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-4
	)	(Low Power)
(Shoreham Nuclear Power	)	
Station, Unit 1)	)	

TESTIMONY OF WILLIAM G. SCHIFFMACHER

EDUCATION, EXPERIENCE AND QUALIFICATIONS

1. Q. Please state your name and address.

   A. My name is William G. Schiffmacher. My business address is 175 East Old Country Road, Hicksville, New York 11801.

2. Q. What is your occupation?

   A. I am by training an electrical engineer and presently Manager of the Electrical Engineering Department at LILCO.

3. Q. How long have you been Manager of the Electrical Engineering Department at LILCO?

   A. Since 1981.

4. Q. What are your responsibilities as Manager of the Electrical Engineering Department?

A. I am responsible for all electrical engineering projects at LILCO including overhead and underground transmission systems, associated substations, distribution engineering materials, fossil plants and buildings and nuclear plants. With respect to nuclear plants, the responsibility for engineering is shared with the Nuclear Engineering Department and the Shoreham Plant Staff.

5. Q. What educational background do you have that qualifies you for your present job?

A. I received a Bachelor of Electrical Engineering degree in 1965 from Manhattan College. In addition, in 1969 I received a Master of Science degree in Management Engineering.

6. Q. How long have you been employed by LILCO?

A. Since 1965 - 19 years.

7. Q. What other job responsibilities have you had with LILCO?

A. From June 1965 to July 1972, I held various positions in the Distribution Engineering and Planning

Departments. My responsibilities there included recommending system improvements and expansion plans for the transmission, subtransmission, distribution substation and feeder circuits. In July of 1972 I became supervisor of Substation Operations where I was responsible for coordinating the efforts of field personnel involved in the operation of the electric system. In November of that year, I became supervisor of Transmission and Inter-system planning. I was responsibile for planning and recommending system transmission projects encompassing overhead and underground transmission facilities and terminal substations. In September of 1975 I became manager of Electric System Planning. I was responsible for the conduct of all studies and investigations for planning LILCO's electric facilities. The division was organized into four specialties - generation, economics, transmission, and inter-system studies. The work included preparation of reports and testimony for the economic and technical aspect of major transmission, generation and interconnection factilities. In December of 1977 I became manager of Substation Design and System Control and Protection

in the Electrical Engineering Department. There I was responsible for the physical electrical design of all substations and complete engineering and design for all protective relaying, supervisory control and telemetering systems for LILCO. In May of 1979 I became once again Manager of Electric System Planning and my responsibilities were as described previously. In April of 1981 I became Manager of Overhead and Underground Distribution Materials. My responsibilities included material specification and testing associated with the materials and components utilized in the overhead and underground distribution systems. In August of 1981 I was promoted to Manager of the Electrical Engineering Department.

8. Q. Are you a member of any professional societies or organizations in the field of electrical engineering or the generation, transmission and distribution of electric power?

A. Until our recent austerity measures, I held membership in the Association of Edison Illuminating Companies' Committee on Electric Power Apparatus, a group concerned with the quality of electric components utilized on transmission systems. I was

also a member of the Edison Electrical Institute's Electrical System and Equipment Committee, which was involved with development and analysis of facilities equipment and systems associated with transmission and generation. I was a member of the National Electric Safety Code Committee, American National Standard C-2 Subcommittee 8 which was responsible for reviewing code requirements for work methods. Finally in 1979, I was a member of the adjunct faculty of the Nuclear Engineering Department of the Polytechnic Institute of New York, masters degree level, where I taught a course on generation economics.

9. Q. Are you familiar with LILCO's generating units and transmission system and particularly with those facilities used to provide power to the Shoreham Nuclear Power Station?

A. Yes, I am.

10. Q. How did you acquire that familiarity?

A. My previous experience in Electric System Planning was directly related to the design of the transmission system and the generation system.

Specifically, that work included the design of the transmission system as it related to the Shoreham Nuclear Power Station. I was also responsible on a project basis for the field installation of the Shoreham related transmission projects.

11. Q. Are you sufficiently familiar with design and operation and configuration of the LILCO generation and transmission facilities to be able to discuss in some detail the means by which LILCO could provide a reliable source of AC power to the Shoreham Nuclear Plant under a variety of operating conditions?

A. Yes. With this question in mind, I have undertaken to analyze the LILCO system from a number of standpoints. First, I have examined all of the LILCO generating sources which could be called upon to provide power to Shoreham. In this connection I have considered everything from our four large steam generation plants right down to the four 2.5 megawatt diesel generators that we are now installing at the Shoreham plant. I have considered these facilities in terms of their historic reliability and the numerous measures which we have undertaken to further enhance their reliability. As an example, we now

have a number of deadline, black start gas turbines which can be brought on line almost instantaneously. Second, I have considered the configuration of our transmission system in order to determine the various routes by which we could deliver power to the Shoreham plant site, assuming a variety of operating conditions. I have also reviewed the measures which we have undertaken to enhance the reliability of our transmission system, and the reliability of the transmission system historically. All of this review has focused ultimately on the capability of LILCO to provide reliable AC power to the Shoreham plant site.

12. Q. Do you feel you are qualified then to discuss the factors which should be considered in determining the capability of LILCO to deliver a reliable supply of AC power to the Shoreham plant?

A. Yes.

LILCO GENERATION

13. Q. Please describe the generic components of the LILCO power supply system which will provide AC power to the Shoreham plant.

A. In the broadest sense, those components would be the

power generation sources and the transmission network facilities for transmitting power to Shoreham. Power generation sources would include those owned and operated by LILCO, such as oil fired steam generators as well as gas turbines, and the generating facilities of the regional power grids with which LILCO is interconnected.

14. Q. Please identify and locate generally the LILCO power generating facilities and the LILCO transmission network which you will be discussing in this testimony?

A. Attachment 1 to this testimony is a reasonably accurate ELECTRIC TRANSMISSION SYSTEM MAP which locates all of LILCO's generating and transmission facilities.

15. Q. Describe generally the LILCO power generating facilities.

A. LILCO's present generating capacity is 3,721 MW consisting of 2,240 MW of base load steam turbine units, 432 MW of mid-range and peaking steam turbine units and 1,049 MW of internal combustion peaking units. The internal combustion units include both

gas turbines and diesel generators. Attachment 2 to this testimony is a schedule identifying all units and showing their location and rated generating capacity.

16. Q. With respect to the LILCO owned and operated power generating facilities, would you describe briefly those facilities which are directly involved in supplying AC power to Shoreham when required?

A. Yes. As shown on Attachments 1 and 2, LILCO has 4 major steam generating stations. Each of these stations is equipped with a backup black start gas turbine to provide starting power under blackout conditions. As an example, Port Jefferson is a major generating station with two 190 MW steam generating units and two 48 MW steam generating units. It also has a black start gas turbine and is located 11 miles from Shoreham.

The LILCO system also includes ten 50 MW class gas turbines at Holtsville. These are located approximately 15 miles southwest of the Shoreham site. Two of these are presently equipped with deadline, black start capability designed and installed specifically to support Shoreham. Three

more will be equipped with black start capability in April 1984. As further backup, there are three deadline black start gas turbines located at Southold, East Hampton and, as stated earlier, Port Jefferson. Each of the three 20 MW class units can supply power through the 69 kV or 138 kV transmission facilities to Shoreham. At the Shoreham site, LILCO is completing the installation of a 20 MW gas turbine with deadline black start capability. This will provide adequate AC power to Shoreham even in the event that all transmission to the site is lost. As an additional source of back-up AC power, and to allow further independence from the LILCO grid and independence from the Shoreham normal station service transformer and reserve station service transformer, LILCO is in the process of installing at the Shoreham plant site a block of four 2.5 MW deadline black start GM diesel generators. The output from these generators can be routed directly into the plant's 4 kV buses by plant operators.

17. Q. Explain what is meant by the terms "black start" and "deadline black start".

A. Black start means that when a loss of power exists the system operator, from a local or remote location, can start a gas turbine to restore power. The term deadline black start means that the gas turbine recognizes through its own circuitry that there has been a loss of power and automatically starts without the necessity for operator activation.

LILCO INTERCONNECTIONS TO REGIONAL POWER GRIDS

18. Q. Is LILCO's ability to deliver power to Shoreham limited to its own generating capacity?

A. No. As noted above, the LILCO system is interconnected to the New York Power Pool (NYPP) and the New England Power Exchange (NEPEX). Through these interconnections, LILCO has access to substantial additional generation resources.

19. Q. Please identify and briefly describe these interconnections.

A. The interconnection with the NYPP is made through three ties which are identified on the left end of Attachment 1. These ties, or interconnections, are rated as follows:

Inter-Connection	Volataqe	Summer Ratings (MW) Norm.	Long Term Emergency	Short Term Emergency
Lake Success/ Jamaica	138 kV	238	341	427
Valley Stream/ Jamaica	138 kV	271	318	441
Shore Rd/ Dunwoodie	345 kV	581	839	1479

The New England Power Exchange interconnection is a submarine cable beneath Long Island Sound. It is a 138 kV facility normally rated at 285 MW. This interconnection is also shown at the top of Attachment 1, toward the middle. These interconnections, together with the LILCO generating capacity, form an integrated electric network for providing reliable AC power to facilities throughout the LILCO system, including the Shoreham plant.

20. Q. Do these interconnections enhance the ability of LILCO to provide reliable AC power to Shoreham?

A. Yes. This network, with its ability to respond rapidly to changing system conditions, provides a reliable source of normal AC power to the plant.

21. Q. What measures do these power grids employ to assure the availability of power when needed by one of the participants?

A. Since all members of the NYPP are required to maintain a reserve capacity of 18% over their peak demand and since the pool members generally do not experience peak demands at the same time, a minimum pool-wide 22% reserve margin is achieved. Furthermore, the NYPP operates with enough spinning reserve to cover the loss of the largest generation source in the State. The New England Power Exchange utilizes similar reserve requirements.

22. Q. In addition to these interconnections, does LILCO have any additional backup power capability at its own generating stations in the event problems are encountered?

A. Yes. As noted above, there are black start gas turbines located at each of our four major generating stations and at other diverse locations on the LILCO grid. In addition there are automatic load shedding procedures which, in the event of a disturbance, serve to quickly stabilize the LILCO grid.

23. Q. When were these black start gas turbines installed and why?

A. After the blackout of 1965 these black start gas turbines were installed at our major generating stations in order to provide a rapid means for restoring AC power to both the generating stations and to the system as a whole. In fact, the restoration of service in 1965 had been successfully initiated utilizing the Southold Gas Turbine, proving the value of diverse gas turbine installations for rapid power restoration.

24. Q. Describe the load shedding procedures and what they accomplish.

A. The load shedding procedures provide an automatic means for removing load from the grid. This system operates on changes of frequency. If the frequency drops below a pre-set level (59.3 Hz), load shedding automatically begins. Thus, by automatically matching load to available generation, a balance between the load to be served and the generation available is maintained. In addition, the System Operator has the ability to reduce voltage which also decreases load. These methods prevent cascading outages on the system.

25. Q. Since the blackout of 1965 has LILCO suffered any loss of its entire grid?

A. No.

26. Q. Has LILCO ever lost a substantial portion of its grid since 1965.

A. Yes, once. In 1979 there was an incident on the system where the grid east of the Holbrook Substation was lost due to vandalism at one substation. The system was completely restored in just slightly over one hour. That restoration was accomplished without the benefit of the procedures that LILCO is currently implementing. If such an event were to occur today, LILCO would be able to restore power to Shoreham within minutes by utilizing the various black start gas turbines available.

27. Q. Because of LILCO's interconnections with other power grids, is LILCO more likely to experience a problem or deficiency on its system as a result of problems experienced by other members of the grid?

A. No. This was demonstrated when Consolidated Edison 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.

TRANSMISSION LINKS TO SHOREHAM

28. Q. Describe how the Shoreham Nuclear Power Station is interconnected to the LILCO transmission network.

A. The Shoreham Nuclear Power Station is interconnected to the LILCO system through 138 kV and 69 kV circuits. The configuration of these facilities in the general area of the plant can be seen in Attachment 3 which is an aerial photograph beginning at the 69 kV switchyard at Wildwood, which is south of the plant, and extending north to the site of the plant itself. These facilities are also depicted schematically on Attachment 4.

Four separate 138 kV transmission lines serve the 138 kV Shoreham switchyard. This switchyard can be seen in Attachments 3 and 4, adjacent to the plant. Two of these 138 kV circuits emanate from the Holbrook 138 kV substation; one from the Wildwood-Riverhead 138 kV substations; and one from the Brookhaven 138 kV substation. These can be seen schematically in Attachment 1.

29. Q. Where is the 138 kV Shoreham switchyard relative to the plant?

A. This switchyard is approximately 1300 feet south of the unit itself.

30. Q. Do all the 138 kV circuits enter the 138 kV switchyard on the same right-of-way?

A. No. Two separate and independent rights-of-way are provided, each containing two of the four 138 kV circuits.

31. Q. Would you please describe the 69 kV circuits?

A. Three 69 kV circuits feed the Wildwood Substation which is approximately one mile south of Shoreham. The three circuits emanate from Riverhead, Holtsville, and Port Jefferson and enter the switchyard via two separate rights-of-way. The Holtsville circuit passes through the Ridge substation before going on to Wildwood. From the Wildwood switchyard, a single 69 kV circuit enters the site.

32. Q. Are the 69 kV lines in the same location as the 138 kV lines?

A. The 69 kV line from Wildwood to the Shoreham 69 kV switchyard has been placed underground in the vicinity of the 138 kV facilities from the 138 kV switchyard to the NSS transformer to maintain complete independence of supply between the normal station service (NSS) and the reserve station service (RSS) transformers. This provision minimizes the likelihood of simultaneous loss of supply to the NSS and RSS transformers by a common event.

33. Q. Are there any features of the 69 kV lines that enhance the reliability of the 69 kV circuits?

A. Yes. In the unlikely event that there is a failure of the underground 69 kV circuit supplying the Shoreham 69 kV switchyard or the underground circuit from the Shoreham 69 kV switchyard to the RSS transformer, there is a bypass 69 kV circuit (bypassing the 69 kV switchyard) and running directly from the 69 kV overhead line from Wildwood to the RSS transformer. 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.

34. Q. How long would it take to place this 69kV bypass in service?

A. Approximately four hours. We have not actually performed this operation but this is a conservative estimate.

35. Q. Are you familiar with the requirements of GDC 17 with respect to the number of offsite circuits required to serve a power station?

A. Yes. It states in part, that: "Electric power from the transmission network to the onsite electric distribution system shall be supplied by two physically independent circuits (not necessarily on separate rights of way) designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. A switchyard common to both circuits is acceptable. Each of these circuits shall be designed to be available in sufficient time following a loss of all onsite alternating current power supplies and the other offsite electric power circuit, to assure that specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded." 10 CFR Part 50, Appendix A.

36. Q. Can you compare those requirements with the transmission network facilities presently serving Shoreham?

A. Yes. At Shoreham, there are four circuits on two separate and independent rights-of-way, each circuit containing two of the four 138 kV circuits as mentioned previously. 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 configuration is shown schematically in Attachment 4. This configuration permits continuation of 138 kV power supplied from separate rights-of-way even in the event a bus section is out of service. A common bus section between these two sources feeds the NSS transformer. In addition, a 69 kV circuit enters the plant area and proceeds to a separate switchyard.

37. Q. Do the number and geographical dispersion of these 138 and 69 kV circuits enhance the reliability of LILCO's ability to provide AC power to Shoreham beyond the 2 circuit requirement of GDC 17?

A. Yes. GDC 17 would permit the 138 kV and 69 kV circuits to enter the plant site as above ground

circuits in a common right of way. In fact, the 138 kV and 69 kV circuits enter the plant site via entirely separate rights-of-way. Furthermore, the 69 kV circuit is underground.

Both the 138 kV and 69 kV lines form part of the LILCO network transmission system. The dispersion of these facilities provides redundant sources and lowers the possibility of the loss of more than one of them. The utilizaton of multiple lines and separate switchyards, and thus the limited exposure to common failures, enhances the reliability of offsite power.

TRANSMISSION NETWORK RELIABILITY

38. Q. Does LILCO employ design criteria for its transmission lines with respect to their ability to withstand high winds?

A. Yes. The transmission system is designed to withstand winds in the range of 100 to 130 m.p.h., in excess of National Electrical Safety Code (NESC) requirements.

39. Q. Has LILCO's transmission system been adversely impacted by tornadoes in the last 20 years?

A. No.

40. Q. Has LILCO's transmission system been adversely impacted by earthquakes in the last 20 years?

A. No.

41. Q. Has LILCO's transmission system been adversely impacted by hurricanes in the last 10 years?

A. Although there may have been outages to individual lines during major storms, there have been no outages of such magnitude as to cause the loss of power to a facility such as Shoreham. This is true because the transmission system is a network system, that is, having multiple sources and transmission paths.

42. Q. Is LILCO going to undertake any additional safeguards to limit even further the possibility of an impact from weather phenomena?

A. Yes. This subject is addressed in the testimony of Mr. Museler which details specific actions to be taken when certain weather warnings are received.

43. Q. Who will be responsible for receiving such warnings?

A. The warnings will be received by the System Operator of the Electric System Operations Department.

44. Q. How will they be received?

A. LILCO receives such warnings from the National Weather Service as well as a contracted weather service at the Electric System Operations center in Hicksville.

45. Q. What will the Electric System Operator then do?

A. He will notify the plant operator.

46. Q. How will he know to do that?

A. He will know so by procedure.

47. Q. Is Attachment 5 a copy of the procedure requiring the weather information to be conveyed?

A. Yes, for all operating plants.

48. Q. What will be then done?

A. The plant will be shut down based on commitments found in William J. Museler's Testimony.

49. Q. Given your experience and knowledge of LILCO's system, are there other natural phenomena which might occur on Long Island and which conceivably could impact on LILCO's transmission system?

A. There are other natural phenomena which could impact pieces of the LILCO system. However, historically, these phenomena have not had a significant impact on the system.

50. Q. And what would those be?

A. The first would be ice storms. The major impact of ice storms is generally on the distribution system. The low voltage lines are susceptible to interference from broken trees. Such a possibility does not generally exist with the 69 kV and 138 kV transmission network because all of these facilities are maintained on cleared rights-of-way. The second phenomena is lightning. There have been instances where a lightning strike on a transmission line has momentari'y caused that line to trip, however there are reclosing facilities (manual and/or automatic) on such lines which re-energize the line after the initial trip.

51. Q. Does LILCO have the capability to repair damaged transmission lines should such repair become necessary?

A. Yes. LILCO routinely designs, constructs and maintains its own transmission facilities. That is, it does not contract out these tasks to outside constructors. As a result LILCO is intimately familiar with these facilities and maintains a state of constant readiness with a large force of trained personnel to restore transmission facilities which may become inoperative for any reason. These trained crews are available twenty-four 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.

52. Q. Using such measures, how quickly can LILCO restore the transmission lines?

A. Using these measures LILCO can restore a mile of 69 kV transmissions facilities within twenty-four hours. While it is not anticipated that such extensive damage would occur on any one transmission line, this capability provides a benchmark indicating the expeditous manner in which LILCO could restore facilities.

53. Q. Now assume that LILCO were to suffer a simultaneous loss of its base load and mid-range steam generating units as well as its interconnections to other grids. Would LILCO have a way to provide AC power to Shoreham under this blackout condition?

A. Yes. It could be provided from a number of separate sources. They are: the Holtsville gas turbines, the East Hampton gas turbines, the Southold gas turbine, the Port Jefferson gas turbine, the Shoreham gas turbine, or the Shoreham GM diesels. All of these facilities have black start capability.

HOLTSVILLE GAS TURBINES

54. Q. Would you please describe the gas turbines at Holtsville.

A. The LILCO system includes ten gas turbines at Holtsville, two of which are presently equipped with deadline black start capability, and three of which will have black start capability designed and installed to support Shoreham. All five black start gas turbines are under the control of, and can be started by, the System Operator. Power from these gas turbines is capable of being supplied to Shoreham through various transmission paths ultimately leading to any of the four 138 kV lines or the three 69 kV lines to Shoreham, as depicted in Attachments 1 and 4. Any one of these five units at Holtsville would be sufficient to supply power to Shoreham.

55. Q. How far is Holtsville from Shoreham?

A. About fifteen miles.

56. Q. How quickly can power be restored to Shoreham from Holtsville?

A. Under simulated conditions, actual tests have shown that power can be restored to Shoreham from Holtsville in six minutes.

57. Q. How is this accomplished and who initiates this procedure?

A. 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 System Operator then clears a transmission line express to Shoreham. LILCO's Emergency and Unusual Procedures Manual dictates that implementation of this procedure is the paramount priority for the LILCO System Operator in the event of a blackout.

58. Q. Is Attachment 6 a copy of the procedure from LILCO's Emergency and Unusual Procedures Manual?

A. Yes it is.

59. Q. You say that LILCO can restore power from Holtsville in six minutes. Does LILCO plan to test this procedure periodically?

A. Yes, it will be done on a bi-weekly basis.

60. Q. What will such testing accomplish?

A. This testing will demonstrate the starting reliability of the gas turbines at Holtsville as well as the ability of the System Operator to restore power to Shoreham on a rapid basis.

61. Q. Are the Holtsville gas turbines designed to withstand earthquakes?

A. Although not specifically designed to withstand earthquakes, as noted in the attached letter from United Technologies (see Attachment 7), the Holtsville (Holbrook) units are able to withstand a 0.2g horizontal load. However, they may not operate through that load, but would be available to operate following such a load.

<u>SOUTHOLD GAS TURBINE</u>

62. Q. What about the Southold gas turbine? Where is Southold in relation to Shoreham?

A. Southold is about twenty-seven miles east of Shoreham, whereas Holtsville is fifteen miles southwest of Shoreham.

63. Q. Does the Southold gas turbine provide sufficient power to Shoreham to meet emergency AC power needs?

A. Yes. It is a 14 MW unit.

64. Q. Through what transmission lines would power be supplied from Southold to Shoreham?

A. Power would be supplied from Southold to Shoreham first through the 69 kV lines to Riverhead where routing to Shoreham could continue via 69 kV or 138 kV lines.

65. Q. How quickly can power be restored to Shoreham from Southold?

A. In ten minutes.

66. Q. How is this accomplished?

A. This is again accomplished by procedures implemented by the System Operator.

67. Q. Who initiates this procedure?

A. It is up to the System Operator to initiate such a procedure. His prime responsibility in the event of a blackout is restore power to Shoreham. He has various means available to him. He has Holtsville, Southold, East Hampton and Port Jefferson. He will

utilize at the time the best means available to him to restore power to Shoreham in the shortest possible time. This may involve the simultaneous use of all means available.

68. Q. Is the procedure written for restoration of power?

A. There is a procedure which says that the priority of restoring power to Shoreham is the prime consideration (see Attachment 6). The specific procedures for the individual units are in the process of being finalized. The most recent draft of these procedures for all of the units, including Southold, is included as Attachment 8. It should be noted, however, that the System Operator, and the district operators who work for him, are trained to react to any transmission system problem on an ad hoc basis. Thus, procedures which are specific to the various units will only enhance what is already a very reliable mechanism for restoring power. The only procedure really necessary to be established is that Shoreham is the first priority for restoration. That procedure has been established.

69. Q. Has the testing of Southold as a restoration source of power to Shoreham been done?

A. Not at this time.

70. Q. Will it be tested periodically?

A. Bi-weekly the gas turbine will be tested as to its ability to start and accept load; however, the 69 kV system which would be used for the routing of the gas turbine is an integral part of the transmission grid and as such it is not anticipated that such a test would be conducted as frequently as, for example, Holtsville. However, a test will be done at least once a year.

EAST HAMPTON GAS TURBINE

71. Q. Where is the East Hampton gas turbine located?

A. The East Hampton gas turbine is located on the south fork of Long Island, southeast of Shoreham, a distance of thirty-five miles. on an independent transmission system from the other gas turbines as far as Riverhead. From Riverhead, power from both the East Hampton and Southold gas turbines, could be transmitted to Shoreham along several alternate 69 kV and 138 kV routes available to be used into Shoreham.

72. Q. Does the East Hampton gas turbine provide sufficient power to Shoreham to meet emergency AC power needs?

A. Yes, it is a 20 MW unit.

73. Q. How quickly can this restoration be accomplished?

A. In about fifteen minutes.

74. Q. Who initiates this procedure?

A. Again, it is at the discretion of the System Operator as mentioned above.

75. Q. Is the procedure written?

A. The most recent draft is included in Attachment 8.

76. Q. Has the procedure been tested?

A. No.

77. Q. Will it be tested periodically?

A. The unit start will be tested on a bi-weekly basis, demonstrating its ability to start and pick up load. However, the express isolation of a transmission line to Shoreham is not presently contemplated on as regular basis as the Holtsville units, but will be done on an annual basis.

PORT JEFFERSON GAS TURBINE

78. Q. Where is the Port Jefferson gas turbine?

A. The Port Jefferson gas turbine is located at the Port Jefferson 380 MW steam generating station about 11 miles west of Shoreham.

79. Q. Can the Port Jefferson gas turbine provide sufficient power to Shoreham to meet emergency AC power needs and in what time frame?

A. Yes, it is a 16 MW unit which starts in approximately five minutes. Various switching operations would be required to clear an express path to Shoreham. These operations could take as long as 25 minutes.

80. Q. Through what transmission lines would power be supplied from Port Jefferson to Shoreham?

A. Power could be routed either via 138 kV or 69 kV lines to Shoreham.

81. Q. Is such a procedure written?

A. Yes. The most recent draft is included as part of Attachment 8.

82. Q. How much time would elapse while the determination was made as to which source would be used to restore power to Shoreham?

A. Only seconds in most cases since the gas turbines would have started automatically. The System Operator would know of their availability, and he would know the status of the various links of the transmission system. He would utilize several sources simultaneously to route power to Shoreham. There is an individual procedure for each unit. It is the operator's expertise in operating the power system that enables him to effect the overall integrated restoration operation and to do so almost immediately.

SHOREHAM GAS TURBINE

83. Q. What about the gas turbine on the site at Shoreham. Would you describe that please?

A. Yes. It is a nominal 20 MW gas turbine (17 MW summer rating, 20 MW winter rating) located in the 69 kV switchyard at Shoreham. It is connected to the 69 kV bus through a step-up transformer.

84. Q. How is it connected to the plant electrical system?

A. The reserve station service transformer is connected to that same 69 kV electrical bus.

85. Q. Is the gas Shoreham turbine now operational?

A. Yes.

86. Q. Does it provide sufficient electricity to meet Shoreham's emergency AC power needs?

A. Yes.

87. Q. How quickly can power be restored to the plant using this gas turbine?

A. Within three minutes power can be restored to 4 kV emergency buses shown schematically on Attachment 9.

88. Q. Is there a procedure to accomplish this?

A. Yes. The procedure is practically automatic. Upon loss of a voltage to the 69 kV bus, the 69 kV bus automatically isolates from the system, automatically sheds loads on that bus, the gas turbine automatically starts, closes into the bus and therefore supplies power to the RSS transformer. On the low side of the RSS transformer are breakers to the three emergency buses (see Attachment 9). Those

breakers are under the control of the plant operator. Upon closure of any one of those breakers, power can be restored to Shoreham.

89. Q. Does Attachment 8 include the most recent draft of this procedure?

A. Yes.

90. Q. Will the procedure be tested periodically?

A. Yes, monthly.

91. Q. Has this procedure been tested?

A. We have implemented the mechanics of this procedure; however, this was done before the procedure was actually written.

92. Q. Will the gas turbine be tested to assure its reliability?

A. Yes, there will be bi-weekly testing.

93. Q. What will the testing prove?

A. The testing will prove the reliability of start of the gas turbine.

94. Q. Do you have any indication now of the reliability of this gas turbine?

A. Yes. With its newly-installed low pressure air start system and fuel control system, this gas turbine is virtually identical to the gas turbine at East Hampton which has an operational availability of 97.9%. Its starting reliability is 100%.

95. Q. What is the difference between this unit and the East Hampton unit?

A. The difference is that in the East Hampton unit in the first stage of compression there is additional cooling which allows for a slightly higher megawatt output. To the best of my knowledge there are no other substantive differences.

96. Q. Do you have any indication as to how this gas turbine would react in an earthquake?

A. Not specifically. However, the 20 MW gas turbine should be able to fulfill its function even after a seismic event. It is a Turbo Power and Marine (United Technology) gas turbine. There are no substantive differences between Turbo Power Marine gas turbines specifically designed in accordance with

the seismic building code and the 20 MW unit at Shoreham or, as mentioned previously at Holtsville. The code requires machines withstand a .3g horizontal acceleration. Accordingly, TP&M has assured LILCO that the 20 MW gas turbine would be structurally sound during a seismic event at Shoreham which would exert only a .2g horizontal acceleration and a .113g vertical accerleration. A letter to this effect is included as Attachment 7.

97. Q. Describe the capacity of the fuel tank for this gas turbine.

A. The capacity of the fuel tank is 972,931 gallons. This capacity would provide a running time at full output of the gas turbine for more than 500 hours or 20 days.

98. Q. Is the fuel tank seismically qualified?

A. No.

99. Q. What is LILCO's doing to compensate for the inability of the fuel tank to withstand an earthquake?

A. LILCO will provide a 9,000 gallon fuel oil tank truck on site at all times on a standby basis to provide fuel to the unit.

100. Q. Will the 20 MW gas turbine at the site start automatically and concurrently with the numerous other offsite gas turbines?

A. Yes, this is a simultaneous operation, not a sequential operation.

101. Q. How is it determined which unit will actually provide power to Shoreham?

A. It is at the discretion of the Plant Operator as to which supply is available most rapidly.

102. Q. In the event of a system blackout, which of the gas turbines discussed above would be used first?

A. All would be brought into operation immediately.

103. Q. Does the simultaneous operation of several power sources create any problem on the system or at the plant?

A. No. These sources are independent. The system operator provides 69 kV or 138 kV power. The final connection to the plant is determined by the Plant Operator.

2.5 MW DIESELS AT SHOREHAM

104. Q. Suppose, following a system-wide blackout, none of the gas turbines operated. Could LILCO provide the necessary AC power to the site?

A. Yes. LILCO is installing a sixth AC power source. In the unlikely event that all of Shoreham's normal design sources of AC power were lost simultaneously, and that in addition the black start gas turbines at Holtsville, Southold, East Hampton, and Port Jefferson as well as the 20-MW gas turbine at Shoreham were also to simultaneously fail at precisely the same time, LILCO is installing at Shoreham a block of four 2.5 MW General Motors EMD Deadline Black Start mobile diesel generators, Model No. 20-645E4B. These generators will be directly connected to the plant's 4 kV bus network.

105. Q. Where are these to be installed?

A. They are presently being installed on the southeast corner of the Shoreham Plant site.

106. Q. How are they connected to the plant's electric system?

A. As noted, they are connected to the plant's 4 kV bus network, which in turn will provide power to the emergency 4 kV buses. This can be seen on Attachment 9.

107. Q. Aside from their redundancy, what additional safeguards do these diesels provide over and above the gas turbines?

A. These diesels provide the ability to get power directly to the plant's 4 kV buses, bypassing both the reserve station service transformer and the normal station transformer. Thus, in the extremely unlikely event of a simultaneous loss of both transformers, adequate power could still be supplied to the 4 kV buses. These generators will be able to provide power to the plant's emergency systems within 30 minutes of the loss of offsite power. The diesels start deadline and are ready to accept load within ten minutes.

108. Q. Would you describe the machines?

A. As noted, the machines are each 2.5 MW. They are General Motors EMD diesels and have been in service since 1967 at New England Power in Lynn,

Massachuesetts where they were utilized for peaking capacity.

109. Q. Were these diesel units purchased from The New England Power Company?

A. Yes.

110. Q. Did you obtain information from The New England Power Company with respect to the operating history of these units?

A. Yes, we obtained sufficient information to know that the units have had an extremely high record of starting and operating reliability.

111. Q. How many of these GM diesel generators are necessary to power the plant's emergency system?

A. At five percent reactor power output, one diesel generator unit provides sufficient power to run the two redundant ECCS subsystems, either of which is sufficient to cool the core.

112. Q. How quickly will these diesels be able to accept load?

A. Within ten minutes.

113. Q. What is the mode of operation of these diesels?

A. On loss of voltage, these units will automatically start up and provide power to an open breaker on the 4 kV bus, Breaker 11-1B. That breaker will be closed by a Plant Operator, as will the breaker to the emergency buses, and thus power will be routed to those emergency buses. The total time required to deliver power from the diesels to the emergency equipment is no more than 30 minutes from the initial loss of power.

114. Q. Are these diesels started concurrently with the numerous offsite gas turbines?

A. Yes.

115. Q. What is LILCO's fuel storage capacity for these diesels?

A. LILCO's fuel storage capacity is about 9,000 gallons to be provided in a fuel tank truck

116. Q. How long can the diesels operate on that amount of fuel?

A. At full load for about nine hours; at quarter load for about 36 hours. A second truck will be onsite available when the first becomes empty.

117. Q. Given all of these sources of power, could LILCO provide AC power to Shoreham, assuming the loss of its conventional offsite power sources, within 86 minutes?

A. Yes.

DOCUMENT/ PAGE PULLED

ANO. 8404230437

NO. OF PAGES 1

REASON

☐ PAGE ILLEGIBLE

☐ HARD COPY FILED AT: PDR CF

OTHER ______

☐ BETTER COPY REQUESTED ON __/__/__

☑ PAGE TOO LARGE TO FILM

☑ HARD COPY FILED AT: PDR (CF)

OTHER ______

☐ FILMED ON APERTURE CARD NO 8404230437-01

ATTACHMENT #2

LILCO Installed Generation Capacity

Unit Name	Summer Rating (MW)
Base load-steam	
E. F. Barrett 1	190
Pt. Jeff. 3	190
Pt. Jeff. 4	190
E. F. Barrett 2	190
Northport 1	370
Northport 2	370
Northport 3	370
Northport 4	370
Peaking-Steam	
Pt. Jeff. 1	48
Pt. Jeff 2	48
Glenwood 4	112
Far Rockaway 4	112
Glenwood 5	112
Internal Combustion	
Montauk 2-4	6
E. Hampton 2-4	6
Southampton	11
Southold	14
W. Babylon 1	17
Pt. Jeff. GT	16
Northport GT	16
Glenwood 1	16
E. F. Barrett 1-8	120
E. Hampton 1	20
E. F. Barrett 9-12	152
Shoreham GT	46
W. Babylon 4	46
Glenwood 2&3	98
Holtsville 1-5	227
Holtsville 6-10	238

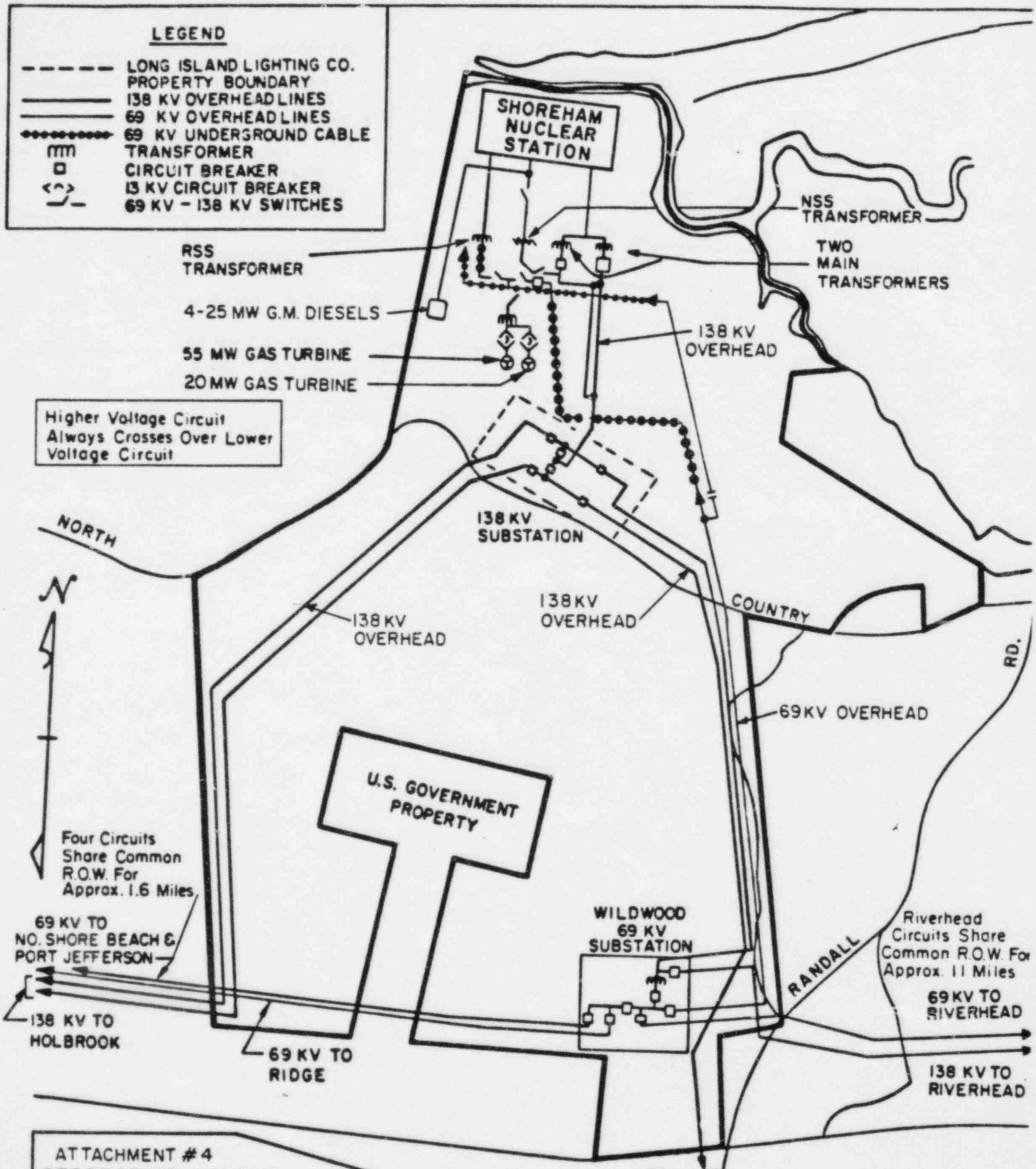
DOCUMENT/ PAGE PULLED

ANO. 8404230437

NO. OF PAGES 1

REASON

- [ ] PAGE ILLEGIBLE
  - [ ] HARD COPY FILED AT. PDR CF
    OTHER ________
  - [ ] BETTER COPY REQUESTED ON __/__/__
- [x] PAGE TOO LARGE TO FILM.
  - [x] HARD COPY FILED AT. PDR (CF)
    OTHER ________
  - [ ] FILMED ON APERTURE CARD NO 8404230437-02



ATTACHMENT #4
GEOGRAPHIC LAYOUT
TRANSMISSION CONNECTIONS
SHOREHAM NUCLEAR POWER STATION-UNIT 1

July 19, 1973

Memorandum to: Electric System Operations

Subject: Dissemination of Weather Information

Because of the possibility of adverse weather conditions affecting various phases of operation at Electric Generating facilities, it is hereby directed that all weather reports received in the Control Room containing information regarding adverse weather conditions that may affect the Long Island area be reported immediately to the station control rooms.

J. R. Gummersall, Jr.

JRG/mrc

Copies to: Mr. W. H. Underwood
Barrett Power Station
Far Rockaway Power Station
Glenwood Power Station
Northport Power Station
Port Jefferson Power Station

ATTACHMENT # 6

March 16, 1984

TO: System and District Operators

Operations During Unusual Emergencies

Commencing with the loading of fuel at Shoreham, the priorities of restoration will change. They will be as follows:

1) Restore power to Shoreham whether the unit was running at the time or was off. All procedures should be pursued until power is restored. The diesels should come on deadline, but we will continue to bring offsite power to the station.

   a) The Shoreham 20MW Gas Turbine should start on deadline.

   b) Shoreham Blackstart 138KV procedure from 8KU Holtsville. Use preferred route if available or in the event of an outage use alternate routes.

   c) Shoreham Blackstart 69KV procedure.

   d) Southold Gas Turbine procedure.

   e) East Hampton Gas Turbine procedure.

2) Restore power to the 8KR LNG Plant using existing procedures.

3) Restore power to the Prompt Notification Siren System using existing procedures.

4) Restore power to the Steam Units using Blackstart GT's at the sites if possible.

5) Restore the Bulk Transmission System and commence picking up load.

All five steps can be pursued simultaneously, but our primary objective will be to restore power to Shoreham.

J. Philip Davis

JPD/jg

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.

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

8KU-HOLTSVILLE GT BLACK START OPERATION

I Pick up of 8XZ-Shoreham NSS Bank #3 under black start conditions:

1 - Upon loss of 138KV potential, a deadline scheme will begin. After 30 seconds the following events occur:

A - The following breakers open at 8KU-Holtsville

1) OCB 1330

2) OCB 1320

B - Depending on which unit is selected as preferred, either GT #1 or GT #3 will start auto and come up to speed.

NOTE: If the preferred GT fails to start, the other unit will start auto.

2 - Preferred GT Unit ACB will close when unit comes up to speed (either 8KU-110 or 8KU-130) thus energizing the 138KV bus at 8KU-Holtsville and making the other nine GTs available.

3 - Operate or check the position of the following breakers at 8D-Holbrook:

A - OCB 6610	Open
B - OCB 1360	Open
C - OCB 1390	Open
D - OCB 1370	Closed
E - OCB 138C	Closed

4 - Open OCB 1310 at 8ER-Brookhaven.

5 - Operate or check the position of the following breakers at 8Z-Shoreham:

A - OCB 1360	Open
B - OCB 1390	Open
C - OCB 1370	Closed
D - OCB 1350	Closed

6 - Check open OCB 1310 and 1330 at 8XZ-Shoreham.

7 - Close OCB 1320 at 8KU-Holtsville which will pick up the 8XZ-Shoreham NSS Bank #3.

SHOREHAM GAS TURBINE #2 DEADLINE OPERATION

I Automatic pick-up of Shoreham RSS Bank #4 by 20 MW GT #2.

A. When the 69KV PT #8 becomes de-energized, a 30 second timer will operate, picking up aux. MG-6 relays 62X and 62X1 with the following results:

1. Trips OCB 640, ACB 8Z-110, ACB 8Z-120, MABS 616 and MABS 617.
2. The GT #2 "Mode Selector Switch" 43-3 will transfer to "Isolate" Mode and block closing of 8Z-110.
3. GT #2 gets start signal when GT #2 comes up to speed, ACB 8Z-120 will close picking up RSS Bank #4.

II To restore system to normal from dead line with 69KV bus at 8DR-Wildwood and line 69-891 energized.

A. Synchronizing by 8Z-Shoreham supervisory:

1. Send OCB 640 a close signal. OCB 640 will automatically sync regardless of the positions of the auto/manual switch and auto synch switches at 8Z.
2. Mode selector switch 43-3 transfers to parallel

B. Local Automatic Sync

1. Place "Auto-Man" switch in "Auto" position.
2. Place sync switch on
3. Turn OCB 640 control handle to close, the release auto sync will automatically close OCB 640
4. Place sync switch off

C. Local Manual Sync

1. Place "Auto-Man" switch in "Man" position
2. Place sync switch on
3. Place synch scope switch on, then using the "voltage matching" handle on OCB 640 panel to adjust voltage output and the "speed matching" handle to adjust frequency, match voltage and frequency of #2 GT to that of system
4. Observing sync scope and sync lites, use OCB 640 control handle to close OCB 640 at the appropriate time.
5. Return sync switch to off position after 640 closes
6. Place sync scope switch off

III Normal Positions of #2 GT Controls:

A - Voltage Regulator Transfer Switch	Auto
B - Engine Mode Selector 43-2	Auto
C - Engine Mode Selector 43-2A	Base/Peak
D - Mode Selector 43-3	Parallel
E - Governor Selector	Base
F - Synch Scope Switch	Off
G - 86 GX Breaker Failure lockout	Reset
H - Field Ground Relay Test Switch	Normal
I - Lockout Relay 86 G 1	Reset
J - Lockout Relay 86 G2	Reset

K - Control Switches A/W;

1 - Gen Oil Cooler Fan	Auto
2 - Gen Oil Exhaust Fan	Auto
3 - GG Lube Oil Cooler Fan	Auto
4 - FT Lube Oil Cooler Fan	Auto
5 - AC Fuel Delivery Pump	Auto
6 - DC Lube Pump	Auto
7 - Inverter	Auto
8 - DC Fuel Forward Pump	Auto
L - ACB 9 a/w Air - PAC	Closed

PORT JEFFERSON APG BLACKSTART OPERATION

I Pick-up of 8XZ-Shoreham NSS Bank #3 under blackstart conditions:

1. Have 8X-Port Jefferson C.R. open the following breakers:

   A - ACB 450

   B - ACB 455

   C - OCB 6620

2. Upon loss of 13KV potential, Port Jefferson APG auto-starts and comes up to speed.

3. Operate or check the position of the following breakers at 8F-Port Jefferson:

A - OCB 6020	Open
B - OCB 6040	Open
C - OCB 6310	Open
D - OCB 6320	Open
E - OCB 6360	Open
F - OCB 6500	Open
G - OCB 1350	Open
H - OCB 1330	Open
I - OCB 6370	Closed
J - OCB 1370	Closed
K - OCB 1310	Closed

Operate or check the position of the following breakers at 8D-Holbrook:

A - OCB 1320	Open
B - OCB 1380	Open
C - OCB 1390	Closed

4. Operate or check the position of the following breakers at 8Z-Shoreham:

A - OCB 1390	Open
B - OCB 1360	Open
C - OCB 1370	Closed
D - OCB 1350	Closed

5. Check open OCB 1310 and 1330 at 8XZ-Shoreham.

6. When 8F-Port Jefferson APG comes up to speed, APG breaker 8F-110 should auto-close.

7. Have 8X-Port Jefferson C.R. close OCB 6620 which will pick up 8XZ-Shoreham NSS Bank #3.

8. Adjust Bank #7 tap changer at 8F-Port Jefferson as necessary to maintain 138KV voltage at 8Z-Shoreham bus.

EAST HAMPTON GT BLACK START OPERATION

I - Pick up of 8XZ-Shoreham NSS Bank #3 under black start conditions:

1 - Upon loss of 13KV potential, 9EU-East Hampton GT deadline scheme will begin. After 30 seconds, the following events occur auto:

A - The following breakers open at 9E-Buell:

1 - OCB 610

2 - OCB 620

3 - OCB 670

B - 9EU-East Hampton GT starts auto and comes up to speed.

2 - Operate or check the position of the following breakers at 9E-Buell:

A - OCB 230	Open
B - OCB 240	Open
C - OCB 630	Open
D - OCB 650	Closed
E - ACB 9E-991	Open
F - ACB 9E-992	Open
G - ACB 9E-985	Open
H - ACB 9E-120	Closed

3 - Operate or check the position of the following breakers at 9B-Southampton:

A - ACB 9B-110	Open
B - ACB 9B-120	Open
C - OCB 690	Open
D - OCB 650	Closed

4 - Operate or check the position of the following breakers at 9J-Tiana:

A - OCB 620	Closed
B - OCB 640	Open
C - OCB 670	Open
D - OCB 9J-958	Open
E - OCB 650	Open
F - OCB 680	Closed

5 - Operate or check the position of the following breakers at 9A-Riverhead:

A - OCB 6500	Open
B - OCB 6010	Open
C - OCB 6610	Open
D - OCB 6090	Open
E - OCB 1350	Open
F - OCB 6030	Closed
G - OCB 6070	Closed
H - OCB 1330	Closed

6 - Operate or check the position of the following breakers at 8DR-Wildwood:

A - OCB 660	Open
B - OCB 1320	Closed

7 - Operate or check the position of the following breakers at 8Z-Shoreham:

A - OCB 1320	Open
B - OCB 1350	Open
C - OCB 1340	Closed
D - OCB 1360	Closed

8 - Check open OCB 1310 and 1330 at 8XZ-Shoreham.

9 - When 9EU-East Hampton GT comes up to speed, ACB 9EU-110 will close auto.

10 - Close OCB 610 at 9E-Buell which will pick up the 8XZ-Shoreham NSS Bank #3.

11 - Adjust Bank #7 Tap Changer at 9A-Riverhead as necessary to maintain 138KV voltage at 8Z-Shoreham bus.

SOUTHOLD GT BLACK START OPERATION

I Pick up of 8XZ-Shoreham NSS Bank #3 under Black Start conditions:

1 - Upon loss of 13KV potential, 8J-Southold GT will auto start and come up to speed.

The following breakers will auto open at 8J-Southold:

A - OCB 210

B - ACB 8J-120

C - ACB 8J-691

2 - When the GT comes up to speed GT breaker 8J-160 will close.

3 - Open ACB 8J-110 at Southold.

4 - Open the following breakers at 8B-Peconic:

A - OCB 8B-110

B - OCB 8B-120

5 - Operate or check the position of the following breakers at 9A-Riverhead:

A - OCB 6040	Open
B - OCB 6080	Open
C - OCB 6020	Open
D - OCB 6030	Open
E - OCB 6610	Open
F - OCB 6010	Open
G - OCB 6090	Open
H - OCB 6620	Open

I - OCB 6060	Closed
J - OCB 6500	Closed
K - OCB 6070	Closed
L - OCB 1350	Open
M - Ocb 1330	Closed

6 - Operate or check the position of the following breakers at 8DR-Wildwood:

A - OCB 660	Open
B - OCB 1320	Closed

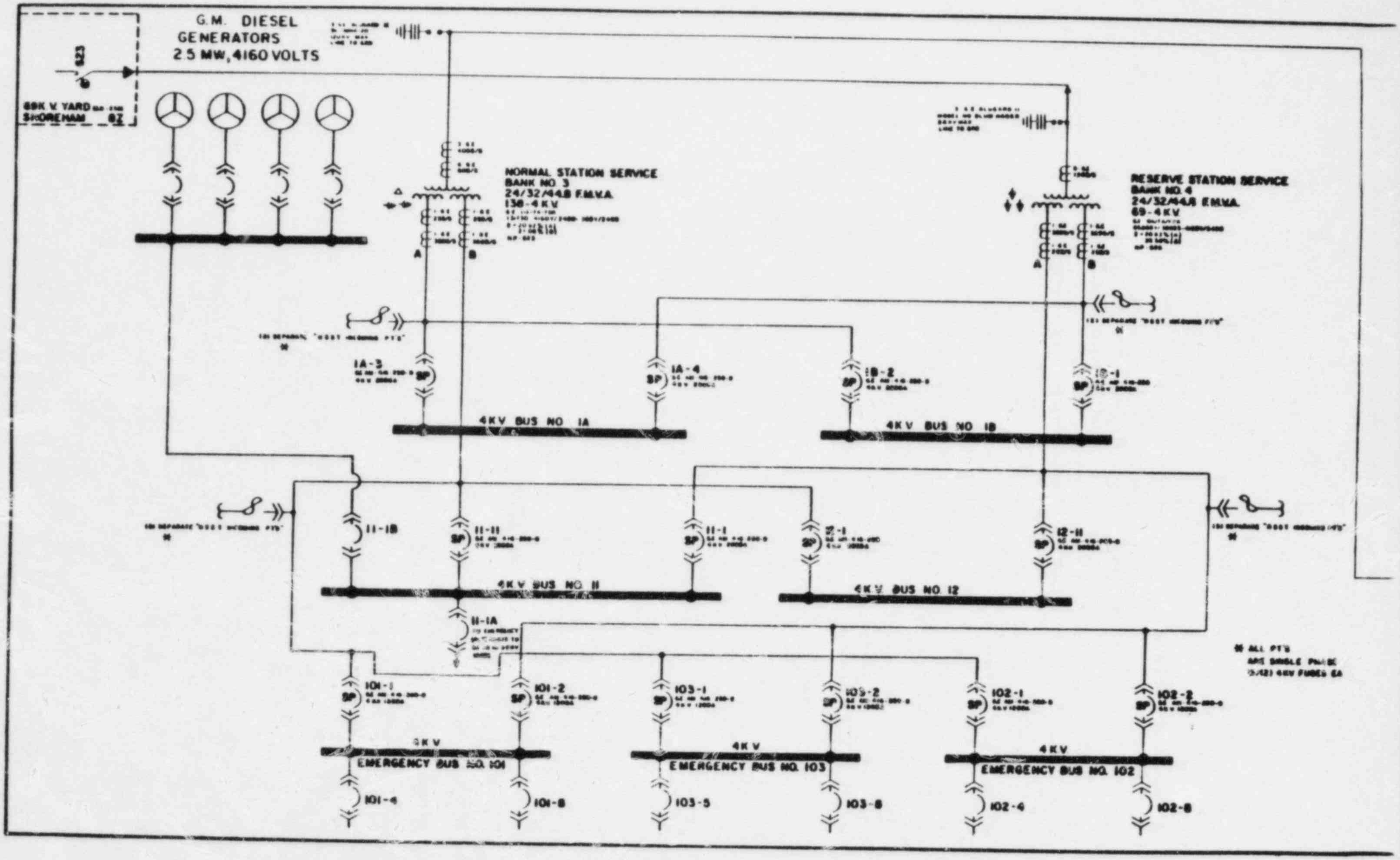
7 - Operate or check the position of the following breakers at 8Z-Shoreham:

A - OCB 1320	Open
B - OCB 1350	Open
C - OCB 1340	Closed
D - OCB 1360	Closed

8 - Check open OCB 1310 and 1330 at 8XZ-Shoreham.

9 - Close ACB 8J-120 at 8J-Southold which will pick up 8XZ-Shoreham NSS Bank #3.

10 - Adjust Bank #7 tap changer at 9A-Riverhead as necessary to maintain 138KV voltage at 8Z-Shoreham Bus.



ATTACHMENT # 9