LONG ISLAND LIGHTING COMPANY
SHOREHAM NUCLEAR POWER STATION
P.O. BOX 618, NORTH COUNTRY ROAD • WADING RIVER, N.Y. 11792

JOHN D. LEONARD, JR.
VICE PRESIDENT - NUCLEAR OPERATIONS

SNRC-1561

APR 14 1989

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Response to 10 CFR 50.63 - The Station Blackout Rule
Shoreham Nuclear Power Station - Unit 1
Docket No. 50-322

Gentlemen:

In accordance with the requirements of 10 CFR 50.63 - The Station Blackout Rule, the Long Island Lighting Company (LILCO) wishes to inform the Nuclear Regulatory Commission (NRC) of its response for the Shoreham Nuclear Power Station. LILCO's response to 10 CFR 50.63 is documented in Attachment I to this letter.

Based upon a scoping study of its several Station Blackout (SBO) options, LILCO has determined that in the unlikely event of SBO, the Shoreham Station possesses sufficient independent and diverse alternate AC (AAC) power capacity to power its Class 1E emergency buses in less than 10 minutes after the onset of a SBO. For this purpose, Shoreham will continue to maintain and use its existing 20 MW gas turbine generator (MWGT) as its primary AAC source. This installation, which is located in the onsite 69 KV switchyard, was approved as an AAC power source in the Shoreham SSER 5 of April 1984 and SSER 6 of July 1984.[1/] The Shoreham

1/ Safety Evaluation Report Related to the Operation of the Shoreham Nuclear Power Station, Unit No. 1, Docket No. 50-322 - NUREG-0420; Supplement No. 5; April, 1984 (pg. 8-1) and Supplement No. 6; July, 1984 (pg. 8-1).

A050
1/1

Plant Staff has demonstrated to NRC inspectors by test[2/], that this blackstart 20 MWGT can be isolated from the LILCO grid and provide power up to Shoreham's Class 1E emergency buses in less than 10 minutes.[3/] To further ensure the fast alignment of AAC power from the control room in the event of a SBO, LILCO plans to install lockout relay bypass switches in Shoreham's control room. This configuration will permit control room operators to energize the Class 1E buses from the control room with 20 MWGT AAC power.[4/]

In the matter of emergency diesel generator (EDG) reliability, Shoreham presently exceeds a target reliability of 0.975 for its three connected Class 1E buses, each powered by a single Trans America Delaval (TDI) EDG. LILCO plans to further enhance this overall EDG reliability and to considerably reduce the already minimal probability of SBO at Shoreham by adding a second power supply to each of the three Class 1E buses. During the plant's first refueling outage, LILCO plans to tie in these additional (Colt) EDGs which will parallel each of the present TDI EDGs, achieving a much increased emergency bus power supply versatility and reliability.

LILCO plans to tie in the three (additional) Colt EDGs, which will parallel the present TDI EDGs, so that each of the three class 1E emergency buses will have two power supplies. At that time, LILCO proposes to apply a system reliability model such as that summarized in Attachment II to compute the combined reliability of having a lead and backup EDG on each bus.

The modifications and associated procedure changes identified in Parts A, B, and C of Attachment I will be completed as noted in the Attachment or within two (2) years after the notification of adequacy provided by the Director, Office of Nuclear Reactor Regulation in accordance with 10 CFR 50.63(c)(3).

2/ See NRC letter of September 18, 1984 from Mr. Thomas T. Martin to Mr. John D. Leonard on subject of Inspection No. 50-322/84-26.

3/ This test is routinely repeated on a regular basis, most recently on June 12, 1988 when the measured time to start and energize the buses was 2 minutes and 38 seconds.

4/ See Attachment I, Section C.2.

Should you have any questions regarding LILCO's compliance to 10 CFR 50.63 or any other matters please do not hesitate to contact this office.

Very truly yours,

John D. Leonard, Jr.
Vice President - Nuclear Operations

MJG:ck

Attachment

cc: S. Brown
W. T. Russell
F. Crescenzo

AFFIDAVIT

STATE OF NEW YORK)
: ss:
COUNTY OF SUFFOLK)

I, JOHN D. LEONARD, JR., being duly sworn, depose and say that I am the Vice President - Nuclear Operations for the Long Island Lighting Company. I am authorized on the part of said Company to sign and file with the U.S. Nuclear Regulatory Commission the enclosed letter (SNRC-1561) for the Shoreham Nuclear Power Station. This response was prepared under my supervision and direction; and the statements contained therein are true and correct to the best of my knowledge, information and belief.

John D. Leonard, Jr.

Sworn to before me this
14th day of April 1989

James A. Little

JAMES A. LITTLE
NOTARY PUBLIC, State of New York
No. 4886267, Suffolk County
Term Expires May 18, 1989

LILCO RESPONSE TO STATION BLACKOUT RULE

This response to 10 CFR 50.63 follows the format recommended by the NUMARC/NUGSBO Working Group entitled GENERIC RESPONSE TO STATION BLACKOUT RULE FOR PLANTS USING ALTERNATE AC POWER as approved by the NRC Staff[1/]

On July 21, 1988, the Nuclear Regulatory Commission (NRC) amended its regulations in 10 CFR, Part 50. A new section, 50.63, was added which requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout (SBO) of a specified duration. Utilities are expected to have the baseline assumptions, analyses and related information used in their coping evaluation available for NRC review. Also identified are the factors that must be considered in specifying the station blackout duration. Section 50.63 requires that, for the station blackout duration, the plant be capable of maintaining core cooling and appropriate containment integrity. Section 50.63 further requires that each licensee submit the following information:

1. A proposed station blackout duration including a justification for the selection based on the redundancy and reliability of the onsite emergency AC power sources, the expected frequency of loss of offsite power, and the probable time needed to restore offsite power;

2. A description of the procedures that will be implemented for station blackout events for the duration (as determined in 1 above) and for recovery therefrom; and

3. A list and proposed schedule for any needed modifications to equipment and associated procedures necessary for the specified SBO duration.

The NRC has issued Regulatory Guide (RG) 1.155, "Station Blackout", which describes a means acceptable to the NRC Staff for meeting the requirements of 10 CFR 50.63. RG 1.155 states

1/ See NRC Letter to W. H. Rasin (NUMARC), subject APPROVAL OF NUMARC DOCUMENTS ON STATION BLACKOUT, from A. C. Thadani (NRC) of October 7, 1988.

that the NRC Staff has determined that NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout At Light Water Reactors," also provides guidance that is in large part identical to the RG 1.155 guidance and is acceptable to the NRC Staff for meeting these requirements.

Table 1 of RG 1.155 provides a cross-reference between RG 1.155 and NUMARC 87-00 and notes where the RG takes precedence.

The Long Island Lighting Company has evaluated the Shoreham Nuclear Power Station against the requirements of the SBO rule using guidance from NUMARC 87-00 except where RG 1.155 takes precedence. The results of this evaluation are detailed below. (Applicable NUMARC 87-00 sections are shown in parenthesis.)

A. Proposed Station Blackout Duration

NUMARC 87-00, Section 3, was used to determine a proposed SBO duration of eight (8) hours.

The following plant factors were identified in determining the proposed station blackout duration:

1. AC Power Design Characteristic Group is P2 based on:

   a. Expected frequency of grid-related LOOPs - does not exceed once per 20 years (Section 3.2.1, Part 1A, p. 3-3);

   b. Estimated frequency of LOOPs due to extremely severe weather places the plant in ESW Group 4 [2/] (Section 3.2.1, Part 1B, p. 3-4);

   c. Estimated frequency of LOOPs due to severe weather places the plant in SW Group 2 (Section 3.2.1, Part 1C, p. 3-7);

   d. The offsite power system is in the I 1/2 Group (Section 3.2.1, Part 1D, p. 3-10);

2. The emergency AC power configuration group is D based on: (Section 3.2.2, Part 2C, p. 3-13)

   a. There are presently three emergency AC power supplies (one per emergency bus) not credited as alternate AC power sources (Section 3.2.2, Part 2A, p. 3-15); [3/]

   b. Two emergency AC power supplies (from an EDG on each of two Class 1E buses) are necessary to operate safe shutdown equipment following a loss of offsite power (Section 3.2.2, Part 2B, p. 3-15).

2/ An analysis was performed of weather data for the Shoreham area obtained from NOAA - National Hurricane Center.

3/ As noted above in the covering letter, LILCO plans to augment the three Class 1E EDGs (one per emergency bus) with one additional EDG per bus at the first refueling outage.

3. The target EDG reliability is .975.

   a. A target EDG reliability of .975 was selected based on having a nuclear unit average EDG reliability for the last 20 demands greater than 0.90 and a nuclear unit average EDG reliability for the last 50 demands greater than 0.94.

4. An alternate AC (AAC) power source will be utilized at the Shoreham Nuclear Power Station which meets the criteria specified in Appendix B of NUMARC 87-00.

   The AAC power source is available within ten minutes of the onset of the station blackout event and has sufficient capacity and capability to operate systems necessary for coping with a station blackout for the required SBO duration of 8 hours, which involves bringing the plant to a safe shutdown and maintaining the plant in a safe shutdown. It is noted that, because the Shoreham plant is a 10-minute AAC station, containment isolation and the capacities of compressed air and Class IE batteries need not be addressed.

   The alternate AC (AAC) Power Source at the Shoreham site is a 20 MW black start gas turbine generator powered by a Pratt and Whitney gas turbine. This AAC source complies with both Reg. Guide 1.155, Appendix B and NUMARC 87-00 and has been described in Shoreham's SSERs 5 and 6[4/]. Figures 1 and 2 are the Main and 69 KV Switchyard One Line Diagrams for the Shoreham Station. These figures show the AAC power source circuitry from the 20 MWGT to the 4.16 KV Class 1E Emergency Buses 101 (Red), 103 (Orange) and 102 (Blue). The circuitry is "circled" to indicate the AAC power connections.[5/]

4/ Ibid, - Note 1 of cover letter.
5/ For convenience, see more detailed description of the 20 MWGT which is attached to this submission as Attachment III.

B. Procedure Description

Plant (and/or LILCO Electrical System Operations) Procedures have been reviewed and modified to meet the guidelines in NUMARC 87-00, Section 4, in the following areas:

1. AC Power Restoration (NUMARC 87-00, Section 4.2.2, SBO Initiative 2.b);

   a. (LILCO Electrical) SYSTEM BLACKSTART PROCEDURE[6/]

   b. Station Procedure 29.015.02 (Rev. 12) - Loss of all AC Power[7/]

6/ The SYSTEM BLACKSTART PROCEDURE provides the LILCO system operator directions for restoring power to the LILCO electric grid in the unlikely event of a partial or full system blackout. Preference is given to restoring power to the Shoreham Nuclear Station.

In the event of a loss of the LILCO electric grid, three (3) alternatives are used simultaneously until power is restored to the Shoreham Nuclear Station: 1) the 20 MW gas turbine, the alternate AC (AAC) source for the station; 2) the lines between the Holtsville Substation are cleared and the Holtsville gas turbines are started; and, 3) the lines between the Port Jefferson Steam Station and Shoreham are cleared and Port Jefferson gas turbine are used to supply power to Shoreham.

7/ Station Procedure 29.015.02 (Rev. 12) - directs all actions at SNPS during a station blackout (loss of all AC power) including operator actions to restore AC power. Immediate action includes notifying the Systems Operator (S.O.) at the LILCO System Control Room at Hicksville, New York that a loss of all AC power has occurred and determining from the S.O. what gas turbines have started and are available to supply power to SNPS.

Subsequent actions include restoring emergency power to the emergency buses from the 20 MW gas turbine by closing the RSST supply breakers to Bus 101, Bus 102, and Bus 103. By this action, AC power can be restored to the emergency buses within ten (10) minutes of the onset of the station blackout.

c. Station Procedure 23.309.01 (Rev. 11) - 4160V Emergency Bus Distribution[8/]

d. Station Procedure 27.307.07 (Rev. 0) - Refuel Outage Blackstart Test of the 20 MW Gas Turbine[9/]

2. Severe Weather Guidelines (NUMARC 87-00, Section 4.2.3, SBO Initiative 2.c).

a. LILCO Instruction 0I40001 - Electrical System Operations Instructions for Emergency Personnel

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8/ Station Procedure 23.309.01 (Rev. 11) provides detailed instructions for restoring normal power to each of the de-energized emergency buses.

Station Procedure 23.309.01 directs the transfer of power to the 4160V emergency buses between the RSST to the NSST. If the 20 MW gas turbine is supplying power to the emergency buses at the time normal station power becomes available, SP 23.309.01 will be applied to transfer of the emergency bus loads from the 69 KV switchyard to the 138 KV switchyard.

9/ Station Procedure SP 27.307.07 (Rev. 0) controls the blackstart test of the 20 MW gas turbine which is performed at each refueling outage. Power to the 69 KV switchyard at SNPS is interrupted by the Systems Operator in LILCO System Control Room at Hicksville, N.Y. The gas turbine is automatically started and connected to the RSST and the 4160 V buses 1B and 12. Power from the 20 MWGT is supplied to within one circuit breaker of each emergency 4160 V bus.

SP 27.307.07 was last performed on 6/12/88 in compliance with 10 CFR 50.63(c)(2). The recorded time between the loss of 69 KV power to the repowering of Bus 12 was 2 minutes and 38 seconds.

(and Substations Prior To and During Emergencies)[10]

b. Station Procedure 29.001.01 (Rev. 9) - Acts of Nature[11]

Plant procedures have been reviewed and changes necessary to meet NUMARC 87-00 will be implemented in the following areas:

1. Station blackout response (NUMARC 87-00, Section 4.2.1 - SBO Initiative 2.a).

   a. Station Procedure 29.015.02 (Rev. 12) - Loss of all AC Power, is being revised to implement the results of LILCO's ongoing SBO coping analysis. This revision will be in place by December 15, 1989.

   b. Procedure changes associated with any modifications required after assessing LILCO's SBO coping capability per NUMARC 87-00 and Reg. Guide 1.155 will be made as the modifications are placed in service.

10/ LILCO Instruction 0I40001 provides the LILCO System Operator at Hicksville, N.Y. directions in the preparation and execution of actions necessary to mitigate the consequences of various system wide emergencies that may affect generation, transmission or distribution of LILCO's electrical system.

The severe weather sections of the procedure are entered forty-eight (48) hours prior to the anticipated arrival of severe weather. All LILCO generating stations are notified and updated on a regular basis on the severe weather situation. Emergency personnel are strategically assembled throughout the LILCO system to assist in mitigating the consequences that may result from severe weather. Preference is given to Shoreham to ensure power will be made available to site.

11/ Station Procedure 29.001.01 (Rev. 9) directs the actions taken in preparation for and to recover from the following acts of nature:
(1) hurricanes and tropical storms
(2) floods
(3) tornadoes and
(4) earthquakes

A future revision of this procedure will include steps to shutdown the plant prior to the expected arrival of a hurricane, such that the plant will be placed in safe shutdown at least two (2) hours before the expected occurrence of hurricane force winds at the site.

C. Proposed Modifications and Schedule

Minor equipment and procedure changes will be performed to assure that the 20 MWGT and associated equipment satisfy all requirements listed in NUMARC 87-00 and Reg. Guide 1.155.

1. Modify Two 20 MWGT Support System Enclosures: These changes consist of replacing two support equipment enclosures to assure compliance with Criterion B.3 which states that components and subsystems shall be protected against the effects of likely weather related events that may initiate the loss of off-site power event. Though the current structures have weathered at least one hurricane (Hurricane Gloria) without damage, stiffer structures will be designed and built to replace the 20 MW GT fuel pump enclosure and the 20 MW GT lube oil cooler enclosure. The two structures are scheduled to be replaced by December 15, 1989.

2. Installation of Bypass Switches to (27/86) Lockout Relays: Shoreham plant operators demonstrated to NRC inspectors in July, 1984 that the 20 MWGT could isolate from the grid and supply AC power in less than four minutes from the onset of a simulated Station Blackout. The procedure then implemented required that an operator proceed to the emergency switchgear room below the control room to manually close the Reserve Station Transformer (RSST) breakers to connect the 20 MWGT to the emergency buses. To allow the operator, during a station blackout, to manually switch in 20 MWGT power to the emergency buses without leaving the control room, three (3) bypass switches will be mounted on the main control board electrical section. The switches will override the 27/86-1R22A03, 27/86-1R22B03, and 27/86-1R22C03 lockout relays during a LOOP. These relays lock out the NSST and RSST station circuit breakers which feed the emergency buses to preclude the operator from accidentally tying in more than one power source to an emergency bus. Each by-pass switch will activate an indicating light when it is placed in the by-pass position. Other power source breakers will be procedurally locked out to continually maintain the safety feature of the lockout relays. This modification will be completed by the end of the first refueling outage.

3. Documentation of 20 MWGT Quality Assurance: The quality assurance (QA) activities which affect the performance of the 20 MW gas turbine were reviewed. The QA activities which are performed have achieved a high level of system performance and reliability. In fact, the average reliability of the unit over the last three

years of operation is 99%. To assure that the QA activities satisfy the requirements of Appendix A of Reg. Guide 1.155, the QA activities will be documented in a QA Program and the existing procedures will be supplemented or amended as needed. Only minor changes in the QA activities are required to comply with the requirements of Appendix A to Reg. Guide 1.155. The QA program for the 20 MWGT will be implemented by March 15, 1990.

4. Installation of Fail Closed AOVs in Primary Containment Floor and Equipment Drain Lines: The Shoreham EOP's currently require an operator to manually close the floor and equipment drain line isolation valves in the secondary containment during a Station Blackout.[12/] To provide automatic isolation of the primary containment floor and equipment drain lines during a station blackout, each line will be modified to include an air operated valve which will be designed to close automatically upon loss of AC power. This modification will be completed by completion of first refueling outage.

SBO Coping: Shoreham is an AAC station with AC power available within 10 minutes of the onset of SBO within the meaning of NUMARC 87-00, Section 7.1.2. However, the following important coping factors are described below under the NUMARC 87-00 sections cited:

1. Condensate Inventory for Decay Heat Removal (Section 7.2.1)

It has been determined from Section 7.2.1 of NUMARC 87-00 that 113,011 gallons of water are required for decay heat removal from the core for 8 hours. The normal condensate storage tank capacity is 440,000 gallons of condensate. In accordance with Shoreham Technical Specifications 100,000 gallons is immediately available for HPCI and RCIC use. Additionally, a minimum of 75,000 gallons of condensate is available for coping from the four condensate hotwells. No plant modifications or procedure changes are needed to utilize these water sources.

2. Effects of Loss of Ventilation (Section 7.2.4)

The AAC power source has sufficient reserve of power to provide power to HVAC systems serving dominant areas of concern. Therefore, the effects of loss of ventilation were not assessed.

12/ This modification is described in Shoreham's PRA Analysis submitted to the NRC via SNRC-1424 of March 2, 1989.

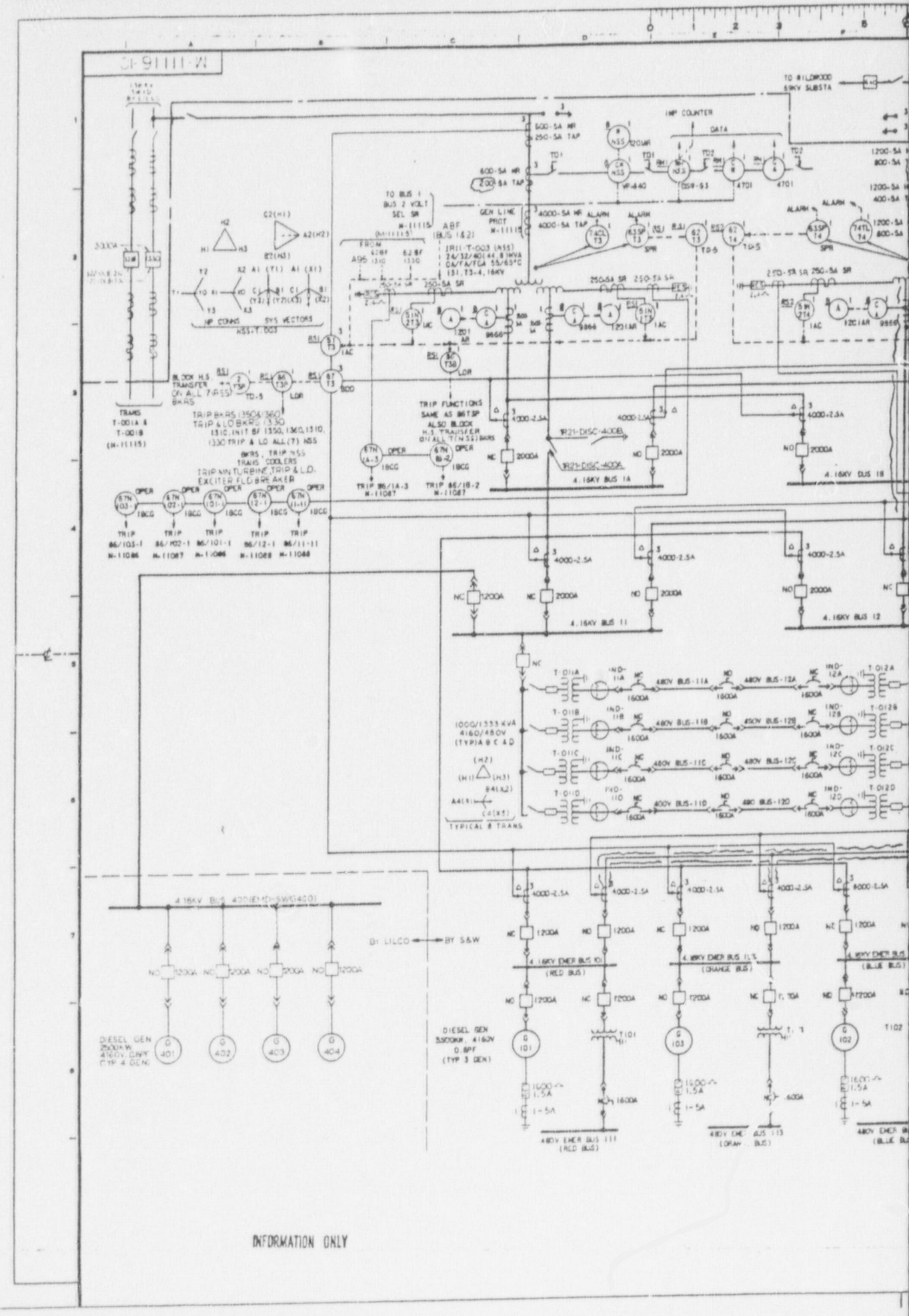
No modifications and/or procedures are required to provide reasonable assurance for equipment operability.

3. Reactor Coolant Inventory (Section 2.5)

The AAC source powers the necessary make-up systems to maintain adequate reactor coolant system inventory to ensure that the core is cooled for the required coping duration.

Schedule of Changes to Procedure and Equipment Modifications

Item	Date of Completion
1. SP 29.015.02 - Loss of All AC Power - Revision to include results of CILCO Coping Analysis	December 15, 1989
2. Modify two 20 MWGT support system enclosures	December 15, 1989
3. Installation of bypass switches to (27/86) lockout relays	End of First Refueling Outage
4. Installation of "fail closed" AOVs in primary containment floor and equipment drain lines	End of First Refueling Outage
5. Implementation of the Modified 20 MWGT Quality Assurance Program	March 15, 1990



INFORMATION ONLY

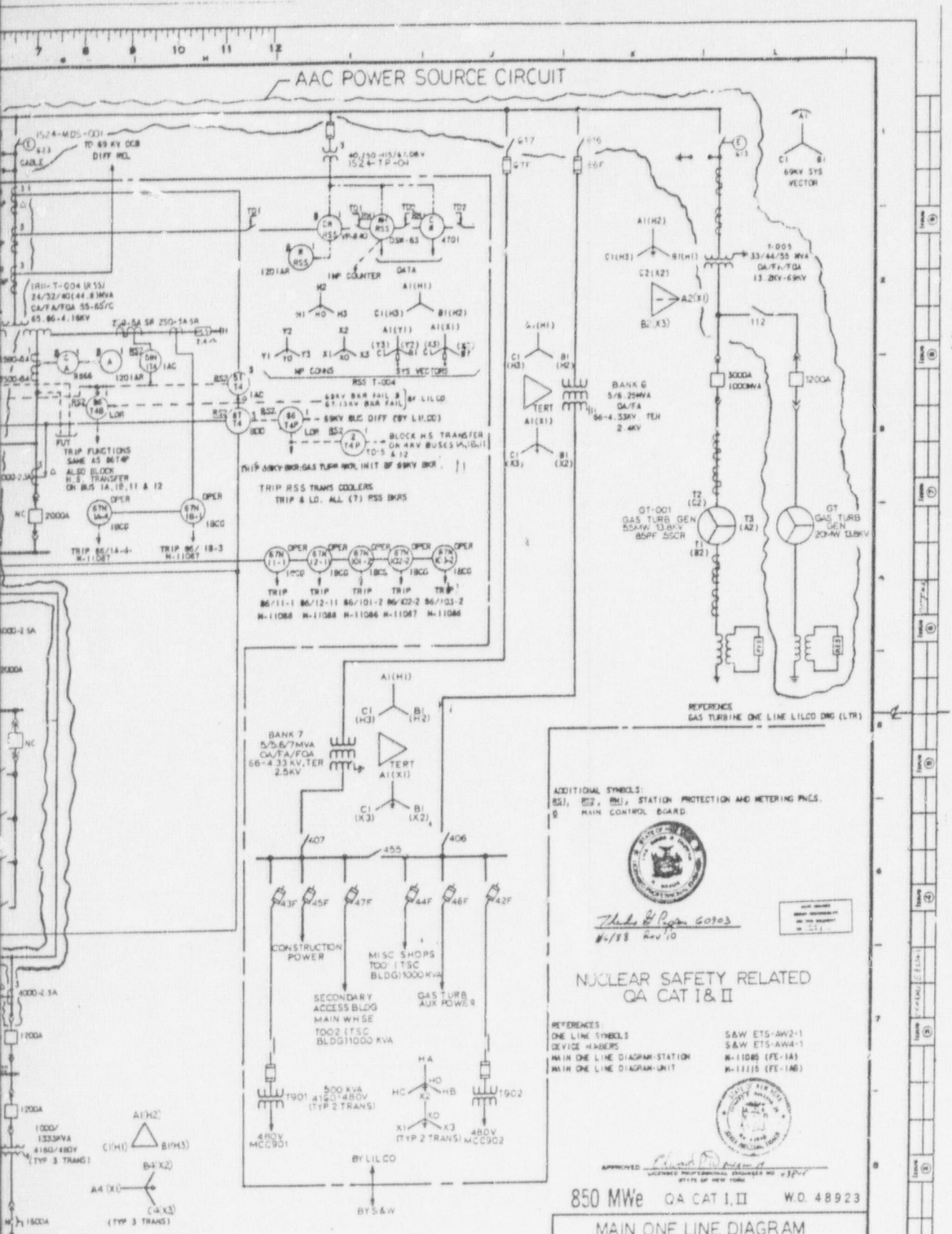


FIGURE-1

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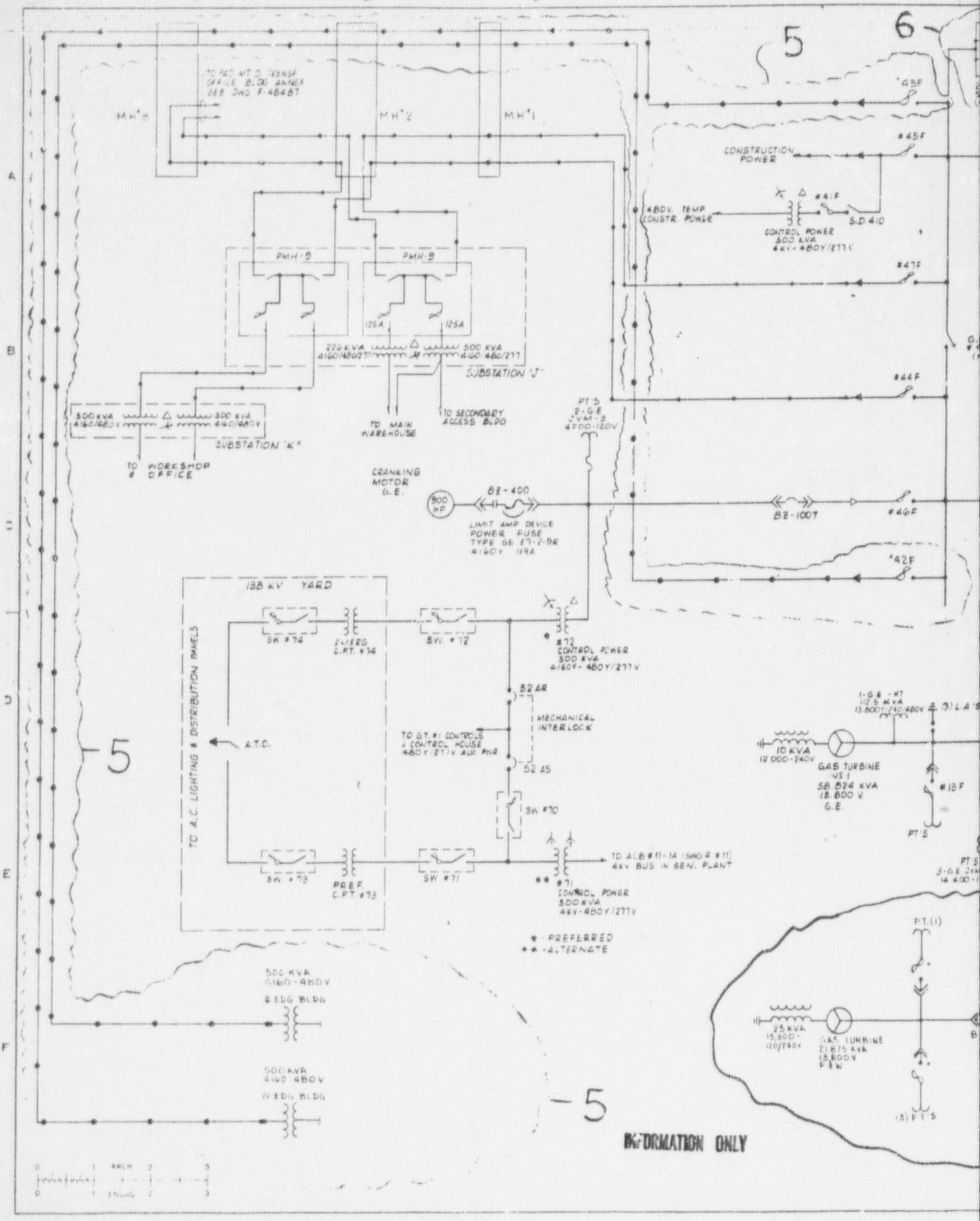
TO PAD MT'D TRANSF OFFICE BLDG ANNEX SEE DWG F-48487
MH"3
MH"2
MH"1
#43F
#45F
CONSTRUCTION POWER
#41F
480V. TEMP CONSTR. POWER
S.D 410
CONTROL POWER 500 KVA 4KV-480Y/277V
#47F
PMH-3
PMH-3
125A
125A
225 KVA 4160/480Y/277
500 KVA 4160/480/277
SUBSTATION "J"
#44F
500 KVA 4160/480V
500 KVA 4160/480V
SUBSTATION "K"
TO WORKSHOP & OFFICE
TO MAIN WAREHOUSE
TO SECONDARY ACCESS BLDG
PT'S 2-G.E. JVM-3 4200:120V
CRANKING MOTOR G.E.
300 HP
BZ-400
LIMIT AMP DEVICE POWER FUSE TYPE GB E7-2-9R 4160V 11A
BZ-1007
#46F
#42F
138 KV YARD
TO A.C. LIGHTING & DISTRIBUTION PANELS
SW. #74
SIEMENS C.P.T. #74
SW. #72
#72 CONTROL POWER 500 KVA 4160Y-480Y/277V
52 AR
MECHANICAL INTERLOCK
A.T.O.
TO G.T. #1 CONTROLS & CONTROL HOUSE 480Y:277V AUX. PWR.
52 AS
SW #70
SW. #73
PREF. C.P.T. #73
SW. #71
#71 CONTROL POWER 500 KVA 4KV-480Y/277V
TO ACB #11-14 (BKG R #11) 4KV BUS IN GEN. PLANT
* - PREFERRED
** - ALTERNATE
1-G.E.-HT 112.5 KVA 13,800-240-480V
10 KVA 12,000-240V
GAS TURBINE #5 1 58,824 KVA 13,800 V. G.E.
#13F
PT'S
PT'S 3-G.E. JVM 14,400-
500 KVA 4160-480V
EDG BLDG
500 KVA 4160-480V
EDG BLDG
P.T.(1)
25 KVA 13,800-120/240V
GAS TURBINE #1 #2 #5 21,875 KVA 13,800V P.I.W.
(3) P.T.'S
INFORMATION ONLY
ARCH
ENGRG

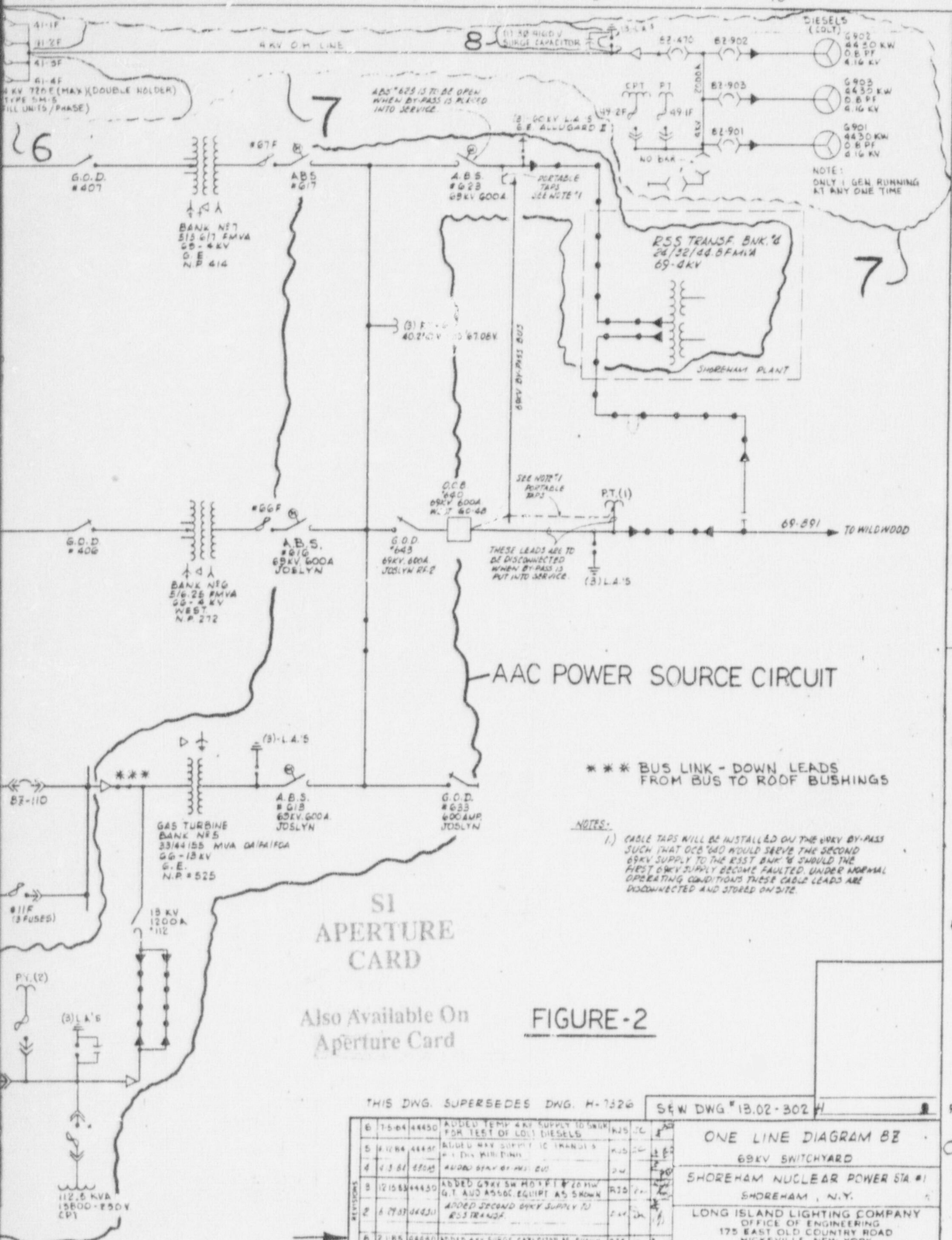

FIGURE-2

THIS DWG. SUPERSEDES DWG. H-7326

S&W DWG # 13.02 - 302

NO	DATE	W.O.	DESCRIPTION	BY	CK	APP
6	7-5-84	44450	ADDED TEMP 4KV SUPPLY TO SWGR FOR TEST OF COLT DIESELS	RJS		
5	4-12-84	44450	ADDED 4KV SUPPLY TO TRANSF'S ... BUILDING	RJS		
4	4-3-84	45045	ADDED 69KV BY-PASS BUS	D.W.		
3	12-15-83	44450	ADDED 69KV SW MO#F1 & 20 MW G.T. AND ASSOC. EQUIPT AS SHOWN	RJS		
2	6-29-83	44450	ADDED SECOND 69KV SUPPLY TO RSS TRANSF.	D.W.		
8	2-1-85	44450	ADDED 4KV SURGE CAPACITOR AS SHOWN	RJS		
	9-25-84	44450	ADDED TEMP 4KV FACILITIES FOR COLT DIESEL TESTING	RJS		

ONE LINE DIAGRAM BZ

69KV SWITCHYARD

SHOREHAM NUCLEAR POWER STA. #1

SHOREHAM, N.Y.

LONG ISLAND LIGHTING COMPANY
OFFICE OF ENGINEERING
175 EAST OLD COUNTRY ROAD
HICKSVILLE, NEW YORK

DATE 3-20-81 — W044430 — F-48570-8

8904190175-02

ATTACHMENT II

Reliability Model For Colt and TDI EDGs on Each Emergency Bus

1.0 Allowable EDG Reliability

After tie-in of the three Colt EDGs, the Shoreham Nuclear Power Station (SNPS) will have a unique 6 EDG configuration. There will be one lead and one backup EDG on each of Shoreham's three Class 1E buses. This will require a unique reliability model to be developed to calculate the reliability of each emergency bus in terms of the measured reliabilities of both EDGs on each bus. The Station Blackout Rule requires that the reliability of each EDG be regularly measured per NSAC 108 and reported to INPO. NUMARC 87-00 provides a method of computing the EDG target reliability that must be satisfied by each nuclear power station. At SNPS, the EDG target reliability must be compared with the calculated reliability of each emergency bus.

A qualitative reliability model proposed in this attachment will be quantified later and internally reviewed as a safety-related calculation. Prior to the completion of the 6 EDG Tie-in modification, LILCO will submit the Emergency Bus Reliability Model to the NRC for review and approval.

This bus reliability model, possibly subject to later development, is as follows:

$$R_{BUS} = 1 - \left(\frac{N_{CSF}}{N_{CSD}}\right) X \left(\frac{N_{TSF}}{N_{TSD}}\right) - \left(\frac{N_{CLF}}{N_{CLD}}\right) X \left(\frac{N_{TLF}}{N_{TLD}}\right)$$

$$-\beta \left[Max \left(\frac{N_{CSF}}{N_{CSD}}, \frac{N_{TSF}}{N_{TSD}}\right) + Max \left(\frac{N_{CLF}}{N_{CLD}}, \frac{N_{TLF}}{N_{TLD}}\right) \right]$$

where:

β = Conditional probability of a simultaneous failure of both EDGs on a bus, given the failure of one EDG on the bus.

N_{CSD} = Number of Colt start demands

N_{CSF} = Number of Colt start failures

N_{TSD} = Number of TDI start demands

N_{TSF} = Number of TDI start failures

N_{CLD} = Number of Colt load demands

N_{CLF} = Number of Colt load-run failures

N_{TLD} = Number of TDI load demands

N_{TLF} = Number of TDI load-run failures

DESCRIPTION OF THE ALTERNATE AC POWER SOURCE AT THE SHOREHAM NUCLEAR POWER STATION

The alternate AC (AAC) Power Source at the Shoreham site is a 20 MW black start gas turbine generator powered by a Pratt and Whitney gas turbine. This AAC source complies with both Reg. Guide 1.155, Appendix A and NUMARC 87-00 and has been described in Shoreham's SSERs 5 and 6.

The turbine generator is designed so that the power section of the turbine is not connected to the compressor section. In this design, the starting motor does not have to turn the mass of the generator during starting. As a result, the generator starts faster, easier and is generally more reliable.

The turbine generator and all electrical and mechanical controls are contained within a weather resistant enclosure. In accordance with the black start capability, this gas turbine generator is capable of "dead line" starting following an appropriate loss of voltage signal. The unit accelerates to rated speed and voltage, and connects to a power distribution system using only self-contained control systems and power sources. The turbine starts by compressed air which drives an air start motor. Starting air is stored at 400 to 500 psig in pressurized receivers of sufficient capability to allow three starting attempts without recharging. An automatically controlled air compressor within the enclosure maintains the compressed air supply at the desired pressure.

The distribution system has a 150 ampere-hour, 125 VDC battery. A 50-amp battery charger maintains the battery charged at required levels. Power for the air compressor and battery charger comes from an auxiliary transformer that is powered from the associated distribution system (69 kV) during standby, and from the gas turbine generator during operation.

Fuel is from an onsite, 950,000 gallon storage tank. Two fuel pumps on AC, one DC each deliver fuel under pressure to the gas turbine. The pump powered from the 125 VDC battery starts automatically when the gas turbine starts. This pump operates until the gas turbine generator is producing power, when the AC power pump starts and the DC pump automatically stops. Power for the AC fuel pump is from the same source used by the air compressor and battery charger.

The gas turbine has the capability of being operated in either an automatic or remote manual mode. In the automatic mode, the following three functions are automatically performed:

(1) Upon loss of voltage on the 69 kV offsite power system bus, the gas turbine automatically starts; breaker number 640, shown on Figures 1 and 2, automatically opens, isolating the 69 kV switchyard from the LILCO offsite grid system, and motor mechanical switches 616 and 617 automatically open to strip off non-essential loads normally connected to the 69 kV switchyard bus.

(2) Motor loads connected to nonsafety buses 1B and 12 are automatically disconnected on loss of voltage. Load center feeder breakers remain closed.

(3) The gas turbine is automatically connected to the 69 kV bus after it attains rated speed.

Figures 1 and 2 of Attachment I are the Main and 69 KV Switchyard One Line Diagrams for the Shoreham Station. The AAC power source circuitry from the 20 MWGT to the 4.16 KV Class 1E Emergency Buses 101 (Red), 103 (Orange), and 102 (Blue) are "circled" to illustrate the connections.

On loss of the normal 69 kV offsite circuit and with the gas turbine in the automatic mode, a source of power is reestablished within a few minutes so that the control room operator need only, by procedure, close breakers 101-2, 102-2, and 103-2 to resupply power to safety loads.

The output breaker on the 20 MW gas turbine is a stored energy spring device which only needs DC power to trip open or to close. If, in the very unlikely event that DC power is lost to the breaker, then an operator can locally operate a manual switch which releases the spring to close the breaker.

In the remote manual mode, breaker 640 and mechanical switches 616 and 617 are tripped, and the gas turbine is started and connected to the 69 kV switchyard via telemetry by the system operator in Hicksville.