UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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

TESTIMONY OF STEVEN J. STARK
FOR THE LONG ISLAND LIGHTING COMPANY
ON SUFFOLK COUNTY CONTENTION 28(a)(i) AND SOC
CONTENTION 7A(1) -- ECCS CUT-OFF

PURPOSE

This testimony shows that installation of the automatic restart feature for low pressure ECCS recommended by NUREG-0737, Item II.K.3.21 would not significantly improve, and might even decrease, the safety of the plant. An automatic restart feature already exists for the high pressure emergency core cooling system. The BWR Owners' Group symptom-oriented Emergency Procedure Guidelines, the Shoreham emergency operating procedures and operator training ensure that the function to be performed by the proposed automatic restart feature for low pressure ECCS will be performed by the operator. This testimony shows that automatic restart logic for the low pressure ECCS would have a negative impact on the plant by reducing plant operational flexibility and increasing system complexity.

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Before the Atomic Safety and Licensing Board

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TESTIMONY OF STEVEN J. STARK FOR THE LONG ISLAND LIGHTING COMPANY ON SUFFOLK COUNTY CONTENTION 28(a)(i) AND SOC CONTENTION 7A(1) -- ECCS CUT-OFF

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

   A. My name is Steven J. Stark. My business address is the 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 BWR Evaluation Programs, Nuclear Energy Business Operations.

3. Q. Please state your professional qualifications.

   A. My resume, which appears on pages 12-13, describes my professional qualifications. My familiarity with the

issues raised in SC Contention 28(a)(i) and SOC Contention 7(A)(1) stems from my current position. I have had primary responsibility for working with the BWR Owners' Group in addressing post-TMI requirements for BWRs including NUREG-0737, Item II.K.3.21.

4. Q. What do SC Contention 28(a)(i) and SOC Contention 7A(1) involve?

A. At the outset, let me note that these two contentions are identical; thus my remarks apply equally to both. These contentions allege that Shoreham does not comply with 10 CFR § 50.46 and § 50.55a(h) because the recommendations of NUREG-0737, Item II.K.3.21 have not been met.

5. Q. What does Item II.K.3.21 recommend?

A. This item recommends that the core spray and low pressure coolant injection systems of a BWR have the capability to restart automatically following shut off by the operator if the low-low water level initiation signal is still present.

6. Q. Does Shoreham have an automatic restart feature?

A. The emergency core cooling system (ECCS) design for Shoreham consists of four systems to protect the core against various hypothetical pipe breaks. Three systems inject water into the core and one is a reactor vessel automatic depressurization system (ADS). The three injection systems are the high pressure coolant injection (HPCI) system, low pressure coolant injection (LPCI) system, and core spray (CS) system.

The HPCI system for the Shoreham plant will restart automatically following manual termination if the necessary signals of low reactor water level or high drywell pressure persist or reappear. The HPCI pump will supply minimum rated flow of 4250 gpm to the vessel down to a vessel pressure of 147 psig. Below 147 psig flow rate drops as steam pressure drops. This system will automatically provide significant core cooling should the operator attempt to manually shut off the systems.

The low pressure ECCS (LPCI and CS) do not automatically restart following manual termination.

7. Q. Please explain what you mean when you say they will not restart automatically.

A. The motor control switch for each CS and LPCI pump has four positions: start, auto, stop and pull to lock. The switch will spring return from start and stop to the auto position. When the switch is turned to the start position, the pump will operate. In the auto position, the pump will be ready for automatic operation if called upon. When the switch is turned to the stop position, the pump stops. In the pull to lock position, the pump also will not run. This last position is used for maintenance to ensure the safety of persons working on the system.

In the event a loss of coolant accident causes the pump to start when the switch is in auto, it will continue to run until the operator manually turns it off. When the pump is secured manually and the switch returns to auto, the pump will not automatically restart if an actuation signal persists or returns unless the operator manually resets the system logic. In other words, the operator must take action to return the system to the automatic mode.

8. Q. Why doesn't Shoreham have a so-called automatic restart capability following manual termination?

A. The automatic restart of the low pressure ECCS following manual termination was considered by General Electric and the BWR Owners' Group in response to NUREG-0737, Item II.K.3.21. The study concluded that an automatic restart capability would, on balance, detract from plant safety. This conclusion rests on several factors. First, the implementation of the Reactor Pressure Vessel (RPV) control guideline of the Emergency Procedure Guidelines (EPG's), coupled with operator training, would ensure that the restart of the necessary low pressure ECCS at low RPV level would be performed by the operator. Second, automating the restart capability would reduce operator flexibility in controlling the low pressure ECCS. And third, the increased system complexity resulting from automatic restart logic would reduce system reliability.

9. Q. Why does the RPV control guideline of the EPG's help ensure that proper action is taken?

A. The EPG's are guidelines to be used by individual utilities in developing plant specific operating procedures. They include operator instructions based on the existence of certain symptoms rather than the occurrence and identification of a specific accident. The RPV control guideline addresses symptoms that

include those that would automatically initiate the low pressure ECCS -- low RPV water level or high drywell pressure. The EPG's instruct the operator to control vessel water level based on the same symptoms that would cause the low pressure ECCS to automatically restart if that logic were installed. In this case, however, the operator is alerted to either of these conditions by the instrumentation displays and alarms in the control room. Consequently, the use of the EPG's coupled with operator training will provide for highly reliable manual control of RPV level during post-LOCA operations. This precludes the need for additional logic changes to provide automatic restart for the low pressure ECCS of the sort contemplated by NUREG-0737, Item II.K.3.21.

10. Q. Has LILCO used the EPG's in developing its emergency procedures for Shoreham?

A. Yes. The station procedures developed from the EPG's to respond to these emergency conditions emphasize restoration and maintenance of the RPV water level. They present a concise action sequence to the operator so that he can respond to accident or transient events.

11. Q. And are the operators trained to recognize when these procedures should be used?

A. Yes. The operators will be trained to use these procedures when any of the following conditions are present:

(a) low RPV water level

(b) high drywell pressure

(c) an isolation condition requiring or initiating a reactor scram

The operators have been trained to be acutely aware of the need to maintain RPV water level following a LOCA. The operator has redundant Class IE water level indication for monitoring RPV level. The operator will also be alerted to low water level conditions by audio and visual annunciators. In addition, the operator will have time available to react to low water level conditions. At least 15 minutes would elapse between the time "Level 1" (the lowest alarm level) is reached and the occurrence of 2200°F fuel clad temperature given zero reactor make-up flow. This assumes a large break in the recirculation system. If the break causing the LOCA is isolated, at least 30 minutes would be available.

12. Q. The second reason you gave for not installing automatic restart in the low pressure ECCS is reduced systems operational flexibility. Please explain.

A. Use of automatic restart of low pressure ECCS would reduce the flexibility the operator now has in controlling these systems. In certain instances, it may be necessary to shut down an ECCS pump during a LOCA. The existing system design allows that to be done in order to maintain the plant in a safe condition. A design change to install the automatic restart described in the contention would inhibit this capability.

13. Q. Under what conditions would an operator want to be able to secure an ECCS pump during a LOCA?

A. Examples of conditions that might require shutting down an ECCS pump during a LOCA include excessive ECCS pump seal leakage, breaks in ECCS piping and failure of an ECCS pump motor. As will be discussed later, complicated control logic could be designed to cope with some but not all of the circumstances that might exist during extended post-LOCA operation.

14. Q. Without a manual cut-off, what sorts of changes in plant conditions would require complicated logic or, possibly, would be precluded?

A. If, as would be expected following a LOCA, a high dry-well signal persisted, the operator might not be able to conduct necessary changes in plant conditions unless he could manually stop selected ECCS pumps. Operators must make decisions on the use of a number of systems based on the conditions present following an accident. Changes in plant conditions involving core cooling, suppression pool cooling, emergency diesel generator load assignment and drywell cooling all must be considered. Specific examples in which a manual shutoff would be desirable include the following:

(a) Electrical loads might have to be controlled by selectively securing some equipment (such as low pressure ECCS) for a short time so that other equipment could be started without overloading emergency power supplies.

(b) Core cooling might be maintained by the core spray system while the RHR system maintains containment cooling. An automatic restart shifting the RHR system back to the LPCI mode would not be necessary or desirable.

Thus, significant flexibility is gained by having the capability to manually secure low pressure ECCS. Installation of an automatic restart capability might interfere with these necessary plant operations, thus reducing the operator's ability to maintain the plant in a safe condition.

15. Q. The third reason you mentioned for not installing automatic restart was the increased complexity that would result. Please explain.

A. Existing ECCS logic would have to be modified so that, even though the system was manually turned off, the pumps would restart if a LOCA signal persisted or reappeared. Furthermore, for long term control of the reactor, the logic would become even more complicated. As already explained, in a post-LOCA situation changes in plant operations involving the low pressure ECCS operation might have to take place. The design of the automatic restart logic would have to anticipate the combinations of equipment that could be in use and then incorporate the appropriate controls to realign systems for automatic operation. These logic changes would not be impossible but would significantly increase system complexity.

16. Q. Please summarize your testimony.

A. The current design of the low pressure ECCS control circuitry for Shoreham provides the best approach for overall reactor safety. The installation of an automatic restart capability for low pressure ECCS offers no significant benefits. First, the HPCI system already has restart capability and can provide significant core cooling down to low RPV pressures. And second, the EPG's, the Shoreham emergency operating procedures developed from them, and operator training ensure that the operator will perform the same function as the auto-restart feature -- maintain RPV level.

On the other hand, the installation of auto restart would have significant drawbacks in reduced operational flexibility and increased system complexity. On balance, the change in design would not improve the safety of the plant.

Steven J. Stark
Manager, BWR Evaluation Programs
Nuclear Energy Business Operations
General Electric Company

My name is Steven J. Stark. My business address is General Electric Company, 175 Curtner Avenue, San Jose, California. I have been Manager of BWR Evaluation Programs since September 1979, responsible for providing licensing direction and program management of General Electric's response to post-TMI requirements. A major responsibility in this position has been the provision of support to the BWR Owners' Group and domestic utilities on an individual basis for their response to post-TMI requirements, such as those contained in NUREG-0737.

I graduated from the University of California at Berkeley in 1968 with a Bachelor of Science Degree in Mechanical Engineering. After three years of engineering experience at General Electric and completion of GE's Advanced Engineering Courses, I returned to the University of California and received a Master of Science Degree in 1972, also in Mechanical Engineering.

Prior to my current assignment, I was Manager of Mark I and II Containment Engineering from September 1976 to September 1979. In this position I was responsible for managing the evaluation of the containment response to design basis transients and accidents. This responsibility included evaluations of the

containment environmental conditions, containment structural loading and safety/relief valve (S/RV) discharge loading. The work performed by this unit covered the performance of tests, including in plant S/RV tests, verification of analytical models and the analysis of transients and accidents by the application of analytical models.

From September 1975 to September 1976 I held the position of Senior Engineer, Technical Leader in the Requisition Plant Containment Systems Unit, responsible for evaluating the hydrodynamic loading on Mark I containments due to loss of coolant accidents and S/RV discharges. From June 1974 to September 1975 I held the position of Engineer in the Nuclear Steam Supply Methods Unit responsible for developing advanced analytical methods and computer codes for the evaluation of the performance of Emergency Core Cooling Systems following loss-of-coolant accidents.

From July 1972 to June 1974 I held the position of Supervisor, Engineering Training Program. From December 1968 to July 1972 I participated in General Electric's Engineering Training Program taking several 6 month rotating work assignments to gain a broad overview of the work of the Nuclear Energy Business Operations.