UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD 4/12/82

In the Matter of	)	
	)	
LONG ISLAND LIGHTING COMPANY	)	Docket Number 50-322
	)	
(Shoreham Nuclear Power Station, Unit 1)	)	

NRC STAFF TESTIMONY OF SUMMER B. SUN
ON ECCS CORE SPRAY

(Suffolk County Contention 10)

OUTLINE OF TESTIMONY

This testimony addresses the concerns related to adequacy of the Emergency Core Cooling System (ECCS) as indicated in Suffolk County Contention 10.

The testimony describes the information from Japanese core spray tests which is available to the Staff and discusses its implications on performance of the Shoreham ECCS.

The testimony concludes that the information from the Japanese test does not pose a safety concern for the Shoreham plant for two reasons:

1. The core spray distribution noted in the available Japanese date indicates a coolant flow rate sufficient to achieve the heat transfer coefficient required by Appendix K.

2. GE analyses demonstrate that even assuming no core spray cooling, the peak clad temperature will not exceed the 10 C.F.R. § 50.46 clad temperature limit of 2200°F.

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NRC STAFF TESTIMONY OF SUMMER B. SUN
ON SC CONTENTION 10

Q. Please state your name and position with the NRC.

A. My name is Summer B. Sun. I am employed by the U.S. Nuclear Regulatory Commission as a Nuclear Engineer in the Core Performance Branch of the Division of Systems Integration.

Q. Have you prepared a statement of professional qualifications?

A. Yes. A copy of my professional qualifications is attached.

Q. What is the purpose of your testimony?

A. The purpose of this testimony is to respond to Suffolk County Contention 10 which is as follows:

> Suffolk County contends that LILCO and the NRC Staff has not adequately demonstrated that the Emergency Core Cooling System (ECCS) for Shoreham meets the requirements of 10 C.F.R. § 50.46 and Appendix K with regard to core spray distribution and counter current flow, as shown by the recent Japanese test data described in BN-81-49.

Q. Explain the term "core spray distribution."

A. "Core spray distribution" refers to the flow of water from the core spray to each fuel rod bundle. The Staff's concern is to assure that the minimum flow of water to each bundle is consistent with the assumptions used for the core spray cooling in General Electric's (GE) ECCS Evaluation Model.

Q. What assumptions are used in GE's ECCS Evaluation Model for core spray cooling?

A. The minimum heat transfer coefficient for core spray cooling as specified in 10 C.F.R. Part 50, Appendix K, § D.6 is 1.5 Btu/hr-ft^2-°F. This value is used in the GE ECCS Evaluation Model.

GE assumed that the minimum flow to each bundle to achieve the heat transfer coefficient is on the order of 1 gallon per minute (gpm). This has been verified by GE in the FLECHT data (APED-5529, "Core Spray and Core Flooding Heat Transfer Effectiveness in a Full-Scale Boiling Water Reactor Bundle," June 1978, F.A. Schraub and J.E. Leonard).

Q. What is the Japanese test data on core spray distribution referred to in Suffolk County Contention 10?

A. As presented in Board Notification BN-81-49, the NRC Staff currently possesses only preliminary data from the Japanese core spray test referred to in Contention SC 10. The full data from Japan are not available. The Staff is attempting to obtain complete data on an expedited basis.

However, the test data now available from Japan indicates that the core spray distribution was determined for a simulated BWR/5 spray nozzle in a steam environment for a 60° sector of the core. The data indicate a lower core spray flow for the central fuel bundles.

We have also been informed, although we do not yet possess any data, that the same test has been done by the Japanese for a 360° full scale facility, for a BWR/5 configuration with 5 out of every 6 spray nozzles blocked. The 360° test gave similar results to the 60° sector test with respect to the relatively low core spray flow for the central fuel bundles.

Q. Shoreham is a BWR/4 core. If the Japanese test is for a simulated BWR/5 core, can the Japanese data be applied to Shoreham?

A. Because a BWR/4 has a similar spray nozzle design to a BWR/5, the Japanese core spray distribution results may also apply to a BWR/4.

Q. Describe the results, as far as they are available, of the 60° sector Japanese test.

A. In the data available, the flow of water to the fuel rod bundles decreased with a decrease in distance from the center of the core, with a minimum flow on the order of 1.5 gpm at a radius of approximately 5 inches. The available data provide no information for core spray distribution to fuel bundles closer to the center of the core than the approximate 5 inch radius.

Q. Does the information available to the Staff from the Japanese core spray tests pose a safety concern for Shoreham?

A. The Staff concludes that the information from the Japanese tests does not pose a safety concern for Shoreham.

The Japanese data available demonstrate that for fuel bundles located at radii greater than approximately 5 inches from the center of the core, the minimum core spray flow is on the order of 1.5 gpm. This would remain consistent with the core spray cooling assumptions employed in the present GE ECCS Evaluation Model which meets the heat transfer

coefficient requirements of Appendix K. As stated above, GE has assumed and verified that the minimum flow to each bundle to achieve the heat transfer coefficient requirement is on the order of 1.0 gpm.

Q. Can the curve for the core spray distribution defined by the available Japanese data be extrapolated to radii less than 5 inches from the center of the core?

A. The Staff does not presently have enough information to know whether or not we can extrapolate the Japanese data to the center of the core. Presently we have no details on such variables as the spray nozzle arrangement or test conditions.

Q. Assume you did extrapolate available Japanese data to the center of the core, and assume that there is no core spray in the center region. What would be the implication on safety of no core spray cooling?

A. In response to our request, analyses were performed by GE for a limiting BWR/4 core to evaluate the effects of no core spray cooling on the peak clad temperature.

Assuming that the core spray coolant flows down peripheral channels to increase the reflood rate as observed in the U.S. Lynn Test, the calculated peak clad temperature did not exceed the 10 C.F.R. § 50.46 peak clad temperature limit of 2200°F. This analysis indicated that even with no credit taken for core spray cooling effects, the BWR/4 would not violate the safety acceptance criteria.

Q. What is your conclusion?

A. The Staff concludes that spray distribution adequacy is not a safety concern for Shoreham since the requirements of 10 C.F.R. § 50.46

and Appendix K are satisfied even without taking credit for core spray cooling, and, accordingly, that Suffolk County Contention 10 is without merit.

Summer B. Sun
Core Performance Branch
Division of Systems Integration
U. S. Nuclear Regulatory Commission

PROFESSIONAL QUALIFICATIONS

I am employed as a nuclear engineer of the Thermal-Hydraulics Section in the Core Performance Branch of the Division of Systems Integration.

I received a Ph.D degree with Chemical Engineering Major from University of Missouri of Columbia, Missouri, in 1974. I am a registered Professional Engineer, Certificate Number 11309, in the state of Connecticut.

In my present work assignment at the NRC, I have technical responsibility for the review of the reactor core thermal-hydraulics design submitted in BWR reactor construction permit and operating license applications. In addition, I participate in the review of analytical models used in licensing evaluation of the core thermal-hydraulic behavior under various operating and postulated accident and transient conditions. The latter responsibility includes technical review of the instrumentation for monitoring inadequate core cooling to comply with the Commission requirements.

Prior to joining the NRC staff in August 1980, I was employed by Combustion Engineering Company, as a consulting engineer. I was responsible for the development and application of computer codes for the analysis of transients for PWRs. I acted as a consultant to the Safety Analysis Section of Combustion Engineering Company (CE) in the use of these codes for analysis of CE plants in the area of safety and performance analyses. My tenure at CE was from 1974 through 1980.