UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

AFFIDAVIT OF WILLIAM G. SCHIFFMACHER

William G. Schiffmacher, being duly sworn, deposes and states as follows:

(1) My name is William G. Schiffmacher and I have been Manager of the Electrical Engineering Department at LILCO since August 1981. I have been employed by LILCO since June 1965 in a variety of technical, management and supervisory positions, the principal ones of which are as follows:

July 1972- November 1972	Supervisor, Substation Operations Responsible for coordinating efforts of 15-20 field personnel involved in operation of the electric system.
November 1972- September 1975	Supervisor, Transmission and Intersystem Planning Responsible for planning and recommending system transmission projects including substations; complement of 5 engineers.

September 1975- December 1977	Manager, Electric System Planning Responsible for conduct of all studies and investigations for planning LILCO's electric facilities. Division is organized into four specialties - generation, economics, transmission and inter-system studies. Work includes preparation of reports and testimony for economic and technical aspects of, among others, Shoreham and Jamesport nuclear units and associated transmission and interconnection facilities. Personnel complement of 15 includes 12 engineers, 1 economist and 2 technicians.
December 1977- May 1979	Manager, Substation Design and System Control and Protection Responsible for the physical-electrical design of all substations and complete engineering and design of all protective relaying, supervisor control and telemetering systems for LILCO; complement of 12 engineers.
May 1979- April 1981	Manager, Electric System Planning Same as above.
April 1981- August 1981	Manager of Overhead and Underground Distribution Materials

(2) As Manager, Electrical Engineering Department, my duties and responsibilities include responsibility for all electrical engineering, including overhead and underground transmission, substation engineering, distribution engineering,

and electrical engineering associated with nuclear and fossil plants and buildings.

(3) I have a Bachelor of Electrical Engineering degree from Manhattan College (1965) and a Master of Science degree in Management Engineering (1969) from Long Island University.

(4) The purpose of this affidavit is to describe all of the normal and additional sources of AC power available to support the Shoreham Nuclear Power Station without reliance on the Transamerica Delaval emergency diesel generators. This explanation will describe the high reliability provided by the numerous and diverse means of providing adequate AC power to Shoreham.

(5) There are numerous sources of AC power available to and designed for Shoreham. Each has substantial backup in the unlikely event of failure. They include the following, all of which are depicted in Exhibit A:1/

(a) LILCO has a 138 KV and a 69 KV high voltage network system with significant interconnection

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1/ For convenience, the facilities described below are referenced to Exhibit A by letters noted in parentheses here and in triangles on the exhibit. Additional detail and perspective are provided in Exhibit A-1.

capacity (i) with the New York Power Pool through Consolidated Edison (three ties totaling 1090 MW) and (ii) with the New England Power Grid through lines beneath Long Island Sound through Connecticut Light & Power Company (285 MW). See (A) Exhibit A; Exhibit B (LILCO Interconnections). This ensures the availability of sufficient power throughout the system to serve Shoreham's needs. Moreover, each of LILCO's major generating facilities is equipped with a backup blackstart2/ gas turbine to provide starting power under blackout conditions. As an example, Port Jefferson is a major generating station with two 185 MW steam generating units and a blackstart gas turbine only eleven miles from Shoreham. See (L) Exhibit A.

(b) Within the LILCO system, there are four 138 KV circuits into the Shoreham 138 KV switchyard (see (D) Exhibit A) along two separate and distinct rights-of-way. See (B, C) Exhibit A. Also, Shoreham is supplied by three separate 69 KV circuits entering a separate switchyard at Wildwood which connects to the

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2/ "Blackstart" indicates the ability to be started independently of any other power source.

Shoreham 69 KV switchyard. See (E) Exhibit A. In contrast, GDC 17 requires only "two physically independent circuits (not necessarily on separate rights-of-way)" and permits a single switchyard.

(c) Even in the event the entire grid is unavailable, the LILCO system includes 10 gas turbines at Holtsville (Holtsville is approximately 20 miles from the Shoreham site), 50 MW per turbine, two of which are presently equipped with deadline blackstart capability designed and installed to support Shoreham. See (F) Exhibit A. Three more will be equipped with blackstart capability by April, 1984.3/

(d) As further backup, there are three blackstart gas turbines located at Southhold (see (G) Exhibit A), East Hampton (see (H) Exhibit A), and Port Jefferson (see (L) Exhibit A), each of which can supply 69 KV power to Shoreham.

3/ Two of the five have deadline blackstart and the other three will be started by the system operator. Deadline operation implies automatic start without operator intervention if system power is lost.

(e) At the site, LILCO is completing the installation of a 20 MW gas turbine with deadline blackstart capability. See (I) Exhibit A. This will provide adequate AC power to Shoreham even in the unlikely event all transmission supplies are lost.

(f) To allow further independence from the LILCO grid and independence from the normal station service transformer and reserve station service transformer, LILCO is in the process of obtaining and installing a block of four 2.5 MW blackstart mobile diesel generators to be located on site and routed into the plant's emergency 4 KV buses. See (J) Exhibit A; Exhibit C (Plant 4 KV system).

With this general description of the variety of AC power sources for Shoreham as background, I will turn next to a more detailed description of each source and a consideration of its role in providing additional assurance that adequate AC power will be provided to Shoreham under normal and emergency conditions.

LILCO'S SYSTEM GRID AND INTERCONNECTION CAPACITY

(6) LILCO has a generating capacity of 3721 MW

consisting of 2240 MW of baseload steam turbine units, 432 MW of mid-range and peaking steam turbine units and 1049 MW of internal combustion peaking units consisting of gas turbines and diesel generators.

(7) In addition to LILCO's bulk power transmission system, LILCO is interconnected with the New York Power Pool through Consolidated Edison. This interconnection is made through three ties providing an additional 1090 MW of power if needed as follows:4/

	Voltage	Summer Ratings (MW) Normal	LTE	STE
Lake Success-Jamaica	138KV	238	341	427
Valley Stream-Jamaica	138KV	271	318	441
Shore Road-Dunwoodie	345KV	581	839	1479

(8) Since all members of the New York Power Pool (NYPP) are required to maintain reserve capacity of 18% over their peak demand, and since the Pool members do not experience peak demands at the same times, a Pool-wide 22% reserve margin

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4/ Exhibit B (LILCO Interconnections) depicts the various interconnections with their nominal ratings. The slight differences in power ratings between Exhibit B and the above ratings resulted from rounding off. Exhibit B also reflects only normal power ratings and not the long-term emergency (LTE) and short term emergency (STE) ratings included above.

is achieved. Furthermore, the NYPP operates with enough spinning reserve to cover the loss of the largest generation source in the state.

(9) LILCO is also connected with the New England Power Grid beneath Long Island Sound through the Northport-Norwalk tieline which is a 138 KV line rated at 285 MW.

(10) Subsequent to the Northeast Blackout of 1965, LILCO implemented substantial measures to increase reliability of its system. These included installation of blackstart gas turbines at each of its major generating stations and implementation of automatic underfrequency load shedding procedures.5/ In the 18 years since, there has been no loss of the entire LILCO grid. There has only been one incident in which LILCO has lost any appreciable portion of its bulk power transmission system. That one incident affected LILCO's system east of Holbrook. Despite the lack of any procedures then in effect mandating priority emphasis on restoring power to Shoreham, power was restored to the entire Shoreham area within one hour and four minutes. With the priority procedures now in effect

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5/ Underfrequency load shedding schemes allow restoration of a balance between load to be served and generation available by automatically disconnecting load from the system. This prevents cascading outages of multiple facilities on the system.

to restore power to Shoreham and the availability of several independent deadline blackstart gas turbines, all of which are described below, it has been demonstrated by exercises that today power can be restored to Shoreham in a matter of minutes.

(11) The reliability of LILCO's bulk transmission system was further evidenced when Consolidated Edison's system experienced a blackout in 1977. LILCO's entire bulk transmission system remained on line and there was no interruption in service to the LILCO system.

THE DESIGNED SYSTEM FOR SHOREHAM

A. Transmission Network

(12) The Shoreham Nuclear Power Station is interconnected to the LILCO system through 138 KV and 69 KV circuits. Four 138 KV transmission circuits serve the 138 KV Shoreham switchyard. Two circuits emanate from the Holbrook 138 KV substation, (B-1) Exhibit A; one from the Wildwood-Riverhead 138 KV substation, (C-1) Exhibit A; and one from the Brookhaven 138 KV substation, (C-2) Exhibit A. See also Exhibit D (LILCO system diagram). Two separate and independent rights-of-way are provided, each containing two of the four 138 KV circuits. The 138 KV switchyard is arranged in a

two bus configuration with circuit breakers and switches arranged to permit isolation and/or repair of either bus section. This permits continuation of 138 KV power supplied from separate rights-of-way even if an entire bus section is out of service.

(13) Additionally, three 69 KV circuits feed the Wildwood substation which is approximately one mile south of Shoreham and from there, one 69 KV circuit enters the site. These three circuits emanate from Riverhead (see (E-1) Exhibit A), Holtsville (see (E-2) Exhibit A), and Port Jefferson (see (E-3) Exhibit A). See also Exhibit D. The 69 KV line from Wildwood to the Shoreham 69 KV switchyard has been placed underground in the vicinity of the 138 KV facilities to maintain complete independence of supply between the normal station service (NSS) and reserve station service (RSS) transformers. See (K-1) Exhibit A. The circuit continues underground from the substation to the RSS transformer. Furthermore, in the unlikely event that either of these underground sections should fail, a bypass 69 KV circuit (bypassing the 69 KV switchyard) to the RSS transformer has been provided. See (K-2) Exhibit A. By utilizing this bypass circuit, power can be restored without having to repair the underground cable or route power through the Shoreham 69 KV switchyard. This bypass allows

reestablishment of the 69 KV RSS supply substantially more quickly than the 72 hours as required in Technical Specification "Electrical Power Systems 3/4.8.1.1" without the necessity of removing the nuclear plant from service.

(14) Both the 138 KV and 69 KV lines form part of the LILCO network transmission system. This system is designed to withstand winds of minimum speeds of 100-130 mph. Other natural phenomena such as tornadoes, hurricanes and earthquakes have not adversely impacted LILCO's bulk transmission system. Nevertheless, when such phenomena are expected, specific precautionary procedures will be invoked as described in the affidavit of William J. Museler.

(15) Even in the unlikely event that any of the transmission facilities are damaged, LILCO has the ability to reconstruct such facilities rapidly. LILCO routinely constructs its own transmission facilities. Therefore, LILCO has a large force of trained personnel to construct and restore transmission facilities. These trained crews are available 24 hours a day to respond to emergency conditions. In order to assure prompt responsiveness for the lines serving Shoreham, LILCO is undertaking extraordinary measures to preplan such an operation. This includes measures such as pre-assigning poles

and hardware and storing this equipment at optimized locations, as well as conducting additional training of overhead lines personnel. Using these measures, LILCO can restore a mile of 69 KV transmission facilities within 24 hours. While it is not anticipated that such extensive damage would occur on any one transmission line, this capability provides a benchmark indicating the expeditious manner in which LILCO could restore facilities.

(16) Additionally, the necessity for reconstructing transmission facilities at any instant in order to serve Shoreham is minimized by the nature of the transmission system. It is a network system of interconnected lines which provide the ability to route or reroute power over multiple paths.

B. Independent Blackstart Generators

(17) The reliability of LILCO's system providing power to Shoreham is further enhanced by a number of independent gas turbines at various locations specifically designed to start during blackout conditions. Exhibit A shows the location of these gas turbines discussed below.

(18) The LILCO system includes 10 gas turbines at Holtsville, 2 of which are equipped with deadline blackstart capability and 3 of which will have blackstart capability designed and installed to support Shoreham. See (F) Exhibit A. All five blackstart turbines are under the control of and can be started by the system operator.6/ Power from these gas turbines is capable of being supplied to Shoreham through various transmission paths ultimately leading to any of the 138 KV lines or the three 69 KV lines to Shoreham as depicted in Exhibit A. Under simulated conditions, tests have shown that power can be restored to Shoreham from Holtsville in 6 minutes. The system operator (in close coordination by telephone and/or radio with the Shoreham control room) deliberately isolates these gas turbines so that the system appears to be in a blackout mode. A unit automatically starts and the operator then clears a transmission line express to Shoreham. Implementation of this procedure has been directed in LILCO's Emergency and Unusual Procedures Manual as the paramount priority for the LILCO system operator in the event of a blackout. Tests of the Holtsville gas turbines and practice restoration

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6/ The system operator controls the entire LILCO grid from a central point. There are 3 such operators on duty at all times at Hicksville.

of power to Shoreham are conducted twice a month. See Museler Affidavit at ¶ 18.

(19) There are additional deadline blackstart gas turbines at 2 locations east of Shoreham, Southhold (15 MW) (see (G) Exhibit A) and East Hampton (20 MW) (see (H) Exhibit A), either of which is capable of supplying adequate power to Shoreham in the event the Holtsville units are unavailable. Power from each of these units is supplied to Shoreham by 69 KV circuits to Riverhead where routing to Shoreham can continue via 69 KV or 138 KV lines. See Exhibit D. A description of testing to assure the reliability of these units is included in the Museler affidavit. Finally, there is a blackstart gas turbine at the Port Jefferson 370 MW steam plant eleven miles to the west of Shoreham which is also capable of supplying power to Shoreham. See (L) Exhibit A.

C. Onsite 20 MW Gas Turbine

(20) The redundant methods of restoring power to Shoreham described above complement and provide yet another backup for the most rapid method of restoring AC power to Shoreham which is a dedicated 20 MW gas turbine being installed at the site. See (I) Exhibit A. This gas turbine has deadline blackstart capablity and is scheduled to be operational in

April 1984. Thus, even with the loss of all alternative AC power sources and their backups, including the Holtsville, Southhold and East Hampton gas turbines, more than adequate AC power could be provided by the 20 MW gas turbine on the site. It has the ability to carry all plant emergency load together with some selected plant nonemergency load. LILCO's procedures call for concurrent, rather than sequential, efforts to restore power to Shoreham using any and all of the available power sources. That is, the 20 MW gas turbine will start automatically, while the system operator will simultaneously institute action to restore power to Shoreham through the transmission system.

(21) The 20 MW gas turbine is connected to the 69 KV bus at Shoreham. It is also equipped with fully automatic (deadline) blackstart capability which gives it the ability to start automatically upon loss of voltage to the 69 KV bus and pick up load as required. The 69 KV bus supplies power to the reserve station service transformer via an underground 69 KV cable. Power can be restored to the reserve station service transformer in approximately 2-3 minutes.

(22) With its newly installed low pressure air start system and fuel control system, the 20 MW gas turbine at

Shoreham is virtually identical to the gas turbine at East Hampton which has had an operational availability of 97.9%. LILCO's procedures for testing this 20 MW gas turbine to assure its reliability are described in the Museler Affidavit.

(23) The 20 MW gas turbine should be able to fulfill its function even after a seismic event. It is a Turbo Power and Marine (Pratt and Whitney) gas turbine. There are no substantive differences between Pratt and Whitney gas turbines specifically designed in accordance with the seismic building code and the 20 MW unit at Shoreham. The code requires that machines withstand a .3g horizontal acceleration. Accordingly, Turbo Power and Marine has assured LILCO that the 20 MW gas turbine would be structurally sound during a design basis seismic event at Shoreham which would exert only a .2g horizontal acceleration and .113g vertical acceleration. See letter of John T. O'Brant attached as Exhibit E.7/

7/ There is no seismic information available as to the electrical panels associated with the unit. If the unit were operating, there is a possibility that it would trip during a design basis earthquake because of relay contact bounce. It would restart automatically in a deadline mode after conclusion of the seismic event if necessary to provide AC power. However, usually the gas turbine will be in a standby mode, ready to run and provide power after such a seismic event has occurred and resulted in some disruption of the normal system power supply.

(24) In an effort to minimize the risk of damage to the fuel tank and associated piping in a seismic event, LILCO will constantly have available a standby mobile supply of fuel for the 20 MW gas turbine (and for the 4 mobile diesels discussed below) by having a loaded tanker truck on site at all times during low power operation.

MOBILE AC POWER SOURCES

(25) Though not necessary or required, LILCO will provide a sixth AC power source to operate upon the unlikely loss of Shoreham's normal designed sources of AC power (i.e., in addition to the blackstart gas turbines at Holtsville, the blackstart gas turbines at Southhold, East Hampton and Port Jefferson and the 20 MW blackstart gas turbine at Shoreham), LILCO is installing at Shoreham a block of four 2.5 MW General Motors EMD blackstart mobile diesel generators, model 20-645 E-4, to be directly connected into the plant's 4 KV bus network which, in turn, will provide power to the emergency 4 KV buses (see (J) Exhibit A). This provides the additional benefit of being able to supply power to the emergency 4 KV buses in the unlikely event of the simultaneous loss of the NSS and RSS transformers and all three of the TDI diesel generators.

(26) These mobile diesel generators will be able to supply power to the plant's emergency systems within 30 minutes of starting the diesels.

CONCLUSION

(27) Even under system blackout conditions, there are numerous ways to feed power to Shoreham. For example, upon loss of the LILCO grid, the multiple units at Holtsville, or the Southhold, East Hampton or Port Jefferson gas turbines can generate adequate power. Upon the inability to start any of these system blackstart gas turbines or upon the loss of the transmission routes into the site, the onsite 20 MW gas turbine remains available and will start automatically and provide power to the RSS transformer. If that were to fail, there are still four mobile diesel generators available to serve required plant loads.8/ A maximum of two of the four mobile units9/ would be required for safe shutdown under normal or accident conditions. Accordingly, based on the historical reliability of the LILCO grid, the multiple redundant sources of power available to Shoreham under blackout conditions and the

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8/ The three TDI diesels would also be available. See Museler Affidavit at ¶ 11.

9/ Testing may show that only one mobile unit will suffice.

multiple transmission paths into the area, the availability of AC power to Shoreham is reasonably assured and is considerably greater than contemplated by applicable NRC regulations.

William G Schiffmacher
William G. Schiffmacher

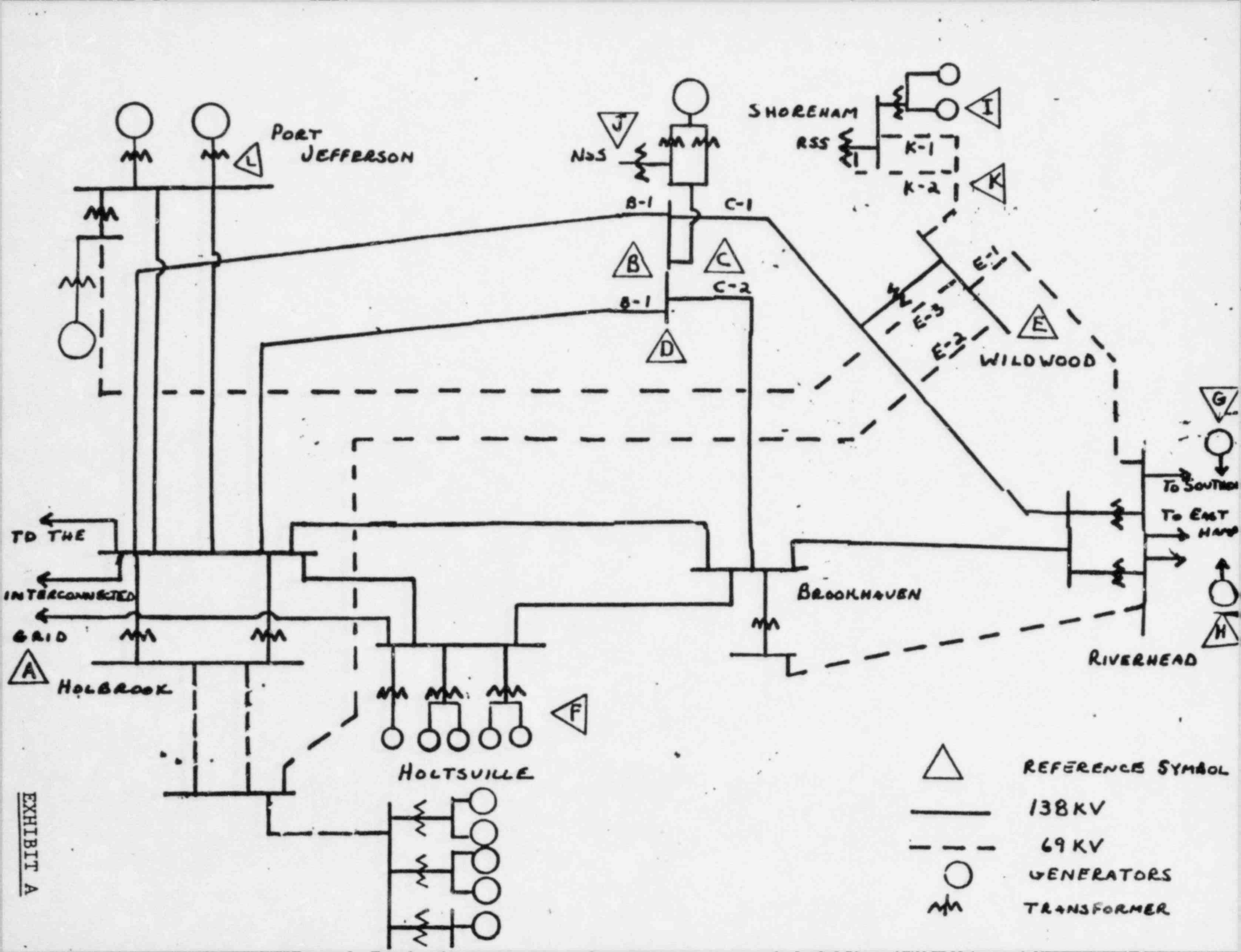
STATE OF NEW YORK)
) To-wit:
COUNTY OF Suffolk)

Subscribed and sworn to before me this 22nd day of March, 1984.

Marie Vanacore
Notary Public

My commission expires: March 30, 1984

MARIE VANACORE
NOTARY PUBLIC, State of New York
No. 30-4769813
Qualified in Nassau County
Commission Expires March 30, 1984


PORT JEFFERSON
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E-3
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E
WILDWOOD
G
TO SOUTHOLD
TO EAST HAMP
H
TO THE INTERCONNECTED GRID
A
HOLBROOK
BROOKHAVEN
RIVERHEAD
F
HOLTSVILLE
REFERENCE SYMBOL
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69KV
GENERATORS
TRANSFORMER

EXHIBIT A

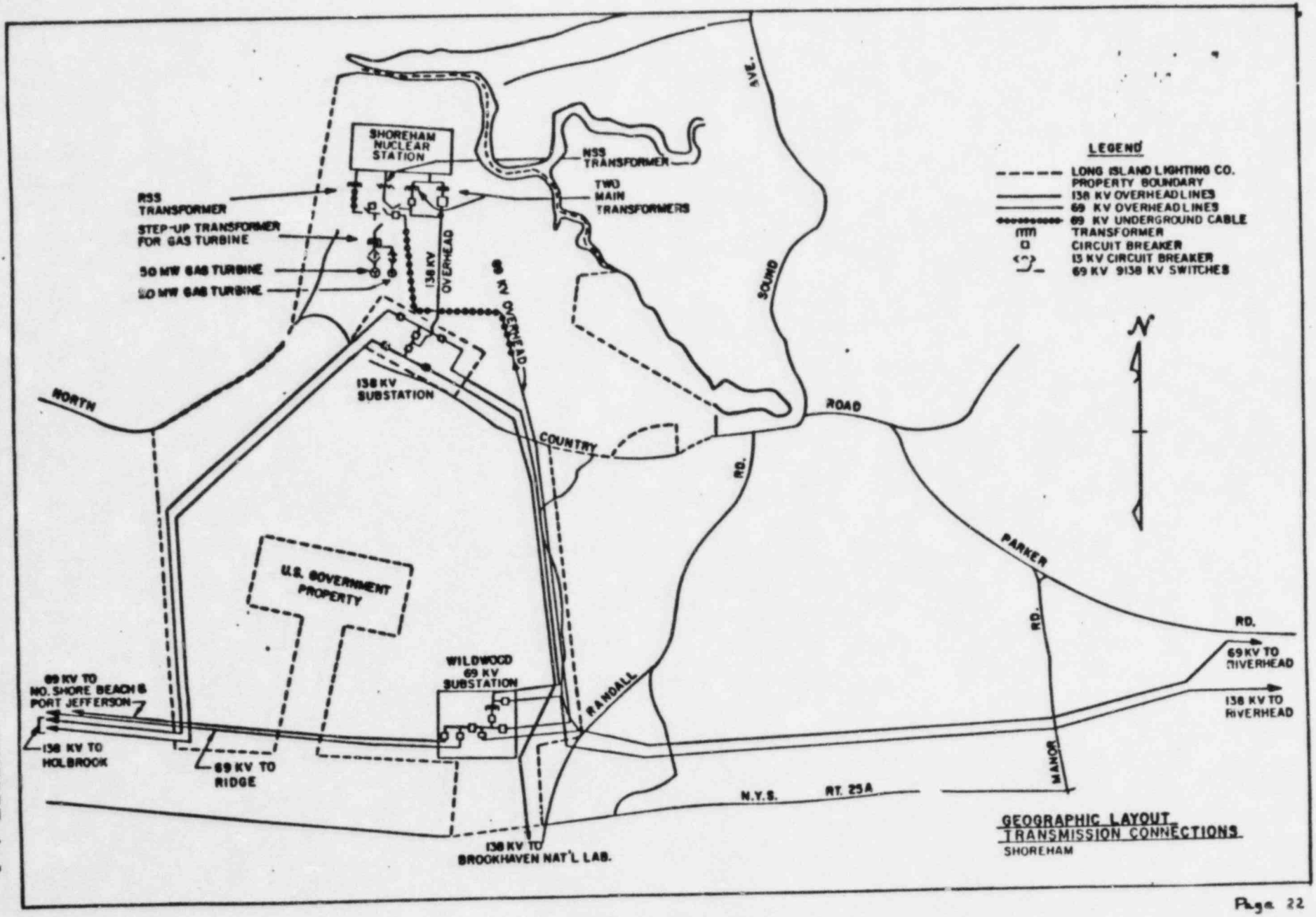
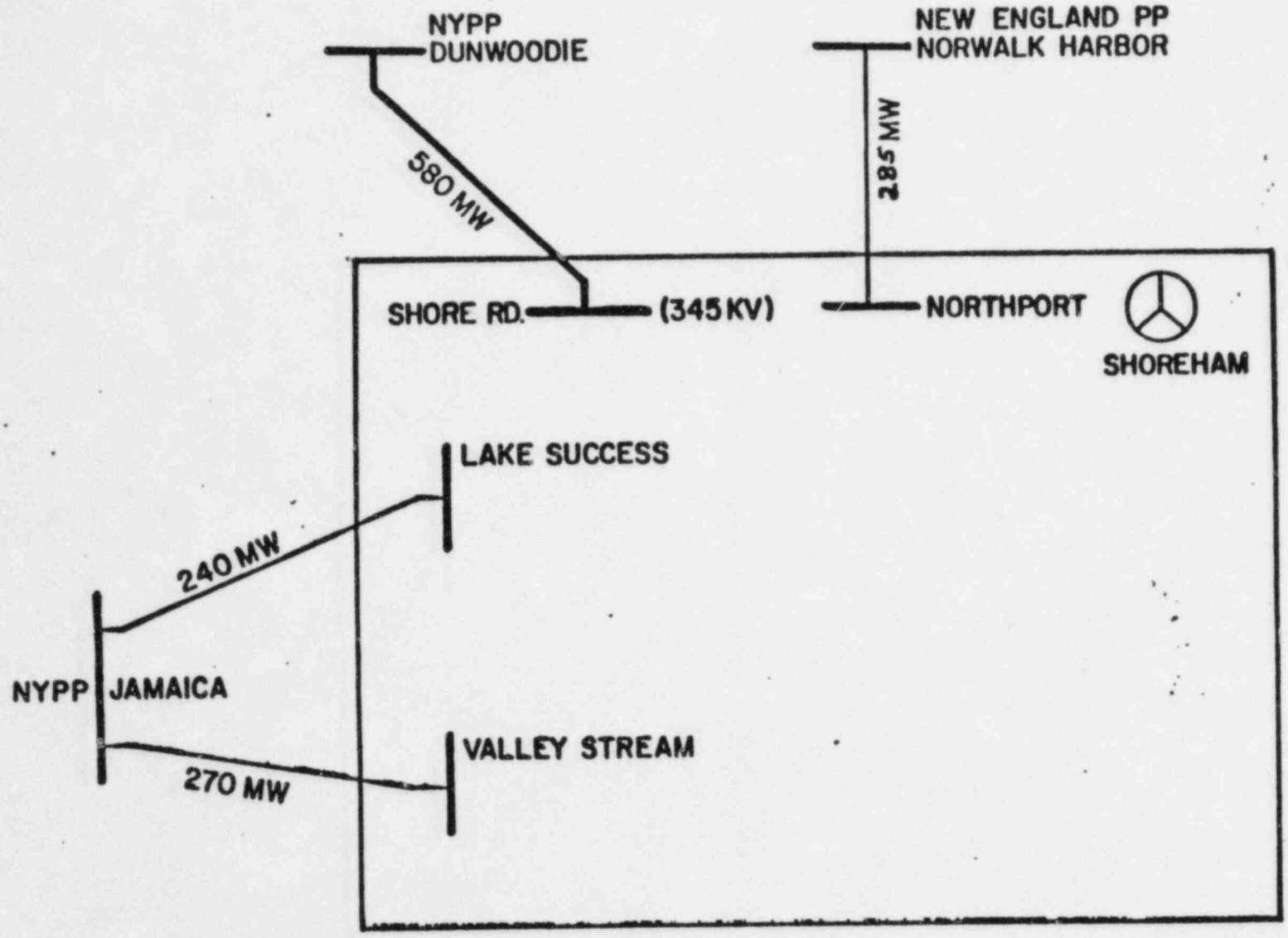

SHOREHAM NUCLEAR STATION
NSS TRANSFORMER
TWO MAIN TRANSFORMERS
RSS TRANSFORMER
STEP-UP TRANSFORMER FOR GAS TURBINE
50 MW GAS TURBINE
50 MW GAS TURBINE
138 KV OVERHEAD
69 KV OVERHEAD
138 KV SUBSTATION
NORTH COUNTRY RD.
SOUND AVE.
ROAD
PARKER RD.
RD.
MANOR RD.
RANDALL
U.S. GOVERNMENT PROPERTY
WILDWOOD 69 KV SUBSTATION
69 KV TO NO. SHORE BEACH & PORT JEFFERSON
138 KV TO HOLBROOK
69 KV TO RIDGE
138 KV TO BROOKHAVEN NAT'L LAB.
N.Y.S. RT. 25A
69 KV TO RIVERHEAD
138 KV TO RIVERHEAD
LEGEND
LONG ISLAND LIGHTING CO. PROPERTY BOUNDARY
138 KV OVERHEAD LINES
69 KV OVERHEAD LINES
69 KV UNDERGROUND CABLE
TRANSFORMER
CIRCUIT BREAKER
13 KV CIRCUIT BREAKER
69 KV 9138 KV SWITCHES
N
GEOGRAPHIC LAYOUT
TRANSMISSION CONNECTIONS
SHOREHAM

EXHIBIT A-1



LILCO INTERCONNECTIONS

EXHIBIT B

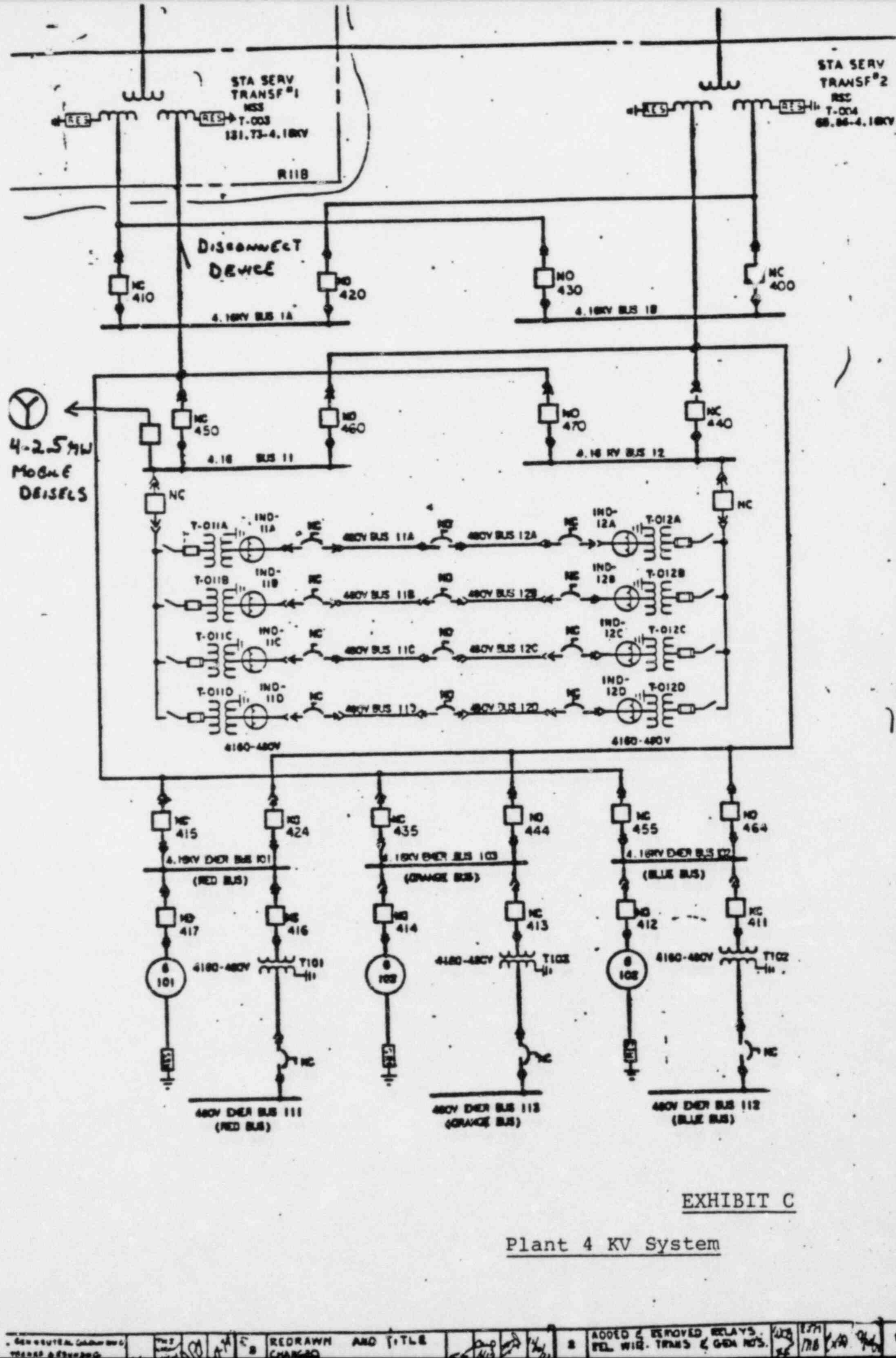


EXHIBIT C

Plant 4 KV System

UNITED TECHNOLOGIES TURBO POWER

Turbo Power and Marine Systems, Inc.

400 Main Street
East Hartford, Connecticut 06108
203/565-4321

March 1, 1984

Long Island Lighting Company
175 East Old Country Road
Hicksville, NY 11801

Attention: Mr. Richard Zambratto

Gentlemen:

In response to your request for information relative to the seismic resistance capability of TPM FT4 units, the following is offered.

Prior to 1975-76, the structural design of FT4 units incorporated a variety of NEMA, ANSI, ASCE, and AWB specifications, but did not incorporate specific seismic load requirements. Beginning in about 1975, we initiated design incorporation of the "Universal Building Code" which includes a 0.3g horizontal load requirement, but no vertical load requirement.

The "Universal Building Code" requirement is that the structures and equipment be able to withstand a 0.3g horizontal load, but does not require that the unit operate through that load. We do not know whether installed protective relays and the Rowan relays installed in the FT4 sequencer units could withstand such a load without tripping.

Even though the structural design of pre 1975-76 units, which includes the West Babylon and the Holbrook units, did not incorporate the 0.3g horizontal load requirement specifically, it is our opinion that all those units would withstand the 0.2g horizontal and 0.113g vertical load requirement you mentioned and still be operable. The concern about operating through such an event without tripping relays would still apply.

There is one other minor point worth mentioning: in a Power Pac (one engine, one generator), the engine/generator coupling is rigid and provides a fixed restraint for the generator rotor which would absorb any axial "g" load without significant movement. In a Twin Pac (two engines, one generator), the engine/generator couplings are the flexible Bendix type which could allow some generator rotor axial movement due to imposition of horizontal load. This axial movement might compress one flexible coupling in the direction of movement and impart a momentary impact load on the power turbine thrust bearing. This remote possibility could result in a peening of the bearing ball/races leading to an eventual failure of the bearing. The restraining stretching action of the opposite end coupling makes this a minor concern.

The gas turbine itself is designed to withstand much higher "g" loads, due to severe flight and military shipboard blast load requirements in the 5-10g range.

EXHIBIT E

I hope this satisfies your immediate need. If we turn up any additional information, we will pass it along.

Very truly yours,

John T. O'Briant
Manager, Product Support

jfp