SUFFOLK COUNTY, 12/17/84

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)	

JOINT MOTION OF SUFFOLK COUNTY AND
NEW YORK STATE TO ADMIT EDG LOAD CONTENTION

By an Order Confirming Grant of LILCO's Motion to Reopen Diesel Engine Hearings, December 4, 1984, the Board confirmed the reopening and supplementing of the record to litigate the EDG contentions with respect to LILCO's proposed maximum "qualified load" rating of 3300 kW. The Board stated that any party may submit a contention challenging that lower load, if the contention meets the regulatory requirements for a timely contention.

Suffolk County and New York State hereby jointly move the admission of the EDG Load Contention attached hereto as Attachment 1. The EDG Load Contention is set forth with particularity and presents the bases for each portion of the contention with reasonable specificity, as required by 10 C.F.R. Section 2.714(b). These bases are given by references to particular documents, including transcripts of depositions of witnesses for LILCO and

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the NRC Staff, and by an affidavit of Dale G. Bridenbaugh, attached as an exhibit to the EDG Load Contention.

On December 18, 1984, LILCO and the NRC Staff will depose by oral examination Mr. Bridenbaugh and his colleague, Mr. Gregory C. Minor, and thereby have an opportunity to discover additional details concerning the EDG Load Contention. Mr. Minor assisted Mr. Bridenbaugh in the development of the EDG Load Contention. We have informed the parties that if the EDG Load Contention is admitted, Messrs. Bridenbaugh and Minor will be our witnesses.

We do not believe the third portion of the EDG Load Contention, dealing with whether the LILCO "confirmatory" testing has properly qualified the EDGs at 3300 kW, needs to be made a part of a new contention. The Board's Order permits litigation of the results of such testing even absent a new contention. December 4 Order at 5. We have included that portion of the EDG Load Contention, however, because it is closely related to other parts of the Load Contention and to give the parties advance notice of our concerns.

Respectfully submitted,

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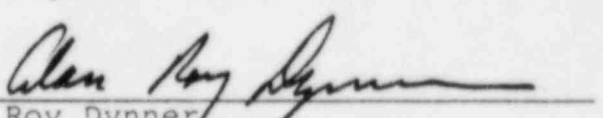

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December 17, 1984

EMERGENCY DIESEL GENERATOR LOAD CONTENTION

Contrary to the requirements of 10 C.F.R. Part 50, Appendix A, General Design Criterion 17 -- Electric Power Systems, the emergency diesel generators at Shoreham ("EDGs") with a maximum "qualified load" of 3300kW do not provide sufficient capacity and capability to assure that the requirements of clauses (1) and (2) of the first paragraph of GDC 17 will be met, in that

(a) LILCO's proposed "qualified load" of 3300kW is the maximum load at which the EDGs may be operated, but is inadequate to handle the maximum loads that may be imposed upon the EDGs. Unlike at other nuclear plants, there is no effective short-time overload rating (over 3300kW) for the EDGs.

(b) There is little or no margin between 3300kW and the maximum emergency service loads for the EDGs, in sharp contrast to emergency diesel generators at other nuclear plants where a substantial margin provides adequate assurance of requisite reliability under GDC 17.

(c) The EDG qualification test run performed by LILCO was inadequate to assure that the EDGs are capable of reliable operation at 3300kW.

Factual matters supporting the foregoing include:

1. LILCO's proposed FSAR Revision 34 (November 1984) provides that the "qualified load" of 3300kW "will be used for all purposes."[1/] It is thus the maximum load at which the EDGs may be operated.[2/] However, the maximum loads imposed on the EDGs may exceed 3300kW:

(a) Intermittent or cyclic loads increase the maximum emergency service loads to 3426.1kW for EDG 101, 3380.7kW for EDG 102, and 3414.1kW for EDG 103.[3/] At other nuclear plants and as contemplated by Regulatory Guide 1.9, intermittent or cyclic loads are bounded, if not by the continuous rating, by a short-time overload rating.[4/]

1/ Section 8.1.4, page 8.1-3.

2/ LILCO has proposed to change the Shoreham Technical Specifications to provide a 3300kW limit. Draft Supplemental Safety Evaluation Report, Emergency Load Requirements for Emergency Diesel Generators, December 3, 1984 ("Dec. SSER") at 5. See Deposition of John Knox, December 13, 1984, at 41-2.

3/ See Affidavit of Dale G. Bridenbaugh, attached hereto as Exhibit 1.

4/ Deposition of John Knox, December 13, 1984, at 20, 87-8; Dec. SSER at 2.

(b) A single worst case operator error would load EDG 103 to 3583.5kW in a LOOP/LOCA condition, and would load EDG 101 to 3784kW in a LOOP only condition.5/ There is no assurance that changes in plant procedures or training can eliminate such operator error, especially in view of the potentially lengthy period of a LOOP or LOOP/LOCA event.

(c) LILCO's calculated maximum emergency service loads of 3253.3kW, 3208.7kW and 3225.5kW for EDGs 101, 102 and 103 respectively,6/ are nonconservative, in that they fail to account for:

(i) future degradation of system conditions;

(ii) potential non-conservative assumptions in the modeling of EDG performance during a LOCA,

(iii) variation of flows due to instrument errors,

(iv) need for equipment adjustments for degradation of pumps, or

(v) off-standard operating conditions of engineered safeguards equipment.

5/ Dec. SSER at 5.

6/ FSAR Revision 34, Table 8.3.1-1A (October 1984), at 3.

The EDGs have no protection against over-voltage on the emergency buses or for significant frequency variations from 60 cycles[7/], which could increase EDG loads. LILCO's emergency operating procedure is inadequate to prevent loads from exceeding 3300kW and in fact could permit operation at 3512kW.

2. The difference between the highest EDG maximum emergency service load calculated by LILCO (3253.3kW) and the 3300kW maximum load at which the EDGs may operate is only 46.7kW, or 1.4% of the maximum load allowed. This small margin assumes no increases in the maximum emergency service loads due to the factors discussed in paragraph 1 above. In contrast, the margins between maximum permitted loads (rated loads) and maximum emergency service loads of emergency diesel generators at 19 boiling water reactors licensed by the NRC over the past 15 years range from 10.5% to 34.6%, with an average of 29%.[8/]

3. The much larger margins at licensed nuclear plants (shown in Table 1 to Exhibit 1 hereto) serve to provide adequate assurance that the types of factors described in

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7/ Deposition of J. Notaro, E. Youngling, G. Dawe and W. Schiffmacher, Dec. 12, 1984 ("LILCO Deposition") at 41-42.

8/ See Exhibit 1 and Table 1 thereto, which presents data prepared from the County's survey.

paragraph 1 will not increase loads beyond the maximum rating of the emergency diesel generators and thus jeopardize reliability. The EDGs have virtually no such margin of safety. Accordingly, they do not provide the standard of reliability, capability and capacity hitherto required to satisfy the requirements of GDC 17.

4. The EDGs were not adequately tested at 3300kW to prove their reliable operation at that load level. The so-called EDG confirmatory load test on EDG 103 purported to demonstrate that the EDGs are capable of running at or above 3300kW for ten to the seventh cycles (approximately 740 hours). However, the plant instrumentation to measure the kilowatt load during the test had a tolerance of ±112kW, was not calibrated during or after the last 525 hours of the test, and may not have been calibrated before that portion of the test.9/ Accordingly, there is no assurance that EDG 103 was operated for some 525 hours of the 740 hours at more than 3188kW.

5. The cylinder block of EDG 103 is of a different grade of grey cast iron and of a different block top design than the blocks of EDGs 101 and 102, both of which contain numerous cracks in the block top. Accordingly, the "confirmatory"

9/ LILCO Deposition at 72-73, 76.

testing of EDG 103 does not demonstrate that EDGs 101 and 102 can be reliably operated at the loads to which EDG 103 was subjected during that testing.

EXHIBIT 1

AFFIDAVIT OF DALE G. BRIDENBAUGH

1. My name is Dale G. Bridenbaugh. I am President of MHB Technical Associates, a principal consultant with that firm, a mechanical engineer and a registered professional nuclear engineer in the State of California. My qualifications have previously been submitted in this proceeding.1/

2. I have evaluated the proposed reduced qualified load (3300kW) and emergency service loads described by amendment No. 52 to LILCO's license application, Revision 34 to the Shoreham FSAR. In the course of my review I have examined documents submitted by LILCO to the NRC in support of this amendment, reviewed the amendment itself, and attended the depositions of LILCO and NRC Staff personnel in this matter. I also have conducted a review of EDG load ratings and LOOP/LOCA loads estimated by other utilities in the licensing of approximately 20 other boiling water reactors licensed for operation over the last 15 year period. The relevant data I have evaluated are summarized in attached Table 1. My review was based upon information obtained from the U.S. NRC's Public Document Room in Washington, D.C.

1/ See Attachment 5 to Joint Direct Testimony of Robert N. Anderson, et al., Regarding Suffolk County's Emergency Diesel Generator Contentions, filed July 31, 1984.

3. As a result of my review and analyses, I have concluded that LILCO's proposed EDG qualification program and LOOP/LOCA emergency load specification does not provide an adequate margin between the EDG capability and the possible maximum emergency service loads to assure that the operation of the Shoreham plant will be in compliance with 10 C.F.R. Part 50, Appendix A, GDC 17. Specific reasons for my conclusion are contained in the following paragraphs.

4. LILCO's original LOOP/LOCA load requirements, as specified in FSAR Table 8.3.1-1, projected that the maximum coincident demand for the highest loaded EDG was 3881.4kW. (FSAR Table 8.3.1-1, page 3, Revision 31). This load was estimated to be approximately constant for the first ten minutes of the accident. After ten minutes, manual action was assumed that resulted in reducing the post-ten minute maximum load to 3409.2kW.

5. I have reviewed the correspondence between LILCO and the NRC Staff discussing possible changes to reduce the EDG loads. The level of the reduced "qualified" load was calculated by LILCO, and LILCO advised the NRC that a 3300kW test run would be performed on EDG 103 that would extend the operating time on that unit to approximately 740 hours. This length of

time was selected to coincide with a crankshaft fatigue cycle level of approximately ten to the seventh stress cycles. The LILCO test run commitment was confirmed in LILCO's SNRC-1094 letter dated 10/18/84, and Exhibit A thereto. Since LILCO claimed credit for 219 hours previously run on EDG 103 at or above 3300kW, it called for an additional run of 521 hours at a load of 3300kW $\pm$100kW.

6. In this same letter (SNRC-1094), LILCO also advised that an FSAR revision would be submitted in the near future which would provide the basis for the qualification of the EDGs at the reduced load requirement of 3300kW. This revision to Section 8.3.1 of the FSAR was formally submitted by LILCO on November 29, 1984 as Amendment 52, consisting of FSAR Revision 34. (Submitted via SNRC-1115, J.D. Leonard to Harold R. Denton, Nov. 29, 1984).

7. Revision 34 contains a number of changes to the original emergency load definition that are of particular relevance. They are:

(a) Two new load terms were added that did not appear on the original Table 8.3.1-1. The first, "Maximum emergency service load" is defined as the maximum load which would exist during a

LOOP/LOCA. It consists of both nameplate and measured loads. The second term, "qualified load," is defined as an upper bound of the maximum emergency service load of all three EDGs. (FSAR, Revision 34, page 8.3.6).

(b) Revisions were made to Table 8.3.1-1 of the FSAR. The changes included the removal of two major loads on EDG-103 from the automatic start category, adjustments to several loads made on the basis of measured rather than nameplate data, and the addition of footnotes indicating that other loads are to be tripped intentionally and in some cases prevented from starting until ten minutes after the LOCA signal.

(c) An additional table, 8.3.1-1A, entitled "Maximum Emergency Service Loads" ("MESL") was added. This table develops MESL totals for each EDG by removing from the Table 8.3.1-1 totals all loads that are cyclic or intermittent or that are tripped or manually initiated after a LOCA signal. By these deletions, LILCO was able to develop loads that are less than 2% below the

in emergency power voltage and frequency. Such off-standard operating conditions must be guarded against for future operation. Accordingly, if pump efficiency deteriorates or instrument error worsens, adjustments will be needed to compensate for the degraded flow conditions. Such adjustments will generally work to increase the increased required electrical load in order to assure that technical specification minimal flows are being delivered. These variations will not be large, but LILCO has provided no margin to account for such uncertainties.

(b) Overload capability. Setting the qualified load almost precisely at the continuous emergency required load provides no margin to accommodate cyclic and intermittent loads, and for the starting transients imposed by the subsequent addition of other pumps and loads. I have calculated that, based on LILCO's own figures, the intermittent or cyclic loads increase the maximum emergency service loads to 3426.1kW for EDG 101, 3380.7kW for EDG 102, and 3414.1kW for

EDG 103. Regulatory Guide 1.9 indicates that less conservative load definition is permissible at the operating license review stage since the design is fixed and the loads are more clearly defined. However, the Regulatory Guide assumes that margin will still be available "within the short-time rating of the diesel-generator unit". (Regulatory Guide 1.9, Revision 2, December 1979, page 1.9-2). The proposed LILCO loading conditions are particularly deficient with regard to overload capability. There is no confirmed overload capability for these EDGs and the qualified load (3300kW) is only 1.4% greater than the maximum continuous emergency service load (3253.5kW). It is a near certainty that the cyclic and intermittent loads arbitrarily removed from the schedule by LILCO will drive the actual EDG load some 5% higher in the first minutes of EDG operation. This is because the event will require the stroking of numerous motor-operated valves early in the cycle, and the starting of the diesels will draw down the starting air tank pressure, automatically

actuating the EDG air compressors for fifteen minutes or more. I have reviewed the intermittent and cyclic loads as well as those loads that can be manually connected subsequent to the LOCA signal. The potential effects of these intermittent and manually added loads is summarized on attached Table 2.

9. I have not yet quantified the total magnitude of the additional load that could be imposed by the uncertainties and intermittent and manual loads described in paragraph 8 above. I do know that they can be a net positive addition to the MESL, and I will be working further to quantify them during the next month.

10. I have obtained data from the NRC's Public Document Room in Washington, D.C. to compare the range of emergency load capability safety margins present at previously licensed plants. The results of my review and analyses are summarized in Table 1 attached. This review covered the majority of boiling water reactors licensed for operation since 1969. It includes nineteen different units ranging in size from 597 to 1152 MW. I find that none of these units has been licensed with less than 10.5% margin between the maximum predicted

emergency service load and the qualified continuous or overload rating of the respective EDGs. The range of margins varies from 10.5% to 34.6% and averages approximately 28%. This appears to be the desirable and commonly applied degree of margin to accommodate the uncertainties and cyclic loads described in the preceeding paragraphs.

11. The availability of additional margin in the load capability described in paragraph 10 above is desirable for yet another purpose -- to allow for the effect that the worst case single operator error could have on the EDG load during a LOOP/LOCA or LOOP event. In response to the Staff questioning, LILCO confirmed that EDG 103 could be loaded to as high as 3583.5kW in the post-LOOP/LOCA condition by the single operator error of manually starting the fourth reactor building service water pump. For the LOOP event, the worst case operator error load addition would be the starting of a core spray pump on EDG 101 which would result in a total diesel generator load of 3784kW.2/ LILCO has responded to NRC Staff questions on this subject that the possibility of such an event will be precluded by additional operator training and procedures. I certainly

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2/ See Staff Supplemental Safety Evaluation Report dated 12/3/84, page 5.

recommend that such steps be taken, but human error cannot be totally eliminated. I am aware that under normal interpretation of the single failure criteria, such operator errors are not required to be considered in the review. However, there is no assurance that the LOOP/LOCA or LOOP events will be terminated in any precise short period of time (in fact, such events could continue for hours or days). In actual accident cases (such as at Three Mile Island-2), errors have been made subsequent to the initiation of the event. It is unreasonable to ignore the possibility of such events and to fail to provide some conservatism in the load margins, particularly since LILCO proposes to operate this plant with EDGs having a long history of serious design and quality problems.

12. In addition to the inadequate load margin discussed in the paragraphs above, the actual qualification of the EDGs at 3300kW is suspect. EDG 103 recently completed a 740-hour test run at load levels of approximately 3300kW, but only after a major rebuild of the engine after 219 hours of operation at that load or greater. The installation on EDG 103 of a completely new and redesigned engine block made of a different grade of cast iron makes suspect the relevance of the completion of the "740-hour run" on this renovated unit to the two other engines with cracked blocks which have not been replaced.

13. There are other factors which further bring into question the 740-hour run. LILCO indicated that the load for the qualification run would be maintained at a level of 3300kW ±100kW.3/ In a deposition on December 12, LILCO witnesses confirmed that normal station instrumentation was utilized in establishing the load level for the run and that no calibration of the instrumentation was required before, during, or after the run was completed.4/ Thus, there is no assurance that the accuracy of the instrumentation even meets the nominal 2% full scale accuracy that was specified from the 5600kW EDG load instrument. Even if the instrumentation is within the specified accuracy, it would still be possible for a portion or some of the test run to have been carried out at a load level of less than 3200kW. I have examined the single handwritten log sheet provided to the County by LILCO, which indicates the EDG load every one-half hour for three hours on 10/31/84. The load level recorded is exactly 3300kW for each entry. I know that the load would vary some amount from hour to hour, and am concerned that the load level was not precisely recorded. It

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3/ SNRC-1094, October 18, 1984, Confirmatory Testing of TDI Diesel Generators.

4/ Deposition of J. Notaro, E. Youngling, G. Dawe, and W. Schiffmacher, Dec. 12, 1984, at 41-42.

is therefore possible that the operators could have interpreted the instructions that the load was to be set at approximately 3300kW and recorded only a nominal level. If the instrumentation was off by plus 2%, and the actual load was running at the low end of a nominal range, the actual load could thus have been well below 3188kW; if a nominal range of ±100kW is assumed, the actual load could have been 3088kW.

14. Taking all of the above uncertainties into account, it is possible that the load qualification test performed on EDG 103 was conducted at levels of only 3200kW or even lower. This is obviously less than the continuous emergency load, and the actual peak emergency load will be higher than the continuous load. There are two different times during the course of the accident when this could be particularly acute. First, during the early minutes, adding the intermittent loads to the MESL (continuous) load of 3253.5kW will lead to an actual LOOP/LOCA EDG load of as high as 3426.4kW. Later in the accident (after ten minutes), load adjustments including the possible addition of an RBSW pump and an RBCLCW pump, require "juggling" of the loads. As shown on Table 2, there is a potential for the load on one EDG to reach as high as 4126.8kW under this condition. The EDG Emergency Operating Procedure cautions the operator in the post-accident condition to limit the EDG load to 3300kW ±100kW.5/ No guidance is given as to

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5/ SP 29.015.01, Revision 6, Loss of Offsite Power Emergency Procedure.

exactly how this caution is to be enforced. The most likely method would be to rely upon the control room indicating kW meter provided for each EDG. These instruments have an accuracy that is specified as ±2% accuracy full scale. Thus, it is possible that the 3300kW ±100kW load stated in the procedure could in actuality reach as high as 3512kW on the EDG. I reach this value by assuming the maximum load permitted by the procedure (3400kW) and adding to it the 2% full scale instrument error permitted (112kW). Thus, it is possible that the maximum emergency service load peak could exceed the 3088kW potential lowest level at which EDG 103 was tested by 10.9 percent for the intermittent peak, and by 13.7 percent for the worst case manually loaded condition in the post-accident condition.

TABLE-1

Comparative BWR EDG Ratings and LOOP/LOCA Loads

Plant	Unit Rating MW	In Service	kW EDG Rating	(4)kW Peak Load	% Margin
Oyster Creek	650	1969	2500(1)	1950	28.2
Duane Arnold	597	1975	3250(3)	2510	29.5
Cooper	836	1974	4000(1)	3619	10.5
Dresden 2-3	800/800	1970/71	2860(2)	1950	46.7
Quad Cities 1-2	800/800	1972/72	2850(2)	2122	34.3
Pilgrim	655	1972	2750(2)	2398	14.7
Peach Bottom 2-3	1152/1152	1974/74	3250(1)	2560	26.9
Brunswick 1-2	821/821	1977/75	3850(2)	2860	34.6
Hatch 1	850	1975	11700(5)	9670	21.0
Hatch 2	850	1979	3500(3)	3100	12.9
LaSalle 1-2	1078/1078	1984/85	3250(3)	2719	19.5
WPPS-2	1103	1984	4650(2)	3860	20.5
Susquehanna 1-2	1152/1152	1983/85	4700(2)	3542	32.7
	AVERAGE		=		27.7%

Notes:
(1) Continuous Rating
(2) 2000 Hour Rating
(3) 30 Minute Rating
(4) Peak Loads are those automatically loaded on LOCA/LOOP
(5) Assuming 4 of 5-2925kW EDGs start
(6) All data taken from USNRC Public Document Room FSARs

TABLE-2

Shoreham Emergency Service Loads (in kW)
(Data extracted from Proposed Revision 34 to the FSAR)

	EDG 101	EDG 102	EDG 103
LOOP/LOCA Maximum Emergency Service Loads (Per LILCO Proposed Table 8.3.1-1A)	3253.3	3208.7	3225.5
Auto-Start Cyclic & Intermittent Loads (Remarks 5, 7, & 8):			
Air Comp.	12.0	12.0	12.0
Fuel Oil Transfer	0.4	0.4	0.4
480V M-G Set	141.0	141.0	176.0
MOVs	19.7	18.3	0.7
SUBTOTAL	173.1	171.7	189.1
Auto-Start Loads as a % of 3300	5.2	5.2	5.7
Maximum Auto-Start Loads Emergency Service Loads	3426.4	3380.4	3414.6
Loads Which May Be Added Manually Or After Ten Minutes (excludes those that are illogical such as EDG heaters, refueling plat-			

TABLE-2

Shoreham Emergency Service Loads (in kW)
(Data extracted from Proposed Revision 34 to the FSAR)

	EDG 101	EDG 102	EDG 103
form, etc.)			
	--	--	358.0
	--	--	80.0
	--	--	52.0
	109.0	109.0	--
	--	26.4	--
	7.0	3.5	--
	180.0	--	--
	20.0	20.0	--
	--	--	20.0
	2.4	2.4	--
	206.1	206.1	--
	80.0	80.0	--
	1.6	1.6	--
	--	48.0	48.0
	--	--	0.4
	--	--	32.0
	8.0	8.0	12.0
	1.2	1.2	--
	8.0	8.0	--
	1.2	1.2	--
	32.0	32.0	--
	--	10.0	--
	45.0	--	--
	3.0	3.0	--
	95.9	75.3	--
SUBTOTAL	700.4	635.7	603.4
Maximum Potential Emergency Service Load After Ten Minutes	4126.8	4016.1	4017.0

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)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of JOINT MOTION OF SUFFOLK COUNTY AND NEW YORK STATE TO ADMIT EDG LOAD CONTENTION, dated December 17, 1984, have been served on the following this 17th day of December 1984 by U.S. mail, first class, except as otherwise indicated.

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DATE: December 17, 1984

By Federal Express
* By Hand Delivery