LILCO, May 13, 1985

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Commission

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

AFFIDAVIT OF JOHN D. LEONARD, JR.

John D. Leonard, Jr., being first sworn, deposes and says as follows:

1. My name is John D. Leonard, Jr. I am Vice President, Office of Nuclear Operations, Long Island Lighting Company (LILCO). My work address is Shoreham Nuclear Power Station, North Country Road, Wading River, New York 11792.

2. I received my bachelor's degree in physics from Duke University in 1953, and was President of Sigma Phi Sigma, the Physics Honorary Society. In 1962, I received my master's degree in physics, with a minor in radiobiology from a nuclear engineering curriculum of the U.S. Naval Postgraduate School, Monteray, California. I am a member of Sigma Xi and a registered professional engineer in New York State. I served in the United States Navy from 1954 to 1974, of which 12 years were

spent on nuclear submarines. I was the Commanding Officer of two nuclear submarines, The U.S.S. Abraham Lincoln (S.S.B.N. 602) and The U.S.S. Benjamin Franklin (S.S.B.N. 640). Following my retirement from the Navy with the rank of Commander, I went to work for the Virginia Electric and Power Company from 1974 through 1976; there I was Corporate Supervisor of Operational Quality Assurance. From 1976 through 1980, I was the first Resident Manager of the James A. Fitzpatrick Nuclear Plant, a boiling water reactor very similar to Shoreham, owned and operated by the Power Authority of the State of New York (PASNY). While I was at Fitzpatrick, in 1977, it was judged by the NRC to be one of the 12 best-managed nuclear power plants in the country from a safety standpoint. In 1980, I was promoted to Vice President/Assistant Chief Engineer for Design and Analysis at PASNY, with responsibility for the Fitzpatrick Plant as well as PASNY's interest in the Indian Point reactors. I remained at that post until I came to work at LILCO as Vice President/Office of Nuclear Operations in May 1984.

3. My professional responsibilities at LILCO include overseeing the safety and operational aspects of the Shoreham Nuclear Power Station (Shoreham) and development of the plant.

4. This Affidavit addresses the Affidavit of Dale G. Bridenbaugh and Gregory C. Minor in Response to Affidavit of John D. Leonard, Jr., submitted by Suffolk County and New York State with their Petition for Reconsideration of CLI-85-1 on May 7, 1985. Many of the statements in the Bridenbaugh/Minor Affidavit are simply inaccurate. Others are misleading. Others involve opinions on matters about which Bridenbaugh and Minor have no expertise. My earlier Affidavit of John D. Leonard, submitted to the United States Court of Appeal for the District of Columbia Circuit in Mario M. Cuomo v. United States Nuclear Regulatory Commission, Docket No. 85-1042, and previously filed with this Commission on March 4, 1985, describes the benefit of low power testing, the need to perform that testing promptly and the low additional incremental effects of Phase III and IV testing in great detail. That earlier Affidavit is attached as Exhibit A and all of its statements remain accurate and are incorporated here. It is not the purpose of this Affidavit to repeat those details but simply to point out the errors, inaccuracies, and misleading statements in the Bridenbaugh/Minor Affidavit.

Beneficial System Testing During
Phases III and IV

5. The Bridenbaugh/Minor Affidavit asserts that there will be minimal benefit in Phase III and IV testing. This is wrong in many respects. See Leonard Affidavit at 7-12, Tr. ff 152, (Gunther), 200-26, 828-30, 837 (Gunther).

6. Messrs. Bridenbaugh and Minor erroneously state that the turbine at Shoreham will not roll during Phases III and IV testing and that as a result, the turbine generator and turbine control portion of the EHC systems will not be operated. (Affidavit ¶ 5). Although a LILCO witness did apparently state on cross-examination that LILCO did not intend to roll the turbine during Phase III and IV testing, this was incorrect, as shown by LILCO's other evidence in the low power record. William Gunther, the witness, had included with his testimony an Affidavit by him and Jack A. Notaro in which it was clearly indicated that the turbine would be turned, since the turbine generator, turbine EHC and turbine lube oil system would be placed in service, operated and tested during Phases III and IV. See Notaro/Gunther Affidavit at 16, paragraph 24. Additionally, the Chapter 15 safety analysis contemplated a turbine trip -- which can only occur if the turbine is spinning -- as a possible event. Tr. 320 (Rao, et al.) In fact, the turbine will

roll and the turbine lube oil system, generator seal oil system and steam seal system will be tested during Phase III and IV testing. Bridenbaugh and Minor are further wrong in their assertion that Phase IV testing will produce insufficient steam to run the turbine (Affidavit ¶ 18); it will.

7. Paragraph 6 of the Bridenbaugh/Minor Affidavit is incorrect. Here, Bridenbaugh and Minor state that the HPCI and RCIC systems can be tested using recirculation pumps without the nuclear operation inherent in Phases III and IV. In a boiling water reactor such as Shoreham, the HPCI and RCIC system cannot be tested using recirculation pumps. Perhaps Bridenbaugh and Minor have confused Shoreham with a PWR, which it is not.

8. The comments of Bridenbaugh and Minor in paragraph 7 of their Affidavit are misleading in asserting that the tests listed there cannot be properly performed at low power levels. In fact, LILCO will partially perform all of the listed tests except the local power range monitor calibration, during low power operation. These include: (a) APRM/IRM calibration at overlap point; (b) the initial set of the APRM trip reference point at 55%; (c) initial APRM calibration; (d) turbine roll and balance at 1800 rpm; (e) generator exciter test; (f)

moisture separator-reheater and drains; and (g) extraction steam. Performance of these tests during Phases III and IV will provide valuable information and will save substantial time in the ultimate ascention to full power, though these tests will continue to be performed as LILCO implements its power ascension program beyond 5% rated power.

9. Bridenbaugh and Minor are totally wrong in their assertion that there is relatively little benefit to be gained by system testing during Phases III and IV (Affidavit ¶ 8).

a. Even if Bridenbaugh and Minor had correctly identified tests which will not be performed -- and they have not -- the remaining testing to be performed, which includes thermal expansion testing of primary (reactor and recirculation) systems is important in and of itself. Such testing is time-consuming and often identifies hardware problems which LILCO could correct now if detected, without later disruption of power generation for LILCO's customers.

b. Based on my naval experience as a nuclear submarine commanding officer and my nuclear experience, I am convinced that there is no substitute for actual operation of the nuclear plant both when testing

equipment and training personnel. Isolated testing of isolated systems does not provide the same opportunity to detect problems, either with equipment or personnel, as integrated operation.

Minimal Impact of Low Power Operation

10. The incremental effects of irradiating the fuel and reactor internals attributable to Phase III and IV operation are minimal. See Leonard Affidavit at 20-24. Bridenbaugh and Minor argue that there are adverse incremental impacts from operating the reactor in Phases III and IV. They are simply wrong on their facts and demonstrate no expertise qualifying them to express the opinions contained in their Affidavit.

11. Bridenbaugh and Minor erroneously contend that additional irradiation of the fuel to occur in Phases III and IV will be substantial and will reduce or eliminate its salvage value. (Affidavit ¶¶ 10-12).

a. It is unlikely that the Shoreham fuel would have any salvage value even if it had not been irradiated during Phase II. See Leonard Affidavit at 21. Nuclear reactor cores are custom designed for the type of reactor and its stage of life. LILCO is not aware of,

and believes that there are not, any other BWR Mark 4 reactors which have neither entered commercial operation, nor had their first core already fabricated. In order to utilize Shoreham's core, another utility would have to have the core redesigned and refabricated. The resale value, if any, would reflect the cost of this costly and cumbersome process of removing, sorting and repacking the usable portion of some 10 million fuel pellets, a substantial percentage of which must be discarded due to the low enrichment characteristics of a first core. It is likely that the last of such refabrication would exceed the cost of simply buying new fuel. Bridenbaugh and Minor do not mention this problem. As importantly, since Shoreham's fuel was purchased, advances have been made in the design of fuel bundles. Fuel now being purchased by utilities employs these advanced designs. It is unlikely that any utility would want to purchase Shoreham's fuel, even if unirradiated, given its now-dated design and the substantial cost of fabrication.

b. Even if the fuel initially had salvage value, that value was destroyed in Phase II. Bridenbaugh and Minor are wrong in their assertion that the fuel would

have a salvage value even after irradiation in Phase II. Since Phase II initial criticality, however, the fuel must be treated as irradiated fuel for regulatory and commercial purposes. Thus, the processes necessary to make the core usable at any other plant can no longer physically be performed without shielding against radiation. The necessity for shielding the fuel in accordance with NRC regulations would render salvage commercially infeasible, particularly in the current market, where neither raw uranium nor enrichment nor fabrication capacity are in short supply. Substantial regulatory proceedings, a costly and time consuming process, may also be required to perform the salvage operations described by Bridenbaugh and Minor in their Affidavit. As stated in my earlier affidavit, therefore, since the completion of Phase II at Shoreham, the salvage value of the Shoreham fuel for any reactor other than Shoreham is essentially zero. There are no further costs associated with the fuel in Phases III and IV.

12. Bridenbaugh and Minor are also wrong in paragraph 13 of their affidavit where they discuss other components whose potential salvage value would allegedly be lost. All of these

components are already irradiated at least to the same degree as the fuel.

a. While control rods could potentially be salvaged for use at other reactors, control rod drives are now in constant use. Indeed, they are used virtually every day at Shoreham. No other facility would rationally use them without a major overhaul. It is unlikely that any other facility would want to install used parts in its reactor. Accordingly, control rod drives have no effective salvage value.

b. The 31 local power range monitors have no salvage value for all practical purposes. There have been technological advances in local power range monitors which are employed in those now being marketed. No other utility would want to use LILCO's irradiated local power range monitors which do not incorporate these technological advances.

c. Bridenbaugh and Minor are also confused concerning the irradiation of the reactor sources, again reflecting a problem with their

understanding about the impact of the low power test program. Neutron sources are irradiated when purchased. They begin decaying immediately and have a half-life of approximately 60 days unless the reactor reaches 5% of rated power. Therefore, Phase III and IV testing would not eliminate the salvage value of the source range monitors, but instead would increase their useful life for LILCO. Even before Phase III testing, they have no value to any other utility because sources cannot be irradiated except in a commercial reactor. After initial irradiation in the test reactor, the source pins are machined such that they cannot be reinserted into the test reactor.

13. Bridenbaugh and Minor are also wrong in their assertion that there will be costs of defueling, decommissioning and disposal of fuel associated with Phase III and IV testing. (Affidavit ¶¶ 14-15). These costs will have to be incurred whether or not Phase III and IV testing goes forward. They are now fixed costs and will not be substantially affected by additional testing. As stated in my earlier affidavit, LILCO estimates the additional costs for decontamination and some

additional costs for disposal of the fuel to be around $13 million, not "tens of millions of dollars" as hypothesized by Bridenbaugh and Minor.

14. The statement of Bridenbaugh and Minor concerning worker exposure to radiation is misleading. (Affidavit ¶ 16). The level of this exposure has been approved and is bounded by the Shoreham FSAR. Most importantly, failure to proceed promptly to Phase III and IV testing may in fact increase the amount of exposure to workers. This is because failure to reach 5% power will necessitate the changing of netron sources, which, in turn, will require entering the reactor vessel. Changing of these sources may not be necessitated this summer if 5% power can be reached as described in my previous affidavit. Leonard Affidavit at 12-14.

15. It is not surprising that Bridenbaugh and Minor would make such erroneous statements since neither is qualified as a nuclear fuel specialist, nor has extensive operational experience in nuclear plants. The evidentiary record discloses that Minor has never operated a nuclear power plant, has never been licensed to operate a nuclear power plant and has never been responsible for operating any power generation equipment. (Tr. 2423-28) Similarly, Bridenbaugh has never been licensed to

operate a nuclear power plant. (Tr. 2428). Their partnership, MHB, spends 50-80% of its time preparing or giving testimony, rather than in actual practice of nuclear engineering. (Tr. 24-26-27). And, their Affidavit indicates no experience or special education concerning testing of nuclear power plants, marketing of nuclear fuel, radiation effects or any other matter qualifying them to render opinions concerning the incremental effects of Phase III and IV testing at Shoreham. In my opinion, the qualifications of such professional witnesses cannot compare with experienced nuclear operators and engineers such as are employed at Shoreham who have determined the accuracy of the statements in this and my earlier affidavits.

Overall Benefit of Low Power Testing

16. The Bridenbaugh/Minor Affidavit states that there will be no benefit from Phase III and IV testing at this time. (Affidavit ¶¶ 18-19). Again, this is simply wrong. Based on my extensive experience in the Navy and in the nuclear industry, in addition to the benefits discussed above and in my earlier affidavit, there is no substitute for actual operation of the reactor to provide (a) advance warning of any potential problems with the plant's systems and equipment, allowing them to be corrected now without jeopardizing or interrupting later

generation of electricity by Shoreham; (b) training of Shoreham's personnel under actual operating conditions of the reactor; and (c) the welding of Shoreham's operators into a cohesive and well-coordinated plant crew which is vitally important to the safe operation of a nuclear power plant. For these reasons, as well as the benefits of retaining experienced personnel and maintaining their morale as outlined in my earlier affidavit, there is immense benefit to conducting Phase III and IV testing as soon as possible.

John D. Leonard, Jr.

STATE OF NEW YORK)
) to-wit:
COUNTY OF SUFFOLK)

Subscribed and sworn to before me this 20th day of May, 1985.

LINDA A. CRATTY
NOTARY PUBLIC, State of New York
No. 4816267
Qualified In Suffolk County
Commission Expires March 30, 1986

Linda A. Cratty
Notary Public

My commission expires: March 30, 1986.

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

MARIO M. CUOMO, GOVERNOR OF THE STATE OF NEW YORK and COUNTY OF SUFFOLK, Petitioners, v. UNITED STATES NUCLEAR REGULATORY COMMISSION, Respondent, and LONG ISLAND LIGHTING COMPANY, Intervenor.	)	Docket No. 85-1042

AFFIDAVIT OF JOHN D. LEONARD, JR.

John D. Leonard, Jr., being first duly sworn, deposes and says as follows:

1. My name is John D. Leonard, Jr. I am Vice President, Office of Nuclear Operations, Long Island Lighting Company (LILCO). My work address is Shoreham Nuclear Power Station, North Country Road, Wading River, New York 11792.

2. I received my bachelor's degree in physics from Duke University in 1953, and was President of Sigma Pi Sigma, the physics honorary society. I received my master's degree in physics, with a minor in radiobiology, in 1962, from a nuclear engineering curriculum of the U.S. Naval Postgraduate School, Monterey, California. I am a member of Sigma Xi and a registered professional engineer in New York State. I served in the U.S. Navy from

1954 to 1974, of which 12 years were spent on nuclear submarines. I was the Commanding Officer of two nuclear submarines, the U.S.S. Abraham Lincoln (SSBN-602) and the U.S.S. Benjamin Franklin (SSBN-640). Following my retirement from the Navy with the rank of Commander, I went to work for the Virginia Electric and Power Company from 1974 through 1976; there I was corporate Supervisor of Operational Quality Assurance. From 1976 through 1980 I was the first Resident Manager of the James A. Fitzpatrick Nuclear Plant, a boiling water reactor very similar to Shoreham, owned and operated by the Power Authority of the State of New York (PASNY). While I was at Fitzpatrick, in 1977, it was judged by the NRC to be one of the 12 best-managed nuclear power plants in the country from a safety standpoint. In 1980 I was promoted to Vice President-Assistant Chief Engineer for Design and Analysis at PASNY, with responsibility for the Fitzpatrick plant as well as PASNY's interest in the Indian Point reactors. I remained in that post until I came to work at LILCO as Vice President-Office of Nuclear Operations in May 1984.

3. My professional responsibilities at LILCO include overseeing the safety and operational aspects of the Shoreham Nuclear Power Station (Shoreham) and development of the plant.

I. BACKGROUND

4. Shoreham is a boiling water commercial reactor of approximately 810 MW net electrical capacity, owned by LILCO and located

at Wading River, on the north shore of Long Island approximately 60 miles east of New York City. I am familiar with the effects of LILCO's being able to conduct low power operations up to 5% of rated power at Shoreham. The purposes of this Affidavit are to provide background on the current posture of the Shoreham licensing proceeding, particularly as it relates to low power operation, to describe the benefits that will accrue from LILCO's conducting low power operation up to 5% of rated power as permitted by the license authorized on February 12, 1985 by the Nuclear Regulatory Commission in its decision CLI-85-01, and to indicate the harm that will occur if LILCO is delayed in conducting such testing.

5. Low power testing is the first experience of a reactor and its crews with actual operation. It is the foundation for the reactor's entire operating life. A soundly designed and executed low power testing program accomplishes the necessary transition from unirradiated, no-power conditions to irradiated operation at commercial power levels and provides a final check on the physical functioning of reactor systems. It also provides a baseline of training and experience that helps to set the tone for future operations. Shoreham's low power testing program has been divided into four phases designed to emphasize training, deliberate procedural actions, thoroughness in operations, and mechanical soundness of equipment. As a result, LILCO has built more testing and training into its low power testing program than is required or customary, and plant management is under operating instructions to

emphasize deliberatness using well-conceived procedures and thoroughness over speed.

6. On December 7, 1984 the Nuclear Regulatory Commission declared effective a September 5, 1984 Licensing Board Order authorizing issuance of a license permitting LILCO to load fuel ("Phase I" of low power testing) and conduct cold criticality testing ("Phase II" of low power testing) at Shoreham. Pursuant to License NPF-19, issued December 7, 1984, LILCO commenced loading fuel on December 21, 1984 and completed that process on January 19, 1985. LILCO commenced cold criticality testing on February 15, 1985, and Shoreham achieved its first self-sustaining nuclear chain reaction at approximately 6:25 pm that day. LILCO completed cold criticality testing on February 17, 1985 at approximately 6:00 am. Shoreham is ready now to proceed to Phase III of low power testing.

7. On February 12, 1985, the Nuclear Regulatory Commission declared effective an October 29, 1984 Licensing Board Initial Decision authorizing issuance of a license permitting LILCO to conduct heatup and low power testing to rated temperature and pressure conditions (1% of rated power) (Phase III) and low power testing to 5% of rated power (Phase IV).

8. This Affidavit is written in the context of a motion for a stay of the Commission's February 12, 1985 decision, pending later reviews on the merits. Consequently, it does not attempt to quantify the monetary cost of delays beyond the time when Shoreham

could otherwise enter commercial service. Rather, it focuses on the costs to LILCO of near-term delays and reviews the cost estimates prepared by Petitioners. A summary of this Affidavit is as follows:

1. Shoreham has a soundly designed, four-phase low power testing program. Phases I and II are complete. Fuel has been loaded into the reactor and it has "gone critical" -- it has had its first self-sustaining chain reaction. The reactor's fuel and vessel internals are by now irretrievably irradiated. The plant is ready to embark now on Phases III and IV of low power testing.

2. As presently planned, Phases III and IV could be completed in 42 days, or by about the end of March, if no complications develop. It would be unusual if at least minor complications, extending the completion of Phases III and IV by several days to several weeks, do not arise.

3. If any delay is imposed on Phases III and IV of low power testing, LILCO will incur, day-for-day, incremental out-of-pocket costs for expert technical advisors at a rate of between $300,000 and $820,000 per month. If LILCO is unable to undertake Phases III and IV by March 1, it will have to order new neutron sources for Shoreham at an out-of-pocket cost of $250,000. If LILCO cannot undertake low power testing before July 1, it will have to replace the neutron sources. This would mean an unavoidable 60 to 70 day further delay before low power testing can commence, in addition to the time for low power testing (42 days plus

time for any complications), for a total delay of nearly four months at least. Thus if the start of low power testing is delayed, for any reason, beyond the end of June, it will be very unlikely that it can be completed before November; if the start were delayed until the end of July, testing could not readily be completed before December. In addition, delays would disrupt what has been to date an orderly and successful plant startup, and would create the risk of damaging losses by attrition from three groups of expert technical advisors retained to assist in plant startup, from the 300-person Plant Staff, and from 300 persons in related support organizations.

4. Petitioners overestimate by about a factor of ten the costs of undertaking Phases III and IV of low power testing, assuming Shoreham never subsequently operates commercially. The fuel in the reactor is already irradiated and not usable except at Shoreham; the incremental fuel cost of proceeding to Phases III and IV is not $120 million as Petitioners suggest, but zero. The same is true of control rods and other reactor internals; the incremental cost of proceeding to Phases III and IV is not $1 to $2 million, but zero. The cost of defueling and decommissioning, put by Petitioners at unquantified "tens of millions" of dollars, has been estimated by LILCO at $13 million. Thus if Shoreham completes low power testing but never operates commercially, the incremental cost is approximately $13 million, not $120 million plus "tens of millions" more. If Shoreham operates commercially, the incremental cost of proceeding to Phases III and IV is zero.

II. THE SHOREHAM LOW POWER TESTING PROGRAM

9. Conducting testing at up to 5% of rated power pursuant to the license for Phases III and IV authorized on February 12, 1985 will produce the following types of benefits, discussed in more detail in ¶¶ 10 below:

a. Testing of the reactor and its components up to the turbines at rated temperature and pressure, during both Phases III and IV;

b. Testing steam operated reactor safety equipment such as the High Pressure Coolant Injection System (HPCI) turbine driven pump and the Reactor Core Injection Cooling System (RCIC) turbine driven pump;

c. Testing the main steam system up to the turbine, including the main steam piping and steam drain system, the condenser under vacuum, and operating the steam driven main feed pump turbines;

d. Testing the off gas system including the catalytic recombiner, steam dilution and reheat systems;

e. Testing the rad waste systems and their associated steam driven concentrators;

f. Testing the steam reboiler system, which utilizes reactor steam to produce auxiliary steam from an

enclosed pressure vessel in a separated loop, thus precluding radioactivity from the reactor from entering certain auxiliary systems;

g. Identifying and resolving unforeseeable equipment malfunctions and other systems operability problems which can be detected only during startup testing;

h. Training of the reactor's crews and other station personnel;

i. Accelerating the date of commencement of full power operation.

10. LILCO's division of low power testing into four steps was intended to permit accomplishment of discrete goals at each step. These were described in detail in the attached Affidavit of Jack A. Notaro and William E. Gunther, Jr., dated March 30, 1984, which accompanied LILCO's Supplemental Motion for Low Power Operating License, and the Testimony of William E. Gunther, Jr. during hearings leading to the Initial Decision now under appeal. (Tr. 152 ff.). Without repeating the details of that Affidavit, the following will summarize the activities at each stage of low power testing:

A. Phases I and II: Fuel Loading and Precriticality Testing (December 21, 1984 - January 19, 1985); and Cold Criticality Testing (February 15-17, 1985) (Gunther-Notaro Affidavit, ¶¶ 6-11): Phase I, now completed, involved placing

some 560 fuel bundles, each containing 62 fuel rods, into the reactor at predetermined locations. It also involved installation and utilization of specially designed startup neutron sources and instrumentation to monitor the reactivity in the core and the functioning of reactivity control measures needed beginning with Phase II. Control rod insertion drives, radiation monitoring, and other systems and instruments were checked. During this phase the plant was not critical -- i.e., there was no self-sustaining nuclear chain reaction occurring in the reactor core.

Phase II, also completed, involved withdrawal of control rods from the reactor core to a predetermined extent and sequence so as to achieve criticality -- i.e., a self-sustaining chain reaction -- at extremely low power levels (not above .001% of rated power). The effectiveness of the 137 control rods in controlling reactivity was measured. Plant operators were able to perform reactivity control manipulations, install vessel instruments under operating constraints, and install instrumentation for later measurement of pipe expansion and vibration upon heatup.

Over 5000 man-hours of valuable training were accumulated during Phases I and II. The plant itself did not become significantly radioactive outside the reactor core. However, as is described more fully in ¶ 17 below, the reactor fuel itself became sufficiently radioactive during Phase II that it no longer has any commercial value at any plant other than Shoreham as a practical if not theoretical matter. The same is true of reactor vessel internals (control rods, radiation monitors, etc.).

B. Phases III and IV: Heatup and Low Power Testing to Rated Pressure/Temperature Conditions (1% of Rated Power) (Authorized but not yet commenced); and Low Power Testing (1% to 5% of Rated Power) (Authorized but not yet commenced) (Notaro-Gunther Affidavit, ¶¶ 13-24): Phase III involves plant heatup and pressurization in progressive steps to rated pressure and temperature at 1% of rated power. Each of the six steps in this process includes the performance of a number of tests relating to thermal expansion of piping and training of reactor crews in integrated systems operation under actual operating conditions.

In Phase IV, the reactor is taken initially to 5% of rated power at rated temperature and pressure, tested and then taken through its first cooldown to ambient conditions. The plant is then heated up a second time to rated temperature and pressure; RCIC, HPCI and reactor feed pumps and associated balance-of-plant equipment are tested; and an endurance run on HPCI and RCIC is conducted. The plant is then cooled again to ambient conditions. Data are taken on nuclear steam supply system thermal expansion during each heatup and cooldown.

III. HARM FROM DELAY

11. A delay in undertaking Phases III and IV, if brief, would delay their completion at least day for day. A longer delay would have much longer than day-for-day consequences because of inevitable need to replace neutron calibration sources in the

reactor core. Such a delay could also jeopardize permanent and temporary plant staffing and training. Any delay imposes out-of-pocket costs.

12. Delay in Completing Low Power Operation: If plant startup were allowed to proceed now without any restraint and if no equipment malfunctions or administrative shortcomings are detected, it is conceivable that Phases III and IV could be completed in as short a period as 42 days. However, a basic purpose of initial plant startup is to detect problems and correct them before the plant enters commercial operation at full power, and risks increase and shutdowns become extremely expensive. If a problem is encountered with a safety-related system, correction can be very time-consuming because of the rigid substantive, documentary and quality assurance requirements covering design, procurement and installation of such systems. While it is not expected that problems requiring major delays in the ability to proceed between 5% and 100% of rated power will be encountered in Phases III and IV, the possibility cannot be ignored. It is conceivable that a malfunction in a safety-related system, however unlikely, could require a year to assess, remedy, and receive approval for in the licensing process. For example, the failure of the TDI emergency diesel generators, which gave rise to the exemption proceeding now under review, occurred in July 1983. The results of the repairs to them are still being litigated over 18 months later. While the likelihood of occurrence of this type of

problem is, in my judgment, extremely low, other, smaller problems with a presently uncertain potential for delay ranging from several days to several weeks will almost inevitably be detected. In addition, a problem that would affect Shoreham's completion of low power testing need not even originate at Shoreham; it could originate at any other plant that was similar in relevant aspects. For example, the difficulties experienced at Shoreham with its TDI diesels affected other plants, including Mississippi Power & Light Company's Grand Gulf plant, then in low power testing, for months.

My policy as Vice President-Nuclear has been, and will remain, to detect problems early and correct them systematically and without unnecessary haste. It is the purpose of plant startup to detect problems and correct them at the earliest possible time. A stay of low power testing at Phases III and IV of low power testing would both impair LILCO's ability to execute this sound policy and would enhance the risk that low power testing could delay commercial operation.

13. Replacement of Calibration Sources: Neutron sources of significant radioactivity must be in the reactor from initial fuel loading on, at any time when there is fuel in the reactor, in order to provide background levels of radiation in the core against which to calibrate reactor instrumentation. Five sets of these sources were installed at Shoreham in late December 1984 as part of fuel loading. These sources have a radioactive half-life of approximately 60 days, and will decay unless regenerated by

other activity in the reactor. When the reactor attains 5% power, the level of radioactivity in the reactor core is sufficient to substantially delay further decay of the sources; at higher power levels (upwards of about 15%), the sources are regenerated by activity in the core. If Shoreham does not start Phases III and IV by March, new power sources will have to be ordered at an out-of-pocket cost of $250,000, because of the long lead time for their fabrication and shipment. If Shoreham is prevented from commencing Phases III and IV by the end of June, the sources will have to be replaced. This would mean an unavoidable delay of at least 60 to 70 days in commencing low power testing. This is because in order to replace the sources the containment must be disassembled, the reactor vessel head unbolted and removed, and various fuel assemblies removed in order to access and replace the neutron sources. New sources would have to be ordered, shipped and replaced, and the reactor reassembled. The reactor would then require hydrostatic and leak rate testing as well as repetition of other types of testing already performed once in Phases I and II. My staff has estimated that this work can be accomplished in 40 days, using 50% of the plant's maintenance force working 3 shifts around the clock seven days per week. In the meantime, all of the ordinary maintenance these personnel would otherwise perform must be set aside. Deferral of maintenance not only is bad practice; it has cumulative effects. We have estimated an additional 20 to 30 days to catch up on this work. If unforeseeable complications

develop (as can easily happen in round-the-clock work) further delays would result. Replacement of the sources would thus entail a delay in resuming Phases III and IV of at least 60 to 70 days and major diversion of personnel resources, in addition to the out-of-pocket monetary cost.

14. A stay which delayed the conduct of Phases III and IV of low power testing would also seriously impair the operational training of the Shoreham reactor crews and could even jeopardize LILCO's ability to retain them, as well as forcing LILCO to incur out-of-pocket costs ranging between $300,000 and about $800,000 per month, according to estimates prepared by my staff. LILCO's philosophy for low power operation has been to provide substantially more training of its reactor crews during Phases I-IV of low power testing than is minimally available or required in low power testing. In Phases I and II the aggregate amount of training totaled about 5000 man-hours. During Phases III and IV it is intended that training will total about 6000 man-hours. This will include repeated startups and heatups to rated pressure and temperature in Phase IV to give <u>each</u> operating crew an opportunity to experience plant response. Altogether in Phase IV, the Shoreham plant staff will be required to place in service, operate, test and maintain 54 plant systems. Notaro-Gunther Affidavit, ¶¶ 12, 24. Delay in Phases III and IV would jeopardize LILCO's ability to see to this training and would force LILCO to make wasted out-of-pocket expenses, in three respects: (A)

retention of access to expert personnel from other organizations, now on site to advise and assist in LILCO's low power and power ascension program; (B) out-of-pocket expenses to retain access to the expert advisors; and (C) training and retention of plant staff and related personnel.

A. Pursuant to technical specifications in its low power license from the NRC, LILCO has retained eight experienced advisors, including employees of other utilities and independent consultants, to act as shift operation advisors during low power testing anticipated to take place in early 1985 and in initial operation thereafter. These shift advisors have sufficient experience in operating nuclear reactors to assist LILCO in the low power testing program and to train LILCO's personnel. The cost to LILCO averages approximately $100,000 per year per advisor, including the cost of their employment and training. If completion of Phases III and IV of the low power testing program is delayed, LILCO will incur out-of-pocket losses for their salaries at the rate of about $70,000 per month.

Four of these advisors are on loan from other utilities. Each of the four has completed or is in the process of completing an eight-week-site-specific training program culminating in examinations to assure familarity with the Shoreham plant. Because these advisors are on loan from other utilities, they cannot remain indefinitely at Shoreham. LILCO has already been advised that at least one such advisor, on loan from Carolina

Power & Light Company, must return to that utility in May. I anticipate that there will be similar requests from the other utilities if a delay is experienced in Phases III and IV, in order that these personnel can remain qualified at their "home" nuclear facilities and advance their own careers. Each time LILCO needs to obtain a different advisor to assist in this process, it must conduct the eight-week site-specific training program before the new advisor can apply his knowledge. Thus delay, in addition to being costly, induces turnovers which involve further delay.

B. Also at the Shoreham site are 28 experienced personnel furnished by General Electric Company and 30 furnished by Stone & Webster Engineering Corporation to assist LILCO with its startup and power ascension program assumed to commence in early 1985. The primary purpose of these personnel is to advise LILCO personnel during the low power testing and startup program based on these organizations' previous operating experience at other nuclear facilities. Twenty-five of these personnel are scheduled to leave at the completion of Phase IV low power testing; the remaining 33 are scheduled to remain through various stages of power ascension. Delay in completion of low power testing imposes two direct costs on LILCO: out-of-pocket costs, and risk of loss of access.

These contractor personnel are charged to LILCO at a rate equivalent to about $12,000 per man-month. For the approximately 25 of these personnel who are scheduled to depart after the

conclusion of low power testing, delay in its commencement represents a direct out-of-pocket cost to LILCO of approximately $300,000 per month. For the other 33 or so whose contracts run through the end of power ascension, full attribution of their costs (about $396,000 per month) directly to delay in Phases III and IV is less clear-cut than with those scheduled to leave at the end of low power testing, but the cost is real.

The second type of cost involves access to valuable experts. When no testing is taking place, these personnel are relegated primarily to paperwork. It has been my experience that unless such personnel are actively engaged in supervisory activities for which they were employed, their principals soon transfer them to other jobs where progress is being made and where the personnel can employ their skills. Accordingly, I anticipate that LILCO will lose the benefit of these personnel if low power testing is delayed. While such personnel may ultimately be able to return to Shoreham, scheduling difficulties make it likely that delays in the power ascension program would be necessitated.

C. Shoreham's Plant Staff, including reactor crews, supervisory personnel and staff support, would be adversely affected by a stay. These personnel, who number about 300, are highly trained and much in demand throughout the nuclear industry. While they are, individually and collectively, highly motivated and loyal to LILCO, they cannot be expected to ignore their own self-interest. Shoreham's completion and operation have been

delayed time and again for a variety of reasons. The plant staff have endured, just in the past year, a reduction in force and pay cuts brought about by LILCO's financial difficulties, and a strike. They are at Shoreham for one purpose: to operate the plant. Delays and attendant frustration have cost LILCO valuable people in the past. With the heightened frustration of being unable to operate a plant which is physically complete and has been licensed by the NRC to operate, I fear the loss of knowledgeable, valuable, hard-to-replace personnel. Based on my naval experience as a nuclear submarine commanding officer and as the New York State Power Authority's first resident manager of the Fitzpatrick Nuclear Power Plant, I am convinced that personnel who have gone through the construction period of a plant or ship and the associated preoperational test programs have experience that directly influences safe reactor operation. It is common knowledge among naval commanding officers that the commissioning crew will probably be the most knowledgeable crew the ship ever has.

D. In addition to the Shoreham Plant Staff, there are approximately 300 additional employees, most of them professional or technical, who work in areas totally or primarily devoted to the support of Shoreham: the Nuclear Engineering Department, the Nuclear Operations Support Division, and the Nuclear Quality Assurance Department. Like the Plant Staff, these employees are highly trained and motivated; like the Plant Staff, they are highly sought after and highly mobile; like the Plant Staff, they

have endured economic and other privations. I fear their loss by attrition if startup is delayed.

15. The effect of delay in the conduct of Phases III and IV of low power testing, whether from the stay requested here or other causes, cannot be stated precisely for all circumstances. However, the following things are clear. First, the out-of-pocket cost of expert utility and contractor personnel now onsite for low power testing and, in some cases, power ascension, is over $820,000 per month. At least $300,000 per month is directly attributable, day for day, to any delay in Phases III and IV. Second, purely from an operational standpoint, if we cannot predict before the end of June that low power testing will be complete by September 1, we will have to install new neutron sources, at an additional delay of at least 60 to 70 days. After that, the low power testing which could not be completed before September 1 will have to be done again, covering another 42 days or more. In short, a delay preventing the undertaking of Phases III and IV of low power testing beyond early June will, in all likelihood, delay completion of that testing until about the start of November, even if all goes smoothly. A delay beyond that time would retard completion of low power testing by at least 110 to 120 days beyond the end of the initial delay. If personnel -- advisors, plant staff or supporting personnel -- were affected in the meantime, the effect of delay would be increased by an unquantifiable but potentially long period.

16. Delay of Phases III and IV of low power testing would also lead to delays in LILCO's ability to generate power to its grid once a full power license is issued. LILCO has designed its ascension test program so that about 60% of the testing activities will be completed by the end of Phases III and IV of low power testing. This is a significantly larger amount of the overall program than is usually completed by the end of testing at 5% power. As a result, when a full power license is issued, LILCO will be in a position quickly to generate power directly to the grid, beginning at approximately 15 to 20% of rated power. Normally, the power ascension program requires the plant to frequently cease power generation to the grid in order to test its reaction to various transients. LILCO will test Shoreham's reaction to the maximum possible number of these transients during Phases III and IV of low power testing, a time when no power generation to the grid will take place. Accordingly, there will be a considerably reduced need to interrupt its power generation to the grid once a full power license is issued.

IV. INCREMENTAL EFFECTS OF PROCEEDING TO PHASES III AND IV

17. The February 12, 1985 Affidavit of Messrs. Bridenbaugh and Minor compares various costs of permitting Phases III and IV of low power operation (assuming that Shoreham never enters commercial operation), with those of halting operation after Phases I and II. Their principal estimated cost element, $120 million for

fuel, is incorrect in all respects. The actual initial cost to LILCO of Shoreham's core was approximately $40 million, and its value for any plant other than Shoreham was effectively reduced to zero when it was irradiated in Phase II. Thus the incremental fuel-related cost of proceeding to Phases III and IV is not $120 million but essentially zero. This and the other, smaller cost elements estimated by Messrs. Bridenbaugh and Minor are discussed more specifically below.

A. Nuclear Fuel: The Bridenbaugh-Minor Affidavit overestimates the value of Shoreham's core, before irradiation, to any other reactor. The $120 million cost estimated by Messrs. Bridenbaugh and Minor to purchase the fuel in the Shoreham reactor is incorrect; the actual figure paid was approximately $40 million, though it would be somewhat higher (on the order of $60 to $65 million) now. However, its resale value for any reactor other than Shoreham, even before irradiation in Phase II initial criticality, would have been substantially lower than its value to Shoreham since there is no ready market for the core. Nuclear reactor cores are custom-designed specifically for (1) the type of reactor (in this case, a BWR Mark 4) and (2) its stage of life (in this case, the first core). LILCO is not aware of, and believes that there are not, any other BWR Mark 4 reactors which have neither entered commercial operation yet nor had their first core already fabricated. Thus in order to be utilized economically and safely in any other reactor, Shoreham's core would have to be

redesigned and refabricated. Each of the nearly 35,000 fuel rods in Shoreham's core would have to be separated individually from the others within its fuel bundle. Virtually every, if not every, rod would have to be opened and its nearly 300 individual fuel pellets (of varying degrees of uranium enrichment) and fuel spacing devices removed, evaluated and repacked, rod by rod, in different configurations, on the basis of engineering calculations performed for the other core. The resale value -- more accurately, salvage value -- of Shoreham's core, unirradiated, would reflect the cost of this costly and cumbersome process of removing, sorting and repacking the usable portion of some 10 million fuel pellets.

B. The Bridenbaugh-Minor Affidavit claims that the resale value of the fuel in the Shoreham reactor will not be substantially affected by irradiation before operation at Phases III and IV, with the implication that proceeding to Phases III and IV will incur a $120 million cost (Affidavit, ¶ 20, esp. ¶ 20(b)). That assertion is simply wrong; the cost, whatever it is, was already incurred in Phase II, when the fuel was initially irradiated. Though the degree of irradiation is not as high as at full power (or even 5%) operation, the fuel must now be treated for regulatory and commercial purposes as irradiated fuel. Thus the processes necessary to make this core usable at any other plant cannot physically be performed anymore without shielding against radiation. In addition, the core could not be removed from the

reactor or shipped without shielding in accordance with NRC and DOT regulations. The amount of shielding required for its handling would not render such operations technically impossible. It would, however, render them commercially infeasible, especially in the current market, where neither raw uranium nor enrichment nor fabrication capacity are in short supply. Thus as of completion of Phase II activities, the salvage value of the Shoreham fuel for any reactor other than Shoreham is essentially zero. There are no further costs associated with the fuel in Phases III and IV.

C. Petitioners claim that proceeding to Phases III and IV will result in other areas of contamination which would not have occurred at Phases I and II: to control rods, radiation monitors and other reactor interals. (See Affidavit, ¶ 20(c)). They evaluate this cost at between $1 and $2 million. This assertion is also wrong. These components are as radioactive as Shoreham's fuel and whatever costs may be associated with their irradiation are already sunk.

D. Petitioners also claim that proceeding to Phases III and IV, without later commercial operation, would entail a cost for defueling, decontamination, decommissioning and disposal which they do not quantify but which, they assert, could be "tens of millions of dollars." (Affidavit, ¶ 20(d)). LILCO has estimated this cost at about $13 million.

E. Even if one assumes that Shoreham never reaches commercial operation, the incremental cost of proceeding to Phases

III and IV is only $13 million, not the $120 million plus $2 million plus uncounted "tens of millions" as postulated by Messrs. Bridenbaugh and Minor. If Shoreham is assumed to ultimately reach commercial operation, the incremental cost of proceeding to Phases III and IV is zero.

State of New York :
: to-wit:
County of Suffolk :

John D. Leonard, Jr.

Subscribed to and sworn before me this 20th day of February, 1985.

LINDA A. CRATTY
NOTARY PUBLIC, State of New York
No. 4816267
Qualified in Suffolk County
Commission Expires March 30, 1986

Notary Public

My Commission expires: March 30, 1986