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

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

September 11, 1984 SNRC-1077

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

TDI Diesel Generators
Shoreham Nuclear Power Station - Unit 1
Docket No. 50-322

Dear Mr. Denton:

The Safety Evaluation Report, Transamerica Delaval, Inc., Diesel Generator Owner's Group Program Plan, dated August 13, 1984 (Owner's Group SER), was received at LILCO on August 21, 1984. We have also reviewed the Staff letter to the TDI Diesel Generator Hearing Board, dated August 24, 1984, as well as the Staff testimony dated August 30, 1984. LILCO understands that the Staff is considering whether any additional performance testing of diesel generator 101 or diesel generator 102 may be appropriate to provide added assurance regarding the crankshafts and the cam gallery area of the block. The purpose of this letter is to provide you with LILCO's reasons for concluding that additional testing is not required. In addition, given that the loads on the diesel generators in the event of a LOOP/LOCA are now predicted to be lower than those stated in the FSAR, this letter sets forth the basis for revising the loads in the FSAR and defines the "qualified load" pursuant to Section 2.3.2.3 of the Owner's Group SER.

Once the Staff has had an opportunity to review this revised load data, LILCO will revise the FSAR accordingly.

EDG Load

As stated in the Owner's Group SER, a more realistic consideration of the maximum Emergency Diesel Generator (EDG) load requirements and the use of a qualified load would result in enhanced component design margin relative to operation at the nameplate rating. LILCO concurs and believes that the implementation of a qualified load which is less than the EDG



B001
1/5

nameplate rating will result in a more reliable machine, while still ensuring that all LOOP/LOCA service load requirements can be accomodated. Accordingly, LILCO initiated an effort to refine the diesel generator required loads and presented in Table 8.3.1-1 of the FSAR. The purpose of this effort was to confirm that the SNPS maximum emergency service load requirements for a LOOP/LOCA are substantially below the EDG nameplate rating and also to justify the establishment of a more appropriate qualified load.

LILCO developed more representative diesel loads by using a combination of analytical and test methods. A review of FSAR Table 8.3.1-1 was performed, together with an analysis that verified the feasibility of deleting the automatic start logic from one of two Reactor Building service water pumps on EDG 103. The results of this analysis, reported to you in SNRC-1065, dated July 3, 1984, resulted in a substantial decrease in both the short term and continuous load requirements for EDG 103.

As SNRC-1065 indicated, bounding peak loads on the SNPS diesels during a LOOP/LOCA were as follows: 3475 kw continuous, and 3500 kw overload. These figures are still excessively conservative because they do not consider measured load data from the Integrated Electrical Test (IET) and individual system/component tests. SNRC-1065 did demonstrate, however, that the 3500kw/3900 kw estimates and safety loads developed during the construction permit stage were overestimated and are no longer appropriate. It should be noted that the previous overload rating of 3900 kw for all three engines was based on short term load requirements on EDG 103 which was formerly 3881 kw. Short term loads on the other two engines have always been below 3500 kw. Thus, the reduction of short term loads on EDG 103, as described in SNRC-1065, makes it appropriate to lower substantially the overload rating for all three engines.

The second phase of the load evaluation used the measured values from the recently completed IET and individual system/component tests as the basis for confirming that the service loads during a LOOP/LOCA event are lower than the current FSAR estimates and the engine nameplate ratings. The use of these test results to establish more appropriate diesel generator loads at the operating license stage of review is consistent with Regulatory Guide 1.9 and the Owner's Group SER.

Analysis of these test results indicates that the short term maximum loads for EDG 101, 102 and 103, representing conservative LOOP/LOCA service load requirements, are 3,291, 3,246, and 3,256 kw, respectively. Table I, attached, provides details on the development of these loads. Therefore, a short term maximum load of 3,300 kw will bound all three machines. Even this figure is conservative because many loads were assumed to be at their maximum levels while in actuality this is unlikely to be the case. Moreover, within twenty minutes after the start of an accident, loads lower than 3,200 kw for all three engines would likely be achieved by operator action to reduce core spray and RHR flow from runout to rated flow conditions.

Crankshaft Testing

As you know, preoperational testing and post-DRQR testing and inspections have been completed. Both the Staff SER as well as the August 24, 1984 letter recommend additional confirmatory testing of a lead diesel for a total of 750 hours of operation at qualified loads if credit is to be obtained for operation of the diesels above 185 BMEP. As we understand the Staff's current view, this testing should be performed to achieve the $10^7$ cycle demonstration for crankshafts.

On August 24, prior to receipt of the Staff testimony and the letter of August 24, I committed LILCO to the performance of a 750 hour demonstration test for the purpose of confirming the acceptability of the crankshaft. This testing was to be performed at a load of 3300 kw. Based on recent discussions with the Staff concerning the crankshaft testing and in light of the discussion above on diesel loads, LILCO has concluded that there is no genuine technical need or justification requiring additional testing of the Shoreham diesels. Sufficient testing at 3,500 kw has already been accumulated on the potential test engine (EDG 101) to more than satisfy the testing requirement for the overload rating. Diesel Generator 101 has approximately 260 test hours at or above 3500 kw. This far exceeds the requirement for 62.5 hours at overload as required by the SER. In addition, of the approximately 260 test hours at or above 3,500 kw, 30.75 hours have been logged at or above 3600 kw. Crankshaft inspections were performed with satisfactory results after 100 hours at or above 3500 kw as part of the DR/QR Program. It is immaterial to the $10^7$ cycle test on crankshafts when during the 750 hours the overload testing is performed.

Further, we are confident, based on our understanding of the Staff's consultants' methodology to determine crankshaft stresses, that they will determine that stresses on the crankshaft, at loads of 3300 kw and below, satisfy the DEMA standard. It is also important to note that ABS has certified the SNPS 13" x 12" crankshaft design and manufacture for 3500 kw.

Significantly, the Saudi Arabian units (Rafha) have accumulated over 6,000 hours at 3,300 kw (on one machine) without crankshaft failure (and many more hours at 3,200 kw on the others) as indicated in TDI letter to the American Bureau of Ships dated April 3, 1984 (attached). This operating experience, coupled with the LILCO data at 3500 kw provides the required assurance that these crankshafts are adequate for the loads outlined above.

Finally, I further believe that the DR/QR final reports, when reviewed by the Staff, will provide the necessary analytical justification to qualify the crankshafts. For all these reasons, therefore, I now conclude that this 750 hour test, which would have cost LILCO approximately $1.4 million in materials, labor, consultants and fuel over and above the total Shoreham diesel recovery and DR/QR efforts of greater than $8 million, is not warranted.

Cam Gallery

The Staff has also indicated that some testing would also be helpful in evaluating the cam gallery cracks. As agreed in our conversations with the Staff, $10^7$ cycle/750 hour testing is inappropriate and not required with respect to these cracks. Metallurgical investigations by Failure Analysis Associates (FaAA) of the cam gallery cracks in the old EDG 103 block indicated that these are process cracks and have not propagated during engine operation. The EDG 103 cracks are characteristic of cracks found in the EDG 101 and EDG 102 cam galleries, although inspection reports indicate the cracking was more extensive in EDG 103. Based on the superior microstructure of the EDG 101 and 102 blocks as compared to the old EDG 103 block, less cracking in EDG 101 and 102 was expected and in fact noted. Moreover, even the cracks in EDG 103 had not propagated during more than 1200 hours of engine operation, nor had they affected engine operation, though LILCO will continue to monitor the cracks in the cam gallery areas in accordance with the recommendations of the Owner's Group DRQR Program. Therefore, no additional testing is necessary with respect to the cam gallery area.

Conclusion

I realize that this is a departure from our previous commitment. However, the issuance of the SER, extensive subsequent discussions with your staff, development of a lower qualified load, consideration of existing Shoreham and other pertinent field data and the cost of conducting the 750 hour test all dictate a different conclusion.

I appreciate the open dialogue and cooperation with your staff and remain available at any time to discuss any remaining concerns or aspects of this letter further.

Very truly yours,

Jeffrey L. Smith for

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

BRM:ck

Attachments

cc: P. Eselgroth
C. Petrone
All Parties Listed in Attachment I

ATTACHMENT I

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ATTACHMENT 2 - SNRC-1077

**Transamerica Delaval**

Transamerica Delaval Inc.
Engine and Compressor Division
550 85th Avenue
P.O. Box 2161
Oakland, California 94621
(415) 577-7400

April 3, 1984

American Bureau of Shipping
65 Broadway
New York, NY 10006

Attention: Mr. Robert A. Giuffrs
Principal Surveyor, Machinery

Subject: Report on Crankshaft Torsional Stresses
Transamerica Delaval Model DSR-48
Serial No. 74010/12
for Long Island Lighting Company

Dear Mr. Giuffra:

As discussed during the meeting on March 14 in your office between yourselves, Mr. Gene Montgomery of LILCO, Dr. Simon Chen of Power & Energy International, Dr. Paul Johnston of Failure Analysis Associates and myself, I am sending you four copies of the "Report on Crankshaft Torsional Stresses" for the three DSR-48 engine generator sets at LILCO's Shoreham plant.

You will note that the report has four sections and contains calculations, test data and operating experience which we consider relevant material to establish the adequacy of these DSR-48 engine generator sets.

The similarity between the DSR-48 referenced in the report are outlined in page 17 and 19. On page 28 are operating hours logged for similar DSR-48. Worthy of note are the Rafha engines which have operated between 5500 hours to 8250 hours at a load level between 3200 KW and 3300 KW. Due to the time constraint on this project, please give this matter your earliest attention. We look forward to receiving your approval.

Very truly yours,

TRANSAMERICA DELAVAL INC.
Engine & Compressor Division

Roland T. M. Yang
Manager Applied Mechanics

RTY:dmh

Enclosures

cc: G. Trussell
G. Montgomery
P. Johnston
ABS-San Francisco

ATTACHMENT

Table - SNRC-1077

SNPS-1 FSAR

REVISED TABLE 8.3.1-1 for DETERMINATION of

EMERGENCY DIESEL GENERATOR SYSTEM

LOOP+ LOCA - QUALIFIED LOADS

| Function | Nameplate Rating (Hp) | Total Plant Number | Number Required: Design Basis Loss of Coolant Accident 0-10 Min | Number Required: Design Basis Loss of Coolant Accident 10 Min on | Number Required: Loss of Offsite Power (Hot Standby) | Maximum Co... Demand (Ki... DG-101 | Maximum Co... Demand (Ki... DG |
|---|---|---|---|---|---|---|---|
| Core Spray Pump | 1250 | 2 | 1 (1) | 1 | - | 998 | ≠ 9 |
| Residual Heat Removal Pump | 1250 | 4 | 2 (1) | 1 | 2 | 999 | ≠ 9 |
| Service Water Pump | 450 | 4 | 2 | 2 | 3 (1) | 358 | |
| RBSVS and CRAC Water Chiller | 292 | 4 | 2 | 2 | 2 | 235 | |
| RBSVS and CRAC Water Chiller Lube Oil Pump | .25 | 4 | 2 | 2 | 2 | .2 | |
| RBSVS Chiller Circ. Water Pump | 75 | 4 | 2 | 2 | 2 | ▲ 32 | ▲ |
| RBSVS Chiller Cond. Water | 20 | 4 | 2 | 2 | 2 | 16 | |
| RBSVS Unit Cooler | 30 | 8 | 4 | 4 | 4 | 16 | |
| RBSVS Exhaust Fan | 100 | 3 | 2 | 2 | 2 | ▲ 60.5 | ▲ |
| Reactor Building Exhaust Booster Fan | 7.5 | 2 | 1 | 1 | 1 | ▲ 3.3 | ▲ |
| RBSVS Filter Reheat Coil | 6.6 kW | 2 | 1 | 1 | 1 | 6.6 | |
| RBCLCW Circ. Pump | 100 | 3 | 2 | 2 | 2 | 80 | |
| Diesel Generator Air Compressor | 10 | 6 | - | - | - | — | |
| Diesel Generator Fuel Oil Transfer Pump | .5 | 6 | 2 | 2 | 2 | — | |
| Diesel Generator Jacket Water Heater | 36 kW | 6 | - | - | - | —(2) | |
| Diesel Generator Jacket Water Keep Warm Pump | 2.5 kW | 3 | - | - | - | —(2) | |
| Diesel Generator Lube Oil Heater | 20 kW | 3 | - | - | - | —(2) | |
| Diesel Generator Before & After Lube Oil Pump | 5 | 3 | - | - | - | —(2) | |
| Diesel Generator Heater | 4.2 kW | 3 | - | - | - | —(2) | |
| Battery Charger (125 V) | 60 kVa (1) | 3 | 2 | 2 | 2 | 20 | |
| 120 V ac Instrument Power | 100 kVa DG 101<br>100 kVa DG 102<br>50 kVa DG 103 | 3 | 2 | 2 | 2 | 80 | |
| 120 V Nonemergency Feeds | 65 kVa | - | - | - | X (1) | —(4) | |
| Diesel Generator Room Vent Supply Fan | 20 | 3 | 2 | 2 | 2 | 16 | |
| Battery Room Vent Supply Fan | 2 | 3 | 2 | 2 | 2 | 1.6 | |
| Control Room Air Conditioning Unit | 40 | 2 | 1 | 1 | 1 | ▲ 30.6 | ▲ |
| Control Room Vent Booster Fan | 7.5 | 2 | 1 | 1 | 1 | ▲ 5.3 | ▲ |

NOTES: Ⓐ NOT A D/G 101 LOAD
Ⓑ NOT A D/G 102 LOAD
Ⓒ NOT A D/G 103 LOAD
Ⓓ TRIPPED ON A LOCA/LOSS of OFFSITE POWER
▲ ACTUAL MEASURED LOADS
Ⓔ LOCKED OUT FOR 10 MIN ON LOCA, MANUAL START AND MANUAL LINE-UP

| Accident (watt) DG-102 | DG-103 | REMARKS |
|---|---|---|
| 98 | — Ⓒ | NAMEPLATE VALUE |
| 99 | ▲1898 | → AT LEAST 1 DIV. III PUMP WILL BE IN A LOOP WITH DIV. I or II PUMP; RESULTING IN 100KW SAVINGS |
| 58 | 358 | → 1 DIV. III PUMP IN PULL TO LOCK (Ⓔ) NO AUTO START |
| 235 | 470 | NAMEPLATE VALUE |
| .2 | .4 | NAMEPLATE VALUE |
| 32 | ▲64 | ACTUAL TEST DATA SHOWED LOAD VALUE OF 32KW vs. 60KW NAMEPLATE |
| 16 | 32 | NAMEPLATE VALUE |
| 96 | — Ⓒ | NAMEPLATE VALUE |
| 0.5 | ▲60.6 | |
| .3 | — Ⓒ | |
| .6 | — Ⓒ | NAMEPLATE VALUE |
| 0 | —— Ⓑ | NAMEPLATE VALUE |
| — | — | } LOADS ARE CYCLIC & NOT CONTINUOUS. THEREFORE NOT INCLUDED IN TOTAL |
| — | — | } |
| Ⓐ | — Ⓓ | |
| Ⓜ | — Ⓓ | |
| Ⓜ | — Ⓑ | |
| Ⓓ | — Ⓓ | |
| Ⓓ | — Ⓑ | |
| 25 | 17 | FSAR VALUE |
| 0 | 40 | FSAR VALUE |
| — Ⓑ | — Ⓓ | |
| 16 | 16 | NAMEPLATE VALUE |
| .6 | 1.6 | NAMEPLATE VALUE |
| 0.6 | — Ⓒ | |
| 5.3 | — Ⓒ | |

TABLE 8.3.1-1 (CONT'D)

| Function | Nameplate Rating (Hp) | Total Plant Number | Number Required: Design Basis Loss of Coolant Accident 0-10 Min | Number Required: Design Basis Loss of Coolant Accident 10 Min on | Number Required: Loss of Offsite Power (Hot Standby) | Maximum Demand (kW) DG-101 | Maximum Demand (kW) DG- |
|---|---|---|---|---|---|---|---|
| Emergency Switchgear, Relay & Computer Rooms Air Conditioning Unit | 40 | 2 | 1 | 1 | 1 | ▲ 30.6 | ▲ 3 |
| TSC Air Conditioning Unit | 40 kW | 1 | - | 1 | 1 | -Ⓐ | - |
| TSC Air Cooled Condenser | 30 kW | 1 | - | 1 | 1 | -Ⓐ | - |
| Emergency Switchgear, Relay & Computer Rooms Exhaust Fan | 10 | 2 | 1 | 1 | 1 | ▲ 6.7 | ▲ ( |
| RBSVS Cooler Room Exhaust Fan | 3 | 2 | 1 | 1 | 1 | 2.4 | 2 |
| Screenwell Exhaust Fan | 10 | 2 | 1 | 1 | 1 | 8 | |
| Screenwell Interposing Relay Panel | 1 kVa | 1 | 1 | 1 | 1 | -Ⓐ | |
| MCC Room Ventilation | .75 | 2 | 1 | 1 | 1 | .5 | . |
| LPCI M-G Set Room Ventilation | 3 | 4 | 2 | 2 | 2 | 2.4 | 2. |
| Unit Cooler MCC 081 Room | 1.5 | 1 | 1 | 1 | 1 | -Ⓐ | 1. |
| Spent Fuel Pool Cooling Water Pump | 30 | 2 | - | 1 | 1 | 24 | 2 |
| Loop Level Pump (CS, RHR, HPCI, RCIC) | 7.5 | 4 | 4 | 2 | 4 | 12 | 1 |
| Atmospheric Cont. - Hyd. Recombiner | 109 kW | 2 | - | 1 | - | -Ⓑ | - |
| MSIV-LCS Heaters | 6.6 kW | 4 | - | - | - | -Ⓐ | - |
| MSIV-LCS Blowers | 4.4 | 3 | - | - | - | -Ⓐ | - |
| Radiation Monitoring | 1 | 10 | - | - | - | -Ⓐ | - |
| Lighting (Equivalent kW) | 407.2 kW | - | - | - | X (1) | 4.8 | 3. |
| Fence Security Lighting | 50 kW | - | - | - | X (1) | -Ⓑ | - |
| Reactor Protection System M-G Set (3) | 25 | 2 | - | - | 2 | 34 | - |
| Reactor Protection System Backup Transformer | 25 kVa | 1 | - | - | 1 | ▲ 17.3 | ▲ 17 |
| Battery Charger ±24 V | 3 kVa | 4 | - | - | - | -Ⓐ | - |
| Uninterruptible Power (Vital Bus) (3) | 37.5 kVa | 1 | 1 | 1 | 1 | -Ⓑ | - |
| Uninterruptible Power (Security & Communications) (3) | 20 kVa | 1 | 1 | 1 | | -Ⓐ | - |
| Battery Charger (Security and Communication) | 20 kVa (3) | 1 | - | - | - | -Ⓐ | - |
| Uninterruptible Power (Computer Bus) (3) | 20 kVa | 1 | 1 | 1 | 1 | 16 | - |
| Control Rod Drive Pump (3) | 250 | 2 | - | - | 1 | -Ⓓ | - |
| Drywell Cooling System Fan (3) | 25 | 8 | - | - | 4 | -Ⓓ | - |

| ncident watt) DG-102 | DG-103 | REMARKS |
|---|---|---|
| 0.6 | — © | |
| ⑧ | 40 | NAMEPLATE VALUE |
| ⑧ | 30 | NAMEPLATE VALUE |
| .7 | — © | |
| 4 | — © | NAMEPLATE VALUE |
| | — © | NAMEPLATE VALUE |
| 8 | — © | NAMEPLATE VALUE |
| 5 | — © | NAMEPLATE VALUE |
| 4 | 48 | NAMEPLATE VALUE |
| 2 | — © | NAMEPLATE VALUE |
| 4 | — © | NAMEPLATE VALUE |
| 2 | — © | NAMEPLATE VALUE |
| 0 | — © | |
| 0 | — © | |
| 0 | — © | |
| | — © | FSAR VALUE |
| 0 | — © | |
| 2 | 26 | FSAR VALUE |
| 3 | — © | |
| 0 | — ⑩ | |
| 0 | — ⑤ | |
| 0 | 30 | FSAR VALUE |
| 0 | 16 | FSAR VALUE |
| 0 | 4 | FSAR VALUE |
| 0 | — © | FSAR VALUE |
| 0 | — © | |
| 0 | — © | |

TABLE 8.3.1-1 (CONT'D)

| Function | Nameplate Rating (Hp) | Total Plant Number | Number Required: Design Basis Loss of Coolant Accident 0-10 Min | Number Required: Design Basis Loss of Coolant Accident 10 Min on | Number Required: Loss of Offsite Power (Hot Standby) | Maximum Co... Demand (Kl... D/G-101 | D/G |
|---|---|---|---|---|---|---|---|
| Primary Containment Air Cooler Subfeed | 2 kVa | 2 | - | - | 1 | — (6) | — |
| Reactor Water Cleanup Recirc. Pump (5) | 60 | 2 | - | - | 1 | — (3) | — |
| Suppression Pool Pump Back Pump | 25 | 1 | - | - | - | — (1) | — |
| Main Turbine Turning Gear (5) | 60 | 1 | - | - | 1 | — (A) | |
| Main Turbine Piggyback Turning Gear Drive | 0.5 | 1 | - | - | 1 | — (A) | — |
| Main Turbine Turning Gear Oil Pump (5) | 40 | 1 | - | - | 1 | — (4) | — |
| Main Turbine Bearing Lift Pump (5) | 5 | 7 | - | - | 7 | — (1) | — |
| Feedwater Turbine Turning Gear (5) | 1.5 | 2 | - | - | 2 | — (1) | — |
| Feedwater Turbine Turning Gear Oil Pump (5) | 10 | 2 | - | - | 2 | — (2) | — |
| RFP EHC Control Transformer | 1.5 kVa | 2 | - | - | 2 | — (2) | |
| Standby Liquid Control Pump | 40 | 2 | - | - | - | — (2) | — |
| Standby Liquid Control Main Heater (5) | 10 kW | 1 | - | - | - | — (1) | — |
| Standby Liquid Control Mixing Heater (5) | 45 kW | 1 | - | - | - | — (1) | — |
| Standby Liquid Control Heat Tracing | 3 kVa | 2 | - | - | - | — (2) | — |
| Heat Tracing Transformer | 25 kVa | 2 | 1 | 1 | 2 | 2 | 2 |
| 480 V M-G Set | 200 (11) | 4 | 2 | 2 | 4 | ▲ 34 | ▲ 7 |
| Refueling Jib Crane | 3.25 | 2 | - | - | - | — (2) | — |
| Refueling Platform Assembly | 3.5 | 1 | - | - | - | — (1) | — |
| Motor Operated Valves | - | - | X | - | - | — | — |
| Nonoperating MOV's (11) | - | - | - | - | - | — | — |

D/G 101 3290.8Kw

D/G 102 3246.2Kw

D/G 103 3256.3Kw

| ...cident (watt) | DG-103 | REMARKS |
|---|---|---|
| D | — D | |
| D | — D | |
| B | — B | |
| B | — B | |
| B | — B | |
| B | — B | |
| B | — B | |
| B | — B | |
| B | — B | |
| B | — B | |
| B | — B | |
| B | — B | |
| B | — B | |
| B | — B | |
| D | — D | FSAR VALUE |
| 4 | A148 | MG SET WILL BE UNLOADED AFTER UPC VLVs HAVE STROKED. |
| B | — B | |
| B | — B | |
| — | — | NOT A CONTINUOUS LOAD |
| — | — | |