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August 31, 1984

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

'84 101-8 P3:07

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of )  
LONG ISLAND LIGHTING COMPANY )  
(Shoreham Nuclear Power Sta. , )  
Unit 1) )

Docket No. 50-322-OL-4  
(Low Power)

NRC STAFF PROPOSED FINDINGS  
OF FACT AND CONCLUSIONS OF LAW

I. BACKGROUND

1. On March 20, 1984, the Long Island Lighting Company ("LILCO") filed a Supplemental Motion for a Low Power Operating License. Because at that time there were admitted contentions in the ongoing operating license proceeding raising questions about the adequacy of the onsite backup power system at Shoreham consisting of three diesel generators manufactured by Transamerica Delaval, Inc. ("TDI"),<sup>1/</sup> LILCO's Supplemental Motion relied in part on the adequacy of substitute backup power sources, including four diesel generators manufactured by the Electro-Motive Division of General Motors ("EMD") and a 20 MW gas turbine. Supplemental Motion at 19-20.

1/ The issuance of low power licenses is governed by 10 C.F.R. § 50.57(c). According to that Section, any party to an ongoing licensing proceeding has the right to be heard on a motion for a low power license to the extent that its contentions are relevant to the activity to be authorized. Because of the pending contentions challenging the adequacy of the TDI diesels, no credit could be taken for these diesels in a low power proceeding before resolution of these contentions. See Oral Argument of April 4, 1984, Tr. 17-20.

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2. LILCO's Supplemental Motion requested a license to conduct four phases of low power testing. Phase I would involve loading of fuel in the reactor vessel and precriticality testing. Gunther, Tr. 201-204. Phase II would involve initial criticality and testing at power levels of .0001% to .001% of rated power at essentially ambient temperature and atmospheric pressure, Gunther, Tr. 204-206; Rao, et al., Tr. 285-286. Phase III would involve reactor heatup and pressurization to rated pressure and temperature conditions (approximately 1% of rated power). Gunther, Tr. 207-208. Phase IV would involve testing at up to 5% of rated power. Gunther, Tr. 209-211.

3. A hearing addressing the adequacy of the backup power sources for low power operation commenced in Hauppauge, New York on April 24, 1984. The next day, the United States District Court for the District of Columbia issued a temporary restraining order suspending the proceeding. Tr. 580 et seq. The proceeding was later stayed by the Commission on April 30, 1984.

4. On May 7, 1984 the Commission held an oral argument to consider the applicability of the General Design Criteria (found in Appendix A to 10 C.F.R. Part 50), and particularly of GDC 17, to LILCO's Supplemental Motion. GDC 17 states in pertinent part:

Criterion 17--Electric power systems. An onsite electric power system and an offsite electric power system shall be provided to permit functioning of structures, systems, and components important to safety. The safety function for each system (assuming the other system is not functioning) shall be to provide sufficient capacity and capability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and (2) the core is cooled and con-

tainment integrity and other vital functions are maintained in the event of postulated accidents.

The onsite electric power supplies, including the batteries, and the onsite electric distribution system, shall have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure.

5. On May 16, 1984, the Commission issued CLI-84-8. In that Order, the Commission held that GDC 17 was applicable to low power operation<sup>2/</sup> and announced that if LILCO wished to seek an exemption from GDC 17, LILCO would have to discuss:

1. The "exigent circumstances" that favor the granting of an exemption under 10 C.F.R. 50.12(a) should it be able to demonstrate that, in spite of its noncompliance with GDC 17, the health and safety of the public would be protected.

2. Its basis for concluding that, at the power levels for which it seeks authorization to operate, operation would be as safe under the conditions proposed by it, as operation would have been with a fully qualified onsite A/C power source.

CLI-84-8 at 2-3 (footnote omitted).

6. The Commission also stated in Footnote 3 of its order:

The Commission regards the use of the exemption authority under 10 C.F.R. 50.12 as extraordinary. This method of relief has previously been made available by the Commission only in the presence of exceptional circumstances. See, United States Department of Energy, et al. (Clinch River Breeder Reactor Plant), CLI-83-1, 17 NRC 1, 4-6 and cases cited therein (1983). A finding of exceptional circumstances is a discretionary administrative finding which governs the availability of an exemption. A reasoned exercise of such

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<sup>2/</sup> LILCO had previously made it clear that it did not consider the 20 MW gas turbine or the four EMD diesels to be "onsite" power sources for purposes of GDC 17. Oral Argument of April 4, 1984, Tr. 44. Because LILCO concededly did not have an onsite AC power system other than the TDI's (which are involved in the full power litigation and hence cannot be relied upon for low power operation), LILCO's alternate configuration of the gas turbine and four EMD's could not meet the literal requirements of GDC 17 (which requires both an onsite and offsite power source).

discretion should take into account the equities of each situation. These equities include the stage of the facility's life, any financial or economic hardships, any internal inconsistencies in the regulation, the applicant's good-faith effort to comply with the regulation from which an exemption is sought, the public interest in adherence to the Commission's regulations, and the safety significance of the issues involved.

Of course, these equities do not apply to the requisite findings on public health and safety and common defense and security.

7. On May 22, 1984, LILCO filed its Application for Exemption. LILCO simultaneously filed Motions for Summary Disposition of Phases I and II. On July 24, 1984, the Board issued an Order granting in part and denying in part the Motions for Summary Disposition.<sup>3/</sup> The Board found that an exemption was needed from GDC 17 for Phases I and II and that the issuance of an exemption raised actual issues that required litigation. The Board also found that the Facts as to Which There is no Material Dispute included with the Motion (and supported in large part by the Staff in its Response of June 13, 1984) were not controverted by either Suffolk County or the State of New York and therefore were deemed admitted for the purposes of this proceeding. Order of July 24, 1984 at 10-14; see also 10 C.F.R. § 2.749(a).<sup>4/</sup>

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<sup>3/</sup> LILCO has requested that the Commission direct certification of the Board's Order ruling on the Motions for Summary Disposition and has also requested that the Board refer its ruling to the Commission. Both of these requests are still pending.

<sup>4/</sup> In brief, the admitted facts showed that no AC power is necessary during Phase I (Order of July 24, 1984 at 10-11) and that there would be (for the worst case analysis) on the order of months following a loss of all AC power before such power would need to be resorted to the site (Id. at 11-14).

8. Hearings on the Application for Exemption were conducted in Hauppauge from July 30th to August 7th, 1984. Direct testimony was presented by LILCO, the NRC staff, Suffolk County, and the State of New York. The hearing encompassed all issues raised by the exemption request except for security-related matters.<sup>5/</sup> Following the hearings, oral closing arguments were held in Bethesda on August 16, 1984.

## II. THE "AS SAFE AS" STANDARD

9. The second standard established by the Commission in CLI-84-8 is the "as safe as" standard. This standard deals with the safety aspects of low power operation with LILCO's proposed alternate power systems (the 20 MW gas turbine and the four EMD diesels). In determining whether this standard is met, two fundamental questions must be answered. First, what are the demands placed upon backup AC power during low power operation? And second, what assurance is provided that these demands will in fact be met in a timely manner?

### A. The Need for Backup AC Power During Low Power Operation

10. In assessing the need for backup AC power during low power operation, one must first determine the situations for which backup AC

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<sup>5/</sup> A separate proceeding concerning security matters is currently in progress.

power would be needed at Shoreham, and then determine how long under these situations the plant could remain in a safe condition without AC power being restored. To address these matters, the Staff presented Wayne Hodges and Ted Quay as witnesses. Mr. Hodges is currently a Section Leader in the Reactor Systems Branch of the NRC. In that position, he and six engineers whom he supervises are responsible for the review of primary and safety systems for boiling water reactors. He has previously been responsible for the review of the capability of boiling water reactors to cope with loss of feedwater transients and small-break loss of coolant accidents. He has also done professional work for the NRC in the area of thermal hydraulic performance of the reactor core and for DuPont's Savannah River Laboratory in the area of hydraulic and heat transfer testing. He holds a Master's Degree in Mechanical Engineering and is a registered professional engineer in the State of Maryland. Tr. 1740-41, 1782-83. Mr. Quay holds a Master's Degree in nuclear engineering. He has worked for the NRC for nine years in varying positions. For the last four years, Mr. Quay has been a Section Leader for the NRC's Accident Evaluation Branch. In that position, Mr. Quay and his section have been responsible for the review of fission product attenuation of accident mitigative features of both operating plants and plants under construction. Tr. 1742-43, 1799-1800. Both Mr. Hodges and Mr. Quay were authors of Section 15 of Supplement 6 to the Shoreham Safety Evaluation Report ("SSER 6").<sup>6/</sup>

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<sup>6/</sup> SSER was admitted into the record as Staff Exhibit LP-2 and was bound into the transcript following page 721.

11. LILCO presented as witnesses in this area a panel consisting of Dr. Atambir Rao, and Messrs. Eugene Eckert, George Dawe, and Robert Kascsak. Dr. Rao has worked for General Electric for eleven years; in April of this year he was promoted to Senior Program Manager, Advanced Engineering. Prior to reaching that position, he held the title of Manager, Plant Safety Systems Engineering, where his responsibilities included managing a group of engineers who performed a variety of plant safety performance analyses. Tr. 232-33, 266-68. Mr. Eckert is the Manager of the Plant Performance Engineering Group at General Electric. His group's responsibility is to evaluate the transient performance of Boiling Water Reactors. Tr. 234, 268-70. Mr. Dawe has worked for Stone & Webster Engineering since 1973; he has been assigned to the Shoreham project since 1974. He currently is Stone & Webster's Supervisor of Project Licensing for Shoreham. Tr. 235-36, 270-72. Mr. Kascsak is LILCO's Nuclear Systems Engineering Division Manager. Tr. 237-38, 273-274.

12. Neither Suffolk County nor the State of New York provided any direct testimony on the need for backup AC power during low power operation.

13. As to the need for AC power during Phases I and II, this Board in its July 24, 1984 ruling on summary disposition matters found that there was no need for AC power during Phase I, and that in the worst case analysis for Phase II (a loss of coolant accident), the plant could survive for months without restoration of AC power. See Order of July 24, 1984 at 10-14.

14. In determining the need for AC power during low power operation, LILCO reviewed the accident and transient analysis in Chapter 15 of its FSAR to determine the effect of low power operation on the public health and safety given the unavailability of TDI diesels. Chapter 15 provides the results of analyses for the spectrum of accidents and transients that must be accommodated by the Shoreham plant to demonstrate compliance with NRC regulations. Rao, et al., Tr. 275-76.

15. In performing its Chapter 15 analysis for low power, LILCO considered Phases III and IV together. The results of this analysis indicated that, at 5% power, three of the 38 events considered in Chapter 15 could not occur, and of the remaining 35, only four require the assumption of the unavailability of offsite power. Those four events are: loss of AC power, loss of coolant accident ("LOCA"), steam line break accident, and feedwater system piping break. Of these events, the LOCA is the most significant from a safety point of view. Rao, et al., Tr. 277, 298, 302. The analysis concluded that using very conservative assumptions, a LOCA at Phase III would require power restoration in approximately six hours; using more realistic assumptions, more than a day would be available before core cooling (and hence AC power) would have to be restored. Id., Tr. 302-03. LILCO's analysis indicated that during Phase IV, using the conservative assumptions, AC power has to be restored within 86 minutes; using more realistic assumptions, more than three hours are available before power is needed. Id. at 307.

16. The NRC Staff also reviewed the Chapter 15 events for their application to low power operation. The Staff found that five of the 38



events could not occur during Phases III and IV (in addition to the three events ruled out by LILCO (see Tr. 320-22), the Staff determined that control rod removal during refueling and fuel assembly insertion error during refueling could not occur by definition). Hodges, Tr. 1789; SSER 6 at 15-4.

17. In the event of a LOCA, 10 C.F.R. § 50.46(b) gives five limits that must be satisfied. First, the calculated maximum fuel element cladding temperature shall not exceed 2200°F. Second, maximum cladding oxidation shall nowhere exceed 17% of the total cladding thickness before oxidation. Third, the calculated total amount of hydrogen generated from chemical reaction of the cladding with water or steam shall not exceed 1% of the hypothetical amount that would be generated if all the metal in the cladding cylinder surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react. Fourth, calculated changes from core geometry shall be such that the core remains amenable to cooling. Fifth, after any calculated successful initial operation of the ECCS, the calculated core temperature shall be maintained at an acceptably low value and decay heat shall be removed for the extended period of time required by the long-lived radioactivity remaining in the core. Hodges, Tr. 1784; see also 10 C.F.R. § 50.46(b)(1) through (b)(5).

18. Mr. Hodges testified that a LOCA is the worst accident that could occur at 5% power. For a non-LOCA accident, he testified that if either the Reactor Core Isolation Cooling system ("RCIC") or the High Pressure Coolant Injection system (HPCI) acts to restore the reactor water level during the first four days after the accident, a peak fuel

cladding temperature of 2200°F would never be reached. HPCI and RCIC are completely independent of AC power; they are steam driven and use DC power for initial valve operation and turbine control. Hodges, Tr. 1785; SSER 6 at 15-6 and 15-7. See, also, Rao et al., Tr. 310-11.

19. The Staff reviewed LILCO's analysis of a LOCA at 5% and found that in the most conservative case, using the approved evaluation model of Appendix K to 10 C.F.R. Part 50 with no makeup at all, the core could be without cooling for 55 minutes before the peak cladding temperature would exceed 2200°F. Still using the Appendix K model, but using more realistic peaking factors and considering to some extent the limited operating lifetime at 5% power, it would take 110 minutes without cooling to reach the 2200°F limit. Using best estimate models which have been reviewed and approved by the NRC, the 2200°F limit would not be reached until more than three hours after the accident (assuming no cooling). Hodges, Tr. 1786; SSER 6 at 15-7.

20. It must be pointed out that the exceedance of the 2200°F peak cladding limit does not result immediately in any kind of fuel failure. This limit was chosen as a conservative value to assure that the fuel will maintain a coolable geometry when cooling is restored. Some data indicate that fuel cladding could reach a temperature of 2700°F and the cladding would retain some ductility and the fuel would not melt. If the 2200°F limit were reached, the rod internal pressure would reach 97.7 psi<sub>g</sub>. Finally, the maximum local cladding oxidation at 2200°F is 6½%. At this level of oxidation, the cladding would retain ductility and would not fracture when exposed to cold cooling water. Therefore, the core would remain coolable and, without cladding rupture, the fission products would be retained in the fuel. Hodges, Tr. 1786-88.

21. During cross-examination, Suffolk County asked Mr. Hodges to compare the time difference between restoring AC power relying on the TDI's, and restoring AC power using the EMD's. Mr. Hodges testified that backup power sources acceptable for full power operation could restore power within 15 seconds. If the alternate AC power system proposed by LILCO for low power operation restored power in 30 minutes, the peak cladding temperature would reach 1086°F; if qualified TDI's were available immediately, the peak cladding temperature would reach only 550°F. Mr. Hodges emphasized that although one could argue that the safety margin was less using the alternate AC source, that from a safety standpoint, the difference was "kind of like driving on a four-lane bridge, being in the outside lane near the edge as opposed to the inside lane." Hodges, Tr. 1749-53, 1788.

22. The evidence presented by LILCO and the Staff demonstrated that the worst event that could occur at low power was a LOCA simultaneous with a loss of all AC power. Using extremely conservative assumptions, it was shown that the core would remain in a safe condition without AC power for at least 55 minutes. Hodges, Tr. 1786. If power is restored within 55 minutes, no fuel fission products will be released. Id. This evidence was not controverted by either the County or the State. Under the circumstances, the Board finds that, in the worst case analysis, the public health and safety would not be threatened if there is assurance that AC power can be restored to the site within 55 minutes.

23. Mr. Quay presented testimony addressing the need at low power for the standby gas treatment system. Tr. 1796-98. The purpose of this system is to reduce the quantity of radioiodine that would be released to

the public in the event of an accident. Id. The system requires AC power in order to operate. Mr. Quay testified that the system is only used to mitigate two accidents: a LOCA and a fuel handling accident. If AC power is restored within 55 minutes, a LOCA will not result in any fuel failures. Id. As for a fuel handling accident, it is not expected that fuel would be moved during low power. Id. Even if fuel is moved and a handling accident were to occur, the fission products that could be released after operation at 5% are substantially less than could be released after full power operation. It was therefore Mr. Quay's professional conclusion that there is no need for a standby gas treatment system during low power operation. Tr. 1772, 1797-98. Mr. Quay did, however, testify that if the Board felt it necessary to provide additional protection, restricting the movement of irradiated fuel for 40 days would result in an additional factor of 20 reduction in the release of iodine as a result of a fuel handling accident after 5% operation. Quay, Tr. 1798. Mr. Quay's professional judgment that there is no need for the standby gas treatment system at low power having been uncontroverted, the Board finds that there is no need to impose a 40 day restriction on the movement of irradiated fuel.

B. The Assurance That AC Power Can Be Restored in 55 Minutes

24. There are two essential elements that must be considered in determining whether there is adequate assurance that AC power can be restored to the plant in 55 minutes. The alternate power sources require manual actions in order to provide power to the plant; what assurance is there that the necessary actions will be taken to restore power to the

plant within 55 minutes? Second, assuming the necessary manual actions, what assurance is there that the machines will actually provide the power needed when called upon?

1. Manual Actions

25. Testimony concerning the manual actions needed to provide power from the alternate AC power sources to the site was provided by LILCO, the NRC Staff, and Suffolk County. LILCO's witness, William Gunther, is the Operating Engineer for the Shoreham facility. Tr. 198-99. The Staff's witness, James Clifford, is an Operational Safety Engineer in the Procedures and Systems Review Branch of the NRC's Office of Nuclear Reactor Regulation. Mr. Clifford wrote Section 13.5.1 of SSER 6. Tr. 1806-07, 1849. Testifying for Suffolk County were John Smith, George Eley, Gregory Minor, and Dale Bridenbaugh. Their professional qualifications are set forth at Tr. 2400-36, 2572-75. None of these gentlemen presented any evidence of personal involvement in the development or in the review of procedures concerning manual actions.

26. In the event of a loss of offsite power at the Shoreham site, LILCO has instructed its operating personnel to take the following actions. First, the operators are expected to observe operation of automatic equipment, which in the case of loss of offsite power, would be the automatic start of the TDI's. If the TDI's fail to start, or if any necessary loads fail to sequence onto the emergency buses, operators would be expected to manually start the TDI's. If the TDI's could not be started, the operators would be expected to line up the 20 MW gas turbine. If the 20 MW gas turbine failed to provide power, operators

would be expected to line up the EMD diesels to the emergency buses. Procedures have been developed by LILCO to provide instructions for the operators to implement these actions. Clifford, Tr. 1843, 1850-51.

27. The Staff has reviewed those procedures and witnessed a demonstration of the operations necessary to restore power using the gas turbine and a similar demonstration of the operations necessary to restore power using the EMD's. During the demonstrations, the necessary actions were taken to restore power using the gas turbine in approximately four minutes and from the EMD's in approximately nine minutes. Clifford, Tr. 1851-52.

28. In the course of his review, Mr. Clifford identified a number of changes the Staff believes are necessary in order to find the procedural and operational aspects of the alternate AC power system for Shoreham acceptable. Those changes are listed at pages 13-2 and 13-3 of

SSER 6. Included among the changes are the following:

1. Emergency lighting must be installed at the NSST to illuminate the disconnects.
2. The portion of the I-beam that protrudes into the stairwell leading from behind the control room back panels to the emergency switchgear room must be removed or padded.
3. The covers for the cabinets in the emergency switchgear room containing the undervoltage bus program fuses must be clearly labelled. In addition, the fuse block for these fuses must be clearly identified within the cabinet.
4. Each operating shift must satisfactorily perform TP 85.84042.3, "Supplemental Diesel Generator-EMD-(GM); Electrical Functional Test Procedure."
5. Various specified modifications need to be made to the following procedures: TP 29.015.03 and SP 29.015.03.

The Staff will condition the Shoreham license to require the completion of these items prior to fuel load. With the resolution of these items

the Staff concluded that there is reasonable assurance that the operators at Shoreham will be capable of implementing the necessary procedures for restoration of AC power to the emergency buses and equipment using the gas turbine and the EMD diesels well within the minimum required time of 55 minutes. Clifford, Tr. 1852; SSER 6 at 13-3.

29. Although the procedures call upon the operators to attempt to draw power from the TDI's, the Staff's conclusion that the operator actions are adequate to restore power within 55 minutes does not depend in any way on the ability of the TDI's to provide power when called upon. Clifford, Tr. 1843-44, 1852.

30. In their testimony, Suffolk County made the bald assertion that reliance on operator action in and of itself makes the alternate system less safe than a fully automated system. Tr. 2579, 2605, 2607, 2608. As has been noted previously, none of the County's witnesses disclosed any experience or expertise in the evaluation of the adequacy of operator procedures. The only two specific problems identified by the County were the problem of darkness at the NSST disconnects, and whether the operators would be capable of performing their function in a timely manner. As to the first problem, the Staff indicated in SSER 6 that it would require that lighting be installed at the NSST disconnects as a license condition. SSER 6 at 13-2. As to whether the operators can perform the required actions in a timely manner, Mr. Clifford testified that only one operator was needed to perform the required actions outside of the control room. Clifford, Tr. 1837-38, 1845. Moreover, while the County's witnesses indicated their belief that the required actions could not be taken in a timely manner, cross-examination revealed that these

witnesses had no idea how much time would be available to the operators to perform the actions and simply could not explain the basis for their view that the required actions could not be performed in a "timely" manner. Smith and Eley, Tr. 2524-28. Although the County's witnesses also espoused the general view that operator actions are per se less safe, they never provided any reason to believe that the operators will be unable to start the gas turbine and/or the EMD's in the time available to them.

31. The Board finds, based on the evidentiary record developed at hearing and discussed above, that with the implementation of the license conditions set forth in SSER 6 at pages 13-2 and 13-3, there is adequate assurance that the operators at Shoreham are fully capable of performing the necessary actions to bring power to the plant from the gas turbine or the EMD's well within the available time of 55 minutes.

## 2. The Ability of the Alternate System to Provide Power

32. The Staff, LILCO, and the County all provided direct testimony on the adequacy of the proposed alternate AC power system. The Staff presented Messrs. John Knox and Edward Tomlinson as witnesses. Mr. Knox is a Senior Electric Engineer in the NRC's Power Systems Branch; Mr. Tomlinson is a Mechanical Engineer in the same branch. Mr. Knox has been involved in the NRC's review of various facets of electrical systems associated with nuclear reactors for ten years. Mr. Tomlinson has been professionally involved in the operation, maintenance and of application



of diesel engines for more than 24 years. Tr. 1856-57, 2337-2341. Both gentlemen are responsible for Section 8 of SSER 6. Tr. 1856.

33. LILCO presented as witnesses on the adequacy of the EMD's Messrs. Thomas Ianuzzi and Kenneth Lewis. Mr. Ianuzzi is Manager of Engineering of the Power Systems Division of Morrison-Knudsen. He is responsible for direct supervision of personnel involved in the design and construction of diesel and turbine generator systems. Mr. Lewis is the Technical Services Manager for the Power Systems Division of Morrison-Knudsen. He is responsible for overseeing all of the service work performed by the Power Systems Division at a number of nuclear facilities. Tr. 1161-67. In addition, LILCO presented Mr. William Schiffmacher both at the April hearing and the resumed hearing. Mr. Schiffmacher is Manager of the Electrical Engineering Department at LILCO; his testimony provided details about both the gas turbine and EMD's at Shoreham. Tr. 326-27, 491-500.

34. The County presented as its witnesses on this issue Messrs. Eley, Smith, Minor, and Bridenbaugh. Mr. Minor has twenty-four years of experience in the nuclear industry. He has worked in equipment design and system design, including areas of equipment qualification and seismic qualification. His qualifications appear at Tr. 2400-02, 2813-19. His qualifications show a general background in nuclear power plant design, but no specific expertise in electric generating systems. See Tr. 2424-28. Mr. Bridenbaugh has 18 years of experience in nuclear-related endeavors, and some limited experience with emergency power systems. Tr. 2403, 2430, 2626-2635. Mr. Eley and Mr. Smith have broad experience in diesel

engines for marine application. Tr. 2403-16, 2621-25. Neither Mr. Eley nor Mr. Smith however has had any experience with EMD diesels. Tr. 2419-20, 2422-23.

35. The configuration of the alternate proposed power source is not controverted by the parties. The 20 MW gas turbine is located in the 69 KV switchyard, 300 feet south of the Shoreham reactor building. The turbine is started using a starting which operates on compressed air. A compressor is provided to automatically maintain sufficient pressure in the receiver that supplies the compressed air to the starter motor. Power from the turbine is routed through an existing step up transformer located in the 69 KV switchyard to the switchyard bus, from whence it makes its way to the safety related switchgear. Knox and Tomlinson, Tr. 2342, 2346, 2349.

36. Each EMD diesel is rated at 2.5 MW. Each diesel contains two starting motors, which receive their starting power from a single lead acid battery. Each diesel has sufficient capability to mitigate the worst case accident (i.e., restore sufficient power for core cooling). Power from the diesels is routed through a non-emergency switchgear room (power from the gas turbine goes through this room as well), to the safety related switchgear room. Knox and Tomlinson, Tr. 2347, 2350; SSER 6 at page 8-6.

37. The gas turbine and EMD's are designed to start simultaneously on loss of voltage signal. If power is available from the gas turbine, the procedure for connecting actual loads to the gas turbine can proceed. If power is not available from the turbine, procedures for reestablishing power from the mobile diesel generators would start. The gas turbine could provide power to the plant within 10 minutes using conservative

assumptions, and within 5 minutes using more realistic assumptions. The diesels could operate cooling equipment within 30 minutes using a conservative approach and 15 minutes using a more realistic approach. Knox and Tomlinson, Tr. 2351-52.

38. The Staff's review of the alternate power sources is detailed in Chapter 8 of SSER 6. The Staff identified a number of conditions it will impose upon LILCO as a result of its reliance on the alternate power source. Those conditions include:

1. The automatic transfer between the two normal offsite power circuits at Shoreham must be removed or disabled during low power operation.
2. A fire barrier or 50 feet of separation must be provided between the cables associated with the mobile diesel generators and the RSS and NSS transformers.
3. A quality assurance program for the gas turbine, the mobile diesel generator, and their associated circuits commensurate with their importance to safety.
4. The circuits associated with the gas turbine and four-mobile diesel generators located in the nonessential switchgear room must be protected in accordance with the requirements of Appendix R or a procedure must be available so that power can be reestablished around the switchgear room within 30 days from one of the alternate AC power sources.
5. More stringent testing of both the gas turbine and the EMD's must be performed. Knox, Tr. 2354-56, SSER 6 passim.

39. In terms of the start reliability of the EMD's, the Staff concluded that based on start figures provided by LILCO indicating in 1982-1983 that 275 of 279 starts were successful on the first attempt (giving a reliability of 98.6% per diesel), the overall reliability of the EMD's approached 100%. The start figures provided by LILCO are

consistent with Mr. Tomlinson's considerable experience with EMD's. Knox and Tomlinson, Tr. 1891, 2348. In the same time frame, the gas turbine started successfully 82 out of 84 times (for a total reliability of 97.6%). This turbine has also been refurbished since being relocated at Shoreham; this refurbishing should enhance its reliability. Knox and Tomlinson, 1873, 2346. This level of reliability for both the turbines and EMD's compares favorably with the reliability of normal onsite safety related diesel generators (demonstrated reliability within 92-99%). The reliability of the alternate source for Shoreham approaches 100%. Knox and Tomlinson, Tr. 2356.

40. The Staff concluded that the alternate sources have the required redundancy, meet the single failure criterion, and have sufficient capacity, capability, and reliability to supply power to all required safety loads for low power. The Staff thus believes the alternate system provides reasonable assurance that AC power will be available to the plant within the 55 minutes needed to respond to a LOCA and simultaneous loss of offsite power. SSER 6 at 8-9; Knox, Tr. 2357.

41. The County raised challenges on four aspects of the alternate power sources. The County attempted to call into question the reliability of the EMD's, the testing of both sources, the vulnerability to single failure, and their seismic capability. We deal with each challenge in turn.

42. In cross-examination of Messrs. Ianuzzi and Lewis, Suffolk County attempted to call into question the adequacy of the maintenance records for the EMD's and thus their reliability. See, e.g., SC LPL-Exhibits 4 through 10; Tr. 1059 et seq. It did appear that the maintenance histories for the EMD's while they were being used as

peaking units were poorly documented. See Ianuzzi and Lewis, Tr. 1172; SC LP-Exhibits 4 through 8. Nonetheless, the Board notes that Suffolk County's witnesses, as noted above, had no experience with EMD diesels before this proceeding, subsequent to the dates identified in SC LP-Exhibits 4 through 8 the starting reliability of EMD's was found to be 98.6% (see pp. 19-20, supra), and the testimony of Mr. Tomlinson (at Tr. 1891) and Mr. Ianuzzi (at Tr. 1171-72) that both gentlemen have had much experience with EMD's and find them to be reliable pieces of equipment and two gentlemen with sizable experience with EMD's, Mr. Tomlinson (at Tr. 1891) and Mr. Ianuzzi (at Tr. 1771-72) testified that they have found the diesels to be reliable pieces of equipment. The Board finds that the evidence shows that EMD's are in fact reliable engines.

43. As to the claim that the EMD's and gas turbine do not meet the single failure criterion, the County's witnesses devoted the bulk of their direct testimony (at Tr. 2572 et seq.) to an attempt to show why each system alone was inferior to the TDI's or did not meet the single failure criterion. See e.g., Eley, Tr. 2452, 2459-60. It is the combined system of the EMD's and gas turbine that LILCO is proposing as its alternate system and that the Staff reviewed in determining that the alternate source was acceptable and that the single failure criterion was met. See SSER 6 at 8-5; see also, Smith, Tr. 2482. The Board finds that the EMD's and gas turbine are adequately independent of each other, and that the proper comparison to be made is between the combined system of the EMD's plus the gas turbine compared to a power system in full compliance with GDC 17.

44. Suffolk County's witnesses also testified that the test procedures for the gas turbine and EMD's are inadequate. Tr. 2579, 2580, 2597-98, 2614-15. The Staff has stated in SSER 6 that, for the 20 MW gas turbine, the Staff will require that the turbine be tested at its full capacity prior to plant operation beyond criticality testing and that a monthly test be performed to demonstrate that loads normally connected to certain buses used by the turbine are automatically disconnected and that the gas turbine itself automatically connects to the 69 kV bus within 2 to 3 minutes. SSER 6 at 8-2 and 8-3. This appears to resolve the concerns expressed by Messrs. Minor and Bridenbaugh (at Tr. 2614-15) that the current test procedures do not adequately verify the turbine's availability.

45. The Staff will also require more stringent testing for the EMD's, including a test to be completed before operation at Phases III and IV where all four EMD's will be loaded to its design load for one hour with verification that voltage and frequency are within required limits. SSER 6 at 8-4. The Staff also is requiring that all four of the EMD's will have to be tested on a biweekly basis and they will have to demonstrate that they can be manually reconnected to their loads if they are disconnected for any reason. Id. Suffolk County's witnesses testified at Tr. 2957-59 that "good operating practice" would dictate that the machines be visually inspected before, during, and after the tests. The County provides no basis to impose this practice as a regulatory requirement. The biweekly test required by the Staff dictating that all 4 diesels be connected to the bus and manually reconnected if there is any problem should give adequate notification of the availability of the EMD's.

46. Both the County and LILCO provided testimony on the seismic capability of the gas turbine and EMD's. See Meyer et al., Tr. 2762 et seq. (County) and Christian et al., Tr. 962 et seq. (LILCO). A LOCA and a seismic event must be considered independent events, because the piping whose rupture would lead to a LOCA is designed to withstand an earthquake. Consequently, to have a combined seismic event and LOCA one must have two unrelated very low probability events occurring simultaneously. This combined event is too improbable to consider as a licensing requirement. Hodges, Tr. 1763, 1794. It of course must be kept in mind that for a seismic event occurring without a LOCA, the plant has at least 30 days before AC power must be restarted. Hodges, Tr. 1785. The Board finds that there is no basis for requiring that the alternate power sources for 5% power demonstrate the ability to withstand a seismic event.

47. Based on the findings set forth above, the Board finds that there is adequate assurance that power can be restored using the alternate power sources well within 55 minutes in the event of a LOCA and a loss of offsite power at the site. Because no fuel fission products can be released if power is restored within 55 minutes, the Board finds that the proposed alternate power system provides a comparable level of protection as would a source in compliance with GDC 17 and thus meets the "as safe as" standard set out by the Commission in CLI-84-8.

### III. EXIGENT CIRCUMSTANCES

48. The other standard established by the Commission in CLI-84-8 is that of exigent circumstances. The Commission made clear that the exigent circumstances standard only comes into play if it is first determined that the exemption would not adversely affect the public health and safety. In determining whether the exigent circumstances test has been met a balancing of the following equities must be performed: the stage of the facility's life; any financial or economic hardships; any internal inconsistencies in the regulation; the applicant's good-faith effort to comply with the regulation from which the exemption is sought; the public interest in adherence to the Commission's regulations; and the safety significance of the issues involved. We will address each equity seriatim.

#### A. Stage of the Facility's Life

49. The only testimony addressing the issue of the stage of the facility's life was presented for LILCO by William Gunther, the Operating Engineer for the Shoreham facility. Mr. Gunther testified that the plant is physically completed and is being maintained in a condition that would allow fuel to be loaded within 2-3 weeks of obtaining a low power license. Tr. 866. He identified as the major activity that must be completed prior to fuel load the installation of the neutron sources into the reactor vessel. Id. These sources will be shipped upon receipt of a license and will be installed within 2-3 weeks. Id. No other party controverted Mr. Gunther's testimony. The Board therefore finds that the stage of the facility's life is essentially complete and thus would favor the grant of an exemption.



B. Any Financial or Economic Hardships

50. Evidence on matters related to financial or economic hardships (or benefits) was filed by LILCO, the County, and the Staff. Both LILCO and the County presented evidence on whether earlier low power operation would result in a financial benefit or detriment to LILCO's ratepayers. See following Proposed Fdg. LILCO also presented testimony on the benefits of reducing its dependence upon foreign oil and on the economic and equitable burden placed upon LILCO by the lengthy litigation process for Shoreham. Szabo, Tr. 1326-27; McCaffrey, Tr. 1731. Finally, the State of New York provided evidence asserting that if Shoreham were to be operated at low power and subsequently abandoned costs would increase unnecessarily, that LILCO's provision of electric service would be adversely affected by devoting funds to low power testing, and that the company is suffering from financial problems. Kessel, Tr. 2912-2916.

51. LILCO's witness on the question of potential benefits (or detriments) that would accrue as a result of earlier full power operation was Anthony Nozzolillo. Mr. Nozzolillo worked for eleven years in LILCO's company planning department, where he specialized in performing economic analyses of alternative engineering and financial options. Since April 1984, he has been Manager of LILCO's Financial Analysis and Planning Department, where he has been responsible for the development and maintenance of financial modelling systems. Tr. 1402-04. Suffolk County's witnesses on this issue were Jamshed Madan and Michael Dirmeier. Both Messrs. Madan and Dirmeier are principals in the firm of Georgetown Consulting Group, Inc. The firm offers services in financial and management consulting with special emphasis on utility regulation.

Direct testimony at pages 1-2.<sup>7/</sup> Mr. Nozzolillo, in his testimony, indicated that the Shoreham ratepayers would receive a net benefit of from 8 to 45 million dollars if Shoreham achieved commercial operation three months earlier. Tr. 1409. Thirty-seven million dollars of this benefit are attributable to tax savings if Shoreham is synchronized on or before December 31, 1984. Nozzolillo, Tr. 1361-62. The possibility of Shoreham actually being synchronized before the end of this year appears questionable at best. Nozzolillo, Tr. 1358-1362. As to the other 8 million dollars of benefit predicted by Mr. Nozzolillo, Messrs. Dirmeier and Madan claimed to use the same data as Mr. Nozzolillo and yet found that the 8 million dollar benefit actually constitutes an economic detriment of 49 million dollars. Direct testimony at 1?. The cross-examination of Messrs. Dirmeier and Madan did not adequately resolve one way or another the conflicting claims of the County and LILCO in this regard. See Tr. 1961-2077. Under the circumstances, the Board cannot find either a financial benefit or detriment stemming from earlier operation.

52. Mr. Cornelius Szabo testified for LILCO on the issue of the need to reduce the utility's dependence on foreign oil. Mr. Szabo is Manager, Resource Evaluation for LILCO. In fulfilling his responsibilities, he spends a substantial portion of his time tracking oil-related supply and demand trends and oil-related commercial and technological developments. Szabo, Tr. 1326-27. Mr. Szabo's direct testimony (1326 et seq.) describes LILCO's reliance on foreign oil and the need to reduce the

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<sup>7/</sup> It appears that the direct testimony of Messrs. Madan and Dirmeier was never bound into the transcript record. Their testimony starts at Tr. 1911.

utility's oil consumption. The Board recognizes the strong national interest in reducing dependence upon foreign oil. The only reduction that could be attributable to the grant of the requested exemption would be for a three-month period only. Cross-examination of Mr. Szabo indicated that the benefits of a three-month reduction if there is no sizeable disruption in the Middle East or in any other major oil exporting area would not be substantial. See, e.g., Szabo, Tr. 1268-84.

53. Finally, Mr. Brian McCaffrey, LILCO's Manager for Nuclear Licensing and Regulatory Affairs, testified that LILCO has suffered a great deal as a result of the lengthy litigation associated with the licensing of the Shoreham facility and that, given this protracted licensing history, "fairness dictates that if LILCO can demonstrate the safety of its proposal, it should be granted an exemption from the regulations." McCaffrey, Tr. 1731. The Commission in CLI-84-8 delineated the equities that had to be balanced in the determination of exigent circumstances, and relief from litigation was not one of the criteria chosen. This Board is charged with the task of determining whether the standards established by the Commission in CLI-84-8 have been met. The fact that LILCO may have been involved in arduous litigation in matters unrelated to this exemption request is not relevant to the decision before the Board.

54. For the State of New York, Mr. Brian Kessel, Director of the New York State Consumer Protection Board, provided testimony setting forth the State's position on the request for an exemption. His testimony was conclusory in nature, and presented the State's views that Shoreham should not be licensed before the uncertainties surrounding its future

operation have been resolved (Tr. 2912), that the public interest would be better served if LILCO incurred only those nuclear expenses related to its attempt to secure an operating license by complying with NRC safety regulations (Tr. 2914), and that a financially weakened company ought not to be allowed to operate a nuclear facility (Tr. 2916). Not only does Mr. Kessel's testimony lack any factual basis, it bears little relationship to any of the equities listed by the Commission. The Board finds that Mr. Kessel has not provided any factual evidence to cause the Board to reach a different conclusion on the financial hardship equity, or indeed of any of the equities set forth in CLI-84-8.

55. On the basis of the evidence outlined above, the Board finds that there is insufficient evidence to conclude that financial matters either favor the grant of an exemption or militate against the grant of such an exemption.

#### C. Internal Inconsistencies in the Regulation

56. No testimony was introduced by any party on the issue of whether there are internal inconsistencies in the regulation (or regulations) involved in this exemption proceeding. In its Application for Exemption, LILCO asserted that granting the exemption would resolve the internal inconsistency between Section 50.57(c), allowing low power licensing, and "the now-mandated inflexibility of GDC 17" (presumably referring to the Commission's ruling in CLI-84-8). Application at 23. Before CLI-34-8 was issued, this Board had agreed with LILCO (and the NRC staff) that Section 50.57(c) and GDC 17 needed to be harmonized for low power operation. The Board believes the Commission resolved this matter in its

decision in CLI-84-8 when it concludes that "Section 50.57(c) should not be read to make General Design Criteria 17 inapplicable to low power operation." GDC 17 provides that nuclear power plants must have both onsite and offsite AC power sources. Both sources must be capable of performing various enumerated safety functions. As GDC 17 applies to low power operation, a party seeking a low power license must demonstrate that it has satisfactory offsite and onsite power sources in the absence of an exemption granted under 10 C.F.R. § 50.12(a), CLI-84-8. Therefore an exemption is needed from the terms of GDC 17 in order to allow for low power operation under 10 C.F.R. § 50.57(c) in this proceeding. Under these circumstances, the Board does not believe there are any inconsistencies between 10 C.F.R. § 50.57(c) and GDC 17 which weigh in favor of granting an exemption.

D. Good-Faith Effort to Comply With the Regulation

57. Mr. McCaffrey testified on this issue for LILCO. His testimony demonstrated that: the original design of the plant included an onsite power source intended to meet the requirements of GDC 17; when problems with this source (the TDI's) were discovered, LILCO undertook extensive efforts to cure the deficiencies found; as an additional contingency the utility is installing another source of onsite power (Colt diesels) that are designed to meet the requirements of GDC 17; and that LILCO has provided enhancements to its offsite power system to assure that AC power will be available in the event offsite AC power is lost during low power testing. McCaffrey, Tr. 1703-04. LILCO had always intended to meet the requirements of GDC 17, and still intends to meet GDC 17 for full power.

Tr. 1704. The steps taken by LILCO with respect to their attempts to comply with GDC 17 are set forth in Mr. McCaffrey's direct testimony at Tr. 1704-1715.

58. Mr. McCaffrey's description of the steps taken by LILCO to comply with GDC 17 is uncontroverted in the record developed at hearing. On cross-examination of Mr. McCaffrey, Suffolk County attempted to demonstrate that LILCO at various times did not pursue problems with the TDI's as aggressively as it should have. See generally Tr. 1439-1510. The Board does not deem it necessary to make a finding this issue. The standard established by the Commission in CLI-84-8 was whether LILCO made a "good-faith effort" to comply with the regulation, not whether they acted "prudently" or whether they could have taken other steps that might have yielded a better result. The Board finds that it is uncontroverted on this record that LILCO in fact took a number of steps over a period of years that were intended to result in an onsite power source in compliance with GDC 17; although the utility is seeking a limited exemption from GDC 17 (for the period of low power operation), the record also shows that LILCO is continuing its efforts to achieve compliance with GDC 17. Under the circumstances, the Board finds that LILCO has made a good faith effort to comply with GDC 17.

E. Public Interest in Adherence With the Regulations

59. No testimony addressed this equity at hearing. In its Application for Exemption, LILCO asserted that in the circumstances of this case, there is minimal public interest in strict adherence with the regulation involved. The Board agrees. There is no question that the

Commission believes its regulations should be met; CLI-84-8 states plainly that exemptions should be granted sparingly and only in the presence of "exceptional circumstances." CLI-84-8, Footnote 3. On the other hand, it is also clear that the exemption here is for a very limited period of time, and that an extensive hearing record has demonstrated that the grant of the requested exemption would have no meaningful adverse effects on the public health and safety. Given the level of protection that will be provided to the public by the alternate power source to be used for low power operation and the limited nature of the exemption, the Board does not believe grant of the exemption will have a detrimental effect on the Commission's policy that exemptions to its regulations should only be granted sparingly.

F. Safety Significance of the Exemption

60. The record needed to make a determination as to the safety significance of the proposed exemption is set forth in Part II, supra. Indeed, the Commission instructed that the standard to be used in this case required that LILCO demonstrate that operation at low power with its alternate power source will be "as safe as" operation would have been if a source in compliance with GDC 17 were used. Given the Board's finding that the "as safe as" standard has been met, the Board sees no safety significance to the grant of the requested exemption.

G. Conclusion

61. In sum, the Board finds that the Shoreham facility is essentially complete, that it can not find that either a significant

economic benefit or detriment will result from a grant of the requested exemption, that there are no relevant regulatory inconsistencies involved here, that LILCO has demonstrated that it made a good faith effort over a number of years to meet GDC 17 (and still intends to meet GDC 17 in the very near future), that the requested exemption will not affect the public interest in adherence to Commission regulations, and that the requested exemption is a matter of no safety significance. On balancing the equities identified in CLI-84-8, the Board therefore finds that the requested exemption meets the "exigent circumstances" test established by the Commission in CLI-84-8.

#### IV. CONCLUSIONS OF LAW

Based on the evidentiary record which closed on August 7, 1984 and the Findings of Fact set forth supra, the Board makes the following conclusions of law:

1. The evidence indicates that no fission products will be released from the fuel if AC power is restored to the plant within 55 minutes in the event of a LOCA, and that there is adequate assurance that in the event of a simultaneous LOCA and loss of offsite AC power, power would be restored from either the gas turbine or the EMD's within 55 minutes. Thus, the Board finds that the alternate AC power sources proposed for use at Shoreham at 5% power provides a comparable level of protection as would a fully qualified onsite source of emergency AC power. The Board therefore concludes that reliance on the proposed alternate sources meets the "as safe as" standard set forth by the Commission in CLI-84-8.



2. Based on the balancing of the equities identified in Footnote 3 of CLI-84-8, as discussed in the findings, the Board finds that the Application for Exemption satisfies the "exigent circumstances" test delineated in CLI-84-8.

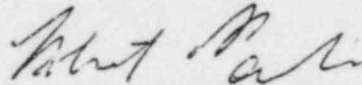
3. In terms of the provisions of 10 C.F.R. § 50.12(a), because of the Board's conclusion that the "as safe as" test is met, the Board finds that the proposed exemption would not endanger life or property.

4. "Common defense and security," as utilized in the Commission's regulations, means the common defense and security of the United States. 10 C.F.R. § 50.2(i); see also Section 11.g of the Atomic Energy Act, 42 U.S.C. § 2014(g). The Commission long ago determined that the term referred principally to "the safeguarding of special nuclear material; the absence of foreign control over the applicant; the protection of Restricted Data; and the availability of special nuclear material for defense needs." Florida Power & Light Co. (Turkey Point Units 3 and 4), 4 AEC 9, 12 (1967). On appeal, the United States Court of Appeals for the District of Columbia Circuit agreed that, as to the meaning of common defense and security, "the internal evidence of the [Atomic Energy] Act is that Congress was thinking of such things as not allowing the new industrial needs for nuclear materials to preempt the requirements of the military; of keeping such materials in private hands secure against loss or diversion; and of denying such materials and classified information to persons whose loyalties were not to the United States." Siegel v. Atomic Energy Commission, 400 F.2d 778, 784 (D.C. Cir. 1968). Based on the definition of the term, the Board concludes that LILCO's exemption request has no impact on the common defense or security.

5. Because the Board has found that the Application for Exemption meets the "exigent circumstances" test of CLI-84-8, the Board concludes that the Application meets the "otherwise in the public interest" requirement of Section 50.12(a).

6. The Board thus resolves all issues involved in the hearing whose record was closed on August 7, 1984 in favor of authorizing the exemption requested by LILCO. No final determination on the Application for Exemption can be made at this time because of the pending proceeding on physical security issues related to the exemption request. See Commission Memorandum and Order of July 18, 1984.

Respectfully submitted,



Robert G. Perlis  
Counsel for NRC Staff

Dated at Bethesda, Maryland  
this 31st day of August, 1984

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

54 NOV -8 P3:07

In the Matter of )  
LONG ISLAND LIGHTING COMPANY )  
(Shoreham Nuclear Power Station, )  
Unit 1) )

Docket No. 50-322-OL-4  
(Low Power)

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW" 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 31st day of August, 1984:

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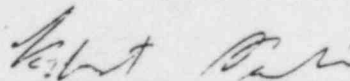
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