UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Commission

In the Matter of	)	
	)	
LONG ISLAND LIGHTING COMPANY,	)	Docket No. 50-322-OL-4
	)	
(Shoreham Nuclear Power Station, Unit 1)	)	(Low Power)
	)	

AFFIDAVIT OF DALE G. BRIDENBAUGH
AND GREGORY C. MINOR IN RESPONSE
TO AFFIDAVIT OF JOHN D. LEONARD, JR.

1. My name is Dale G. Bridenbaugh. I am president of MHB Technical Associates ("MHB"), a technical consulting firm specializing in nuclear power plant safety and licensing matters, located at 1723 Hamilton Avenue, Suite K, San Jose, California 95125. I received a Bachelor of Science degree in mechanical engineering from South Dakota School of Mines and Technology in 1953 and am a licensed professional nuclear engineer. I have more than 30 years experience in the engineering field, primarily in power plant analysis, construction, maintenance and operations. Since 1976, I have been employed by MHB and have acted as a consultant to domestic and foreign government agencies and other groups on nuclear power plant safety and licensing matters. Between 1966 and 1976, I was employed by the Nuclear Energy Division of General Electric Company ("GE") in various managerial capacities relating to the sale,

service and product improvement of nuclear power reactors manufactured by that company. Between 1955 and 1966, I was employed in various engineering capacities working with gas and steam turbines for GE. I have written numerous technical papers and articles on the subject of nuclear power equipment and nuclear power plant safety and have given testimony on those subjects.

2. My name is Gregory C. Minor. I am vice president of MHB. My education background is in electrical engineering (with a power systems option) in which I received Bachelor of Science (University of California, Berkeley, 1960) and Master of Science (Stanford, 1966) degrees. I have over 24 years of experience in the nuclear industry, including design and testing of systems for use in nuclear power plants. Since 1976, I have been employed by MHB and have acted as a consultant to domestic and foreign government agencies and other groups on nuclear power plant safety and licensing matters. Between 1965 and 1976, I was employed by the GE Nuclear Energy Division as a design engineer and manager of engineering design organizations. My responsibilities included the design, testing, qualification and pre-operation testing of safety equipment and control rooms for use in nuclear power plants.

3. Our experience with the Shoreham plant started when we were employed by GE. At that time we were involved with the design of reactor system components for Shoreham and implementation and resolution of problems related to that design. After leaving GE, we have been involved with the Shoreham case on a virtually continuous basis since 1977, when we were originally retained as consultants to Suffolk County. As consultants on the Shoreham plant, we have performed diverse assignments, focusing primarily on technical reviews of safety and cost issues. Over the course of the Shoreham proceedings, we have visited the plant on numerous occasions and have testified on diverse issues before the NRC's Atomic Safety and Licensing Board ("ASLB") and the State of New York Public Service Commission ("NYPUC"). In August 1984, we testified on behalf of Suffolk County in the ASLB's Shoreham exemption hearings where the question of low power operation without nuclear qualified emergency diesel power sources was addressed.

4. In this Affidavit, we address certain statements made by John D. Leonard, Jr. in an affidavit filed by LILCO to support its Petition for Review of ALAB-800.

SYSTEM TESTING DURING LILCO'S PROPOSED PHASES III AND IV IS VERY LIMITED

5. LILCO asserts that 54 systems will be required to be in service, operated and tested during Phases III and IV testing (Notaro and Gunther Affidavit at 16, cited in Leonard Affidavit at 10). This is misleading since 41 of those systems are already operational and have been checked out as part of Phase I and Phase II testing (Notaro and Gunther Aff. at 8 and 9). Thus, according to LILCO, Phases III and IV provide the opportunity to check out only 13 additional systems. However, this number is also overstated because LILCO witnesses testified in the exemption hearings that LILCO will not roll the turbine during Phase III and IV testing (Tr. at 776). Therefore, the Turbine Generator and the turbine control portion of the EHC systems will not be operated in Phases III and IV, contrary to LILCO's recent suggestion. (Notaro and Gunther Aff. at 16). In addition, the support systems, consisting of the Turbine Lube Oil System, Generator Seal Oil Systems, and Steam Seal System, will not be finally checked out until the turbine generator is actually run. Thus, only 8 additional systems could be checked out during Phase III and IV testing.

6. Among the systems listed by LILCO to be checked during Phase III and IV testing are the HPCI and RCIC systems which

rely on steam driven turbines. Contrary to LILCO's suggestion, however, it is possible to test these systems without the nuclear operation inherent in Phases III and IV. The closed reactor system can be heated to normal operating temperature and pressure by running the two large (5600 HP) recirculation pumps. This would permit sufficient steam to be directed to the RCIC turbine and HPCI turbine for testing. Thus, if LILCO were serious about its intent to find any problems as early as possible, the RCIC and HPCI systems could be operationally "de-bugged" without going critical and without having to irradiate the reactor fuel and reactor components at the 5% power level.

7. In addition, there are several tests which cannot be properly performed at low power levels (5% or less). These include:

- APRM/IRM calibration at overlap point
- Set APRM trip reference point at 55%
- APRM calibration (inaccurate at very low readings and would have to be repeated at higher pow levels)
- Turbine roll and balance at 1800 RPM
- Generator exciter test
- Moisture separator-reheater and drains (dynamic test)
- Extraction steam (dynamic test)
- Local power range monitor calibration

8. Considering that Phases III and IV would only add a few systems to those already checked out, other systems can be tested without nuclear operation, and still other systems require higher power levels for testing, there is relatively little benefit to be gained by pursuing Phase III and IV operation for the purpose of system testing.

ADVERSE IMPACTS OF LOW POWER OPERATION

9. Low power testing necessarily causes irreversible changes to a nuclear reactor and its supporting systems. We discuss below these changes with specific reference to the Shoreham plant.

10. There is necessarily significant irradiation of the nuclear fuel as a result of low power testing. This irradiation results in the build-up of quantities of fission products within the fuel which requires that the fuel subsequently be handled, transported, and treated as irradiated fuel. Such irradiation necessarily increases the risk of worker exposure to harmful radiation.

11. In its non-irradiated condition, the fuel loaded into the Shoreham core probably had a recovery (or salvage) value nearly equal to the original purchase value for that fuel. This fuel, if not irradiated, likely could have been sold to

other nuclear plants to use as is, or, if necessary, to have it reconfigured for a different reactor. (For example, some bundles might have required manual disassembly and rod rearrangement or reconfiguration of the pellets for the necessary pattern of enrichment.) The fuel still has a salvage value even after the light irradiation involved in Phases I and II. However, once the fuel is substantially irradiated and there is a substantial build-up of fission products (even though relatively small compared to what would be built up after long term full power operation), as would occur during Phases III and IV, it makes fuel reconfiguration, and therefore most opportunities for reuse of the fuel, more complicated and costly and therefore far less likely to be implemented. The result is that the cost of the fuel is not recoverable and therefore it is a potential cost of the decision to conduct low power testing. According to LILCO, the Shoreham fuel is worth approximately $65 million.

12. LILCO takes the position that once the Shoreham fuel has been through Phase II criticality (to a power level of from 0.0001% to 0.001%), it is by definition "irradiated" and is totally without salvageable value. We agree that the achievement of the extremely low power criticality of Phase II for a brief period of time does irradiate the fuel to a measureable level

and that care in handling is subsequently necessary, and some reduction in resale value would occur. There is, however, a factor of 500 to 5000 difference between the Phase II power level and the 5% level planned for Phase IV of the Shoreham low power testing program. In addition, operation at 5% power is projected to last for a much longer time than the brief period at criticality involved in Phase II. We believe that substantial positive salvage value could be realized from the fuel in its post-Phase II condition, although not as much as if the fuel were not irradiated at all. There would be no such value if the fuel were used at the 5% power level, however. The NRC Staff apparently shares our view in this matter and believes that after a decay period of about 6-12 months, the post-Phase II fuel could be shipped in its original shipping containers if further irradiation is not undertaken. (See Affidavit of Edward F. Goodwin, dated February 20, 1985, filed by NRC in U.S. Court of Appeals, at 9.)

13. During low power testing other components of the Shoreham plant would also be irradiated to the extent that significant potential salvage value would be lost. These include the 137 control rods and control rod drives, the 31 local power range monitors, and a number of source and intermediate range neutron monitors. We estimate the replacement value of these

components to be at least $2-6 million. These components are virtually identical in all BWRs and are periodically replaced. Thus, a resale market for them should exist unless they are heavily irradiated. The NRC Staff appears to agree with our opinion. (Goodwin Affidavit cited above, at 10). LILCO has asserted that after Phase II of low power testing, these components would be "as radioactive" as the fuel and thus have no salvage value. We disagree. The radiation levels present after Phase II operation would not, in our opinion, preclude altogether their transfer and installation in other reactors, although it would be more difficult and complicated than if they were not irradiated at all. Additional irradiation during Phases III and IV would reduce their marketability to practically nothing.

14. Additional costs resulting from a decision to perform low power testing are the costs of defueling, decontaminating, and decommissioning, and disposal of the fuel as well as portions of the primary reactor system following a low power testing period in the event that a full power license is not obtained. Low power testing creates an inventory of radioactive fission products within the fuel. Sustained operation at power levels up to 5% will irreversibly irradiate the 137 control rods, the 31 local power range monitors, startup sources

and instrumentation monitors, and portions of the reactor internals and structures (in addition to the fuel). It can also contaminate other reactor components, equipment, and piping, and if contaminated, special care would be required in handling these items. The cost of necessary removal/-disposal/decontamination efforts could be tens of millions of dollars, depending on the specific disposal requirements, and such efforts carry with them the potential for worker radiation exposure.

15. We disagree with LILCO's previously stated $13 million estimate of the costs of decontaminating, decommissioning and disposal following low power testing. First, our estimated cost (tens of millions) -- but apparently not LILCO's -- includes the cost of disposal of the irradiated fuel as high level radioactive waste. LILCO agrees that the Shoreham fuel, when irradiated at 5% power levels, must be treated for regulatory and commercial purposes as irradiated fuel. The U.S. Department of Energy has published expected costs for the receipt and ultimate disposal of irradiated fuel. The costs are currently being collected at a rate of $.001/kwhr of generation for fuel exposed now to be disposed of by DOE in the future. For fuel with a design exposure of 15,000 MWD (t)/ton this cost is equivalent to approximately $120,000 per ton. The potential

cost for disposal by DOE of the 100+ tons at Shoreham is therefore approximately $12,000,000, not counting transportation or possible cost increases. In addition, no disposal facility is planned nor expected before about the year 2000, some 15 years in the future. LILCO would therefore be required to store and safeguard the spent fuel on site until that time. Assuming an operational and security staff of at least 10-15 people for this core, an annual cost of $500,000 to $1,000,000 is not unreasonable and is probably low. The cost of spent fuel disposal alone thus becomes a $20 to 30 million obligation. Reactor component removal, handling and disposal would be additionally required. We conclude that LILCO's $13 million figure is greatly understated.

16. The conduct of low power testing of necessity requires some worker exposure during the course of the testing. This may not be large and probably would not exceed allowable limits, unless errors were made. However, it is an additional environmental impact which results from low power testing.

17. During Phases I and II of LILCO's Shoreham low power testing program, some irradiation of the fuel and contamination of reactor internals and components, with the resulting economic costs, occurred. The amount of irradiation and

contamination, and resulting economic costs involved in Phases III and IV of the low power testing are substantially greater.

18. The essential purpose of a low power license is to test reactor systems which cannot be effectively tested in non-critical conditions. It is necessary to conduct such testing prior to operating the plant at higher power levels (i.e., greater than 5% power). However, during the testing, the Shoreham reactor would never be put in the "run" mode and the turbine would not be operated because sufficient steam will not be produced. Therefore there would be no electric power supplied to the grid as a result of the testing, and there would be no displaced oil or fuel cost savings. Instead, power from the grid would be required to run the plant during the tests. Thus, none of the benefits assumed in the NRC's 1977 EIS for Shoreham would be achieved by low power testing; however, as noted, low power operation would result in environmental impacts, such as plant contamination with radioactive material, the likely loss of the resale value of the fuel and other components once they become irradiated, the cost of decontamination, decommissioning and disposal, and worker exposure.

19. Because low power testing standing alone produces no benefits but does have serious adverse effects, it is our

opinion that there is no reason to conduct low power testing just for its sake alone. Rather, low power testing can be rationally justified only in circumstances where there is no substantial doubt that the plant subsequently will operate at higher power levels so that its benefits (i.e., generation of electricity) will be available to offset the adverse effects (fuel irradiation, radioactive contamination, potential worker exposure) which cannot be avoided. In our technical opinion, the optimum time for performing low power testing of any nuclear reactor is shortly before full power operation is reliably anticipated to begin.

Dale G. Bridenbaugh

DALE G. BRIDENBAUGH

Gregory C. Minor

GREGORY C. MINOR

Subscribed and sworn to before me on this 6th day of May, 1985.

Catherine Citrigno-Norris

Catherine Citrigno-Norris
NOTARY PUBLIC

My Commission expires:

OFFICIAL SEAL
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SANTA CLARA COUNTY
My Comm. Expires Nov. 18, 1988

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Commission

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CERTIFICATE OF SERVICE

I hereby certify that copies of Suffolk County and State of New York Petition for Reconsideration of CLI-85-1 and Affidavit of Dale G. Bridenbaugh and Gregory C. Minor in Response to Affidavit of John D. Leonard, Jr., have been served on the following this 7th day of May 1985, by U.S. mail, first class, except as otherwise noted.

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Dated: May 7, 1985