analysis at George Washington University, and one in man-machine interface engineering at the University of Wisconsin.

Following five years' service in the United States Navy nuclear power program, I joined Westinghouse Electric Corporation, where I was Senior Engineer in the Westinghouse Pressurized Water Reactor Systems Division (1974-1977). In that capacity I acted as program manager and was responsible for planning, implementing, and controlling multi-divisional research programs in human factors and systems integration.

I moved to GE in 1977. From 1977 to 1980 I was Principal Engineer acting as program manager responsible for coordination and integration of programs in dynamic load analysis of equipment and BWR safety analyses in response to Three Mile Island. I became Systems Evaluation Program Manager in September, 1980.