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WILLIAM D. HARRINGTON
SENIOR VICE PRESIDENT
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January 28, 1985

BECo 85-018

Mr. Darrell G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

License DPR-35
Docket 50-293

Subject: Generic Letter 84-15: Proposed Staff Action to Improve and Maintain Diesel Generator Reliability, dated July 2, 1984

Reference: W. D. Harrington to D. G. Eisenhut; "Request for Extension to Submit Response to Generic Letter 84-15", BECo Letter #84-135, dated August 15, 1984

Dear Sir:

Boston Edison Company (BECo) received Generic Letter 84-15 on July 16, 1984. This letter required BECo to submit information to the NRC on or before October 1, 1984, regarding diesel generator surveillance tests, reliability data and reliability programs. By reference, BECo requested an extension to January 31, 1985 to submit a response. The enclosure addresses our response to the Generic Letter 84-15.

Should you require further information regarding this submittal, please contact us.

Very truly yours,

W J Harrington

Enclosure

WGL/kmc

Commonwealth of Massachusetts)
County of Suffolk )

Then personally appeared before me W. D. Harrington, who, being duly sworn, did state that he is Senior Vice President - Nuclear of the Boston Edison Company, the applicant herein, and that he is duly authorized to execute and file the submittal contained herein in the name and on behalf of the Boston Edison Company and that the statements in said submittal are true to the best of his knowledge and belief.

My Commission expires: JUNE 20, 1991

Dorothy M. Lopes
Notary Public



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ENCLOSURE
BECo RESPONSE TO NRC
GENERIC LETTER 84-15:
PROPOSED STAFF ACTIONS TO IMPROVE
AND MAINTAIN DIESEL GENERATOR RELIABILITY

NRC Request

1. Reduction in Number of Cold Fast Start Surveillance Tests for Diesel Generators

This item is directed towards reducing the number of cold fast start surveillance tests for diesel generators which the staff has determined results in premature diesel engine degradation. The details relating to this subject are provided in Enclosure 1. Licensees are requested to describe their current programs to avoid cold fast start surveillance testing or their intended actions to reduce cold fast start surveillance testing for diesel generators.

BECo Response

Pilgrim Nuclear Power Station (PNPS) diesel generators have engine prelube systems which maintain continuous warm lube oil flow through the diesel generators when they are not running. As a result, PNPS fast start surveillance tests are conducted warm. Procedures related to warm-up prelubrication for startup are also followed, and are in accordance with the manufacturers recommendations.

PNPS Technical Specifications require testing the diesels at least once per month; however, we conduct startup tests twice per month. We believed that by increasing the startup frequency to 2 at warm-up conditions the diesels would be maintained in a highly reliable condition. In general, however, we feel that excessive fast starts and surveillance tests have the potential to cause undue wear and damage to moving parts.

We are currently investigating the impact of test starts and frequency for the purpose of developing a periodic testing policy. The objective of this investigation is to optimize the performance specification of diesel generators to alleviate the concerns expressed in NUREG/CR-0660 "Enhancement of On-site Emergency Diesel Generator Reliability" and Generic Letter 84-15. Should this investigation indicate any changes which will enhance D/G reliability, we will address such changes at that time.

NRC Request

2. Diesel Generator Reliability Data

This item requests licensees to furnish the current reliability of each diesel generator at their plant(s), based on surveillance test data. Licensees are requested to provide the information requested in Enclosure 2 of Generic Letter 84-15.

BECo Response

The Attachment to Enclosure provides the reliability data on PNPS diesel generators. This data indicates that PNPS has established a high level of diesel generator reliability, for diesel A, 98%, and Diesel B, 99%. As discussed in the attachment, diesels A and B had fuel oil booster pump drive belt failures. We have addressed these failures, and effectively corrected the problem. Considering these belt problems as engine failures (the worst case), the reliability data for diesel A is 95% and for Diesel B, 97%

To correct the belt failure problems, detailed instructions and drawings regarding replacement of the booster pump drive belts were included in the diesel generator maintenance procedure. This item was closed-out by the NRC inspector in Inspection Report 83-23, Inspector Follow-up Item 83-10-02.

The reliability data included in the attachment was furnished to the NRC in response to the Generic Letter 83-41.

NRC Request

3. Diesel Generator Reliability

Licensees are requested to describe their program, if any, for attaining and maintaining a reliability goal for their diesel generators. An example of a performance Technical Specification to support a diesel generator reliability goal has been provided by the staff in Enclosure 3 to Generic Letter 84-15. Licensees are requested to comment on, and compare their existing program or any proposed program with the example performance specification.

BECo Response

BECo does not have a diesel generator reliability program in place in the format specified in the Generic Letter 84-15. However, the below identified station procedures provide information related to D/G start-up, failure, repair and maintenance activities.

2.1.12: D/G Daily Surveillance
8.9.1 : Manually Start and Load Each D/G Once Per Month
8.9.13: Manually Start and Load D/G A&B
8.M.3-1: Automatic ECCS Load Sequencing of Diesels and Shutdown Transformer with simulated loss of Off-site power.

In addition, each time the diesel fails, a Failure and Malfunction Report (F&M) is generated which requires root cause determination and correction of the problem. The maintenance history and F&M report data are trended over time when required. This provides valuable information to address potential problems. Mechanical inspections are performed every cycle with a qualified consultant on hand to assist and advise us.

Our goal is to maintain the diesel generator reliability at a high level. Part of the overall effort to maintain high reliability, as explained in Item 1, is to optimize the periodic testing policy. The optimization study which we have undertaken will provide the necessary data to propose changes in technical specifications and/or modifications.

Our comments on the NRC proposed reliability program are as follows:

a. We agree that highly reliable diesel engines are needed at the station; however, we believe that the performance specification included in the proposed reliability program appear to be more punitive than constructive. The reliability program should attempt to identify causes of failures and provide assurance to enhance the reliability. The testing frequencies included in the proposed reliability program are excessive and contrary to the recommendations of NUREG/CR-0660. The proposed testing frequencies give little or no flexibility to the licensees once the root cause of the problem is identified and effectively rectified. We believe a frequency of once per month is acceptable. Beyond that, the licensee should have the option to change the testing cycle depending upon the root causes of the problem rather than be locked into inflexible testing frequencies. Manufacturers recommendations, warm-up and prelubrication should be implemented as effective mechanisms to enhance engine reliability.

b. The proposed program to determine the D/G reliability is based upon the last 100 valid demands. While this may be a sound bases for statistical purposes, at least 4 years of data is required in order to compute reliability based on this number of demands. During those 4 years, significant changes usually occur to alleviate problems which improve the performance of the diesel. Thus the base data of 100 does not account for the contribution made by recent changes or modifications, and may therefore grossly underestimate or overestimate reliability. Also, the diesels are thoroughly inspected during refueling outages. BECo recommends that at least one refueling interval's (generally 18 months) data be used to compute reliability.

c. The proposed program focuses on the engine startup test data. In many cases failure can be attributed to inadequate training, inadequate procedures and guidance (from the vendor), as well as equipment-subpart failures. The proposed program should focus on the adequacy of training and procedures to minimize human errors. It is suggested that, instead of excessive start-up tests, flexibility should be provided in the program so that management could evaluate the current DG maintenance and testing practices whenever the reliability declines below predetermined levels.

ATTACHMENT

DIESEL GENERATOR RELIABILITY DATA

DESCRIPTIONS

Valid Tests & Failures:

Guidelines established in Regulatory Guide 1.108 Revision 1, August 1977 were used for establishing the valid test and failure criteria.

Valid Tests

1. Procedure 8.9.1 - Manually start & load each D/G once/month
2 Procedure 8.M.3-1 - Simulated auto initiation of Diesel Generators
3. During Loss of off-site power events, the diesels performed their design function.

"Failure"

For any of the above (3) valid tests, the failure to start, accelerate, and assume the design-rated load within and for the time prescribed, except as noted in Non-Failures below. (I e., The Diesel/Generator would not have performed in the emergency mode.) The Daily Surveillance identifies any problems associated with the subparts and auxiliary parts necessary to support the Diesel Generator.

Non Failure

For any of the above valid tests, the test was terminated and the failure could be attributed to operating error, to spurious operation of a trip that is bypassed in the emergency mode, or to malfunction of equipment that is not operative in the emergency operating mode. (i.e. The Diesel/Generator would have performed during the emergency mode.)

Last 100 Successful Valid Tests Per Each Diesel - Failures not Included

| Date | Diesel | | Date | Diesel | | Date | Diesel | |
|---|---|---|---|---|---|---|---|---|
| 6/4/84 | - | B | 4/21/83 | A | - | 4/20/82 | A | B |
| 5/29/84 | A | B | 4/20/83 | - | B | 4/7/82 | A | B |
| 5/15/84 | A | - | 4/6/83 | A | B | 3/22/82 | A | B |
| 5/1/84 | - | B | 3/16/83 | A | B | 3/17/82 | A | B |
| 4/17/84 | - | B | 3/15/83 | A | - | 3/14/82 | A | B |
| 4/3/84 | - | B | 3/13/83 | A | - | 3/13/82 | A | B |
| 3/20/84 | - | B | 3/12/83 | A | B | 3/10/82 | - | B |
| 3/6/84 | A | B | 3/2/83 | A | B | 3/5/82 | - | B |
| 3/5/84 | - | B | 2/28/83 | - | B | 3/2/82 | A | B |
| 2/21/84 | A | B | 2/16/83 | A | B | 2/19/82 | A | - |
| 2/7/84 | A | B | 2/15/83 | A | - | 2/19/82 | A | - |
| 1/24/84 | A | B | 2/13/83 | A | B | 2/18/82 | - | B |
| 1/10/84 | A | B | 2/2/83 | A | B | 2/17/82 | A | B |
| 12/20/83 | A | B | 1/19/83 | A | B | 2/3/82 | A | B |
| 12/5/83 | A | B | 1/5/83 | A | B | 1/29/82 | - | B |
| 11/22/83 | A | B | 12/19/82 | A | B | 1/20/82 | A | - |
| 11/8/83 | A | B | 12/18/82 | A | - | 1/6/82 | A | - |
| 10/25/83 | A | B | 12/17/82 | - | B | 12/16/81 | A | - |
| 10/19/83 | A | B | 12/16/82 | A | - | 12/9/81 | A | - |
| 10/5/83 | A | B | 12/15/82 | A | B | 12/8/81 | - | B |
| 9/21/83 | A | B | 12/1/82 | A | B | 12/7/81 | - | B |
| 9/14/83 | A | B | 11/17/82 | A | B | 12/6/81 | A | B |
| 9/7/83 | A | B | 10/21/82 | - | B | 12/5/81 | A | B |
| 8/13/83 | A | B | 10/20/82 | A | - | 12/4/81 | A | B |
| 8/11/83 | A | B | 10/13/82 | A | B | 12/3/81 | - | B |
| 8/3/83 | A | B | 10/6/82 | A | B | 12/2/81 | - | B |
| 8/2/83 | A | B | 9/15/82 | A | B | 12/1/81 | - | B |
| 7/22/83 | A | B | 9/1/82 | A | B | 11/30/81 | - | B |
| 7/20/83 | A | B | 8/18/82 | A | B | 11/29/81 | - | B |
| 7/6/83 | A | B | 8/14/82 | - | B | 11/28/81 | - | B |
| 7/4/83 | A | B | 8/12/82 | A | - | 11/27/81 | - | B |
| 6/15/83 | A | B | 8/11/82 | - | B | 11/26/81 | - | B |
| 6/14/83 | - | B | 8/10/82 | A | - | 11/25/81 | - | B |
| 6/6/83 | A | B | 8/9/82 | A | - | 11/24/81 | A | - |
| 6/5/83 | A | - | 8/6/82 | - | B | 11/17/81 | A | - |
| 6/4/83 | A | - | 8/5/82 | A | B | 11/4/81 | A | - |
| 6/3/83 | A | - | 7/21/82 | A | B | 10/8/81 | A | - |
| 6/2/83 | A | - | 7/7/82 | A | B | 9/17/81 | A | - |
| 6/1/83 | A | - | 6/16/82 | A | B | 9/16/81 | A | - |
| 6/1/83 | A | - | 6/2/82 | A | B | 9/14/81 | A | - |
| 5/26/83 | - | B | 5/20/82 | A | B | 9/4/81 | A | - |
| 5/19/83 | - | B | 5/3/82 | A | - | 9/3/81 | A | - |
| 5/18/83 | A | - | 5/2/82 | - | B | 9/2/81 | A | - |
| 5/18/83 | A | - | 5/2/82 | - | B | 8/27/81 | A | - |
| 5/4/83 | A | - | 5/1/82 | - | B | | | |
| | | | 4/30/82 | - | B | | | |
| | | | 4/27/82 | - | B | | | |
| | | | 4/21/82 | A | B | | | |

FAILURES
for
Diesel "A" from 8/27/81 through 6/12/84
Diesel "B" from 11/25/81 through 6/12/84

| | Diesel | | Date | F&M Report | Reason |
|---|---|---|---|---|---|
| 1. | A | | 4/30/82 | F&M 82-68 | Tach Pac Failure |
| 2. | A | * | 2/15/83 | F&M 83-24 | Drive Belt on Fuel Oil Booster Pump |
| 3. | B | * | 2/28/83 | F&M 83-38 | Drive Belt on Fuel Oil Booster Pump |
| 4. | A | * | 4/20/83 | F&M 83-67 | Drive Belt on Fuel Oil Booster Pump |
| 5. | A | * | 5/4/83 | F&M 83-74 | Drive Belt on Fuel Oil Booster Pump |
| 6. | B | * | 5/18/83 | F&M 83-80 | Drive Belt on Fuel Oil Booster Pump |
| 7. | B | | 5/1/83 | F&M 83-88 | Governor would not accept full load |
| 8. | A | | 5/11/84 | F&M 84-70 | Governor would not accept full load |

Failures

A Diesel

A = 1 Tach pak — 1982 = 1
A = 3 Belt failures* — 1983 = 3
A = 1 Governor — 1984 = 1
A = 5 Total failures in last 100 starts

B Diesel

B = 2 Belt failures* — 1982 = 0
B = 1 Governor failures — 1983 = 3
1984 = 0
B = 3 Total failures in last 100 starts

*See Belt Failures Explanation

Broken Belt Failures

The broken belts of the fuel oil booster pumps which are driven from the diesel shaft are classified as failures on the engines for the following reasons:

Diesel electrical relaying logic dictates, from start time zero, that the dc backup booster pump will not be available for 20 seconds. This means that if the belt breaks at time zero, the diesel will be required to start, accelerate and accept staggered starting of the three ECCS pumps without a fuel booster pump. We believe that without a fuel booster pump, the diesel cannot reliably perform from a stopped position as required for a LOCA condition with a loss of off-site power. However, if the diesel were up to speed, fully loaded, and the belt were to break, the diesel would switch to the backup dc pump, continue to operate, and would be capable of sustaining the full load steady state condition.

The belt failures were attributed to improper installation and maintenance. These problems were effectively corrected. Diesel Generator Maintenance Procedure No. 3.M.4-36 was revised to include instructions, references and drawings for replacement of fuel oil booster pump drive belts.

Impact on Reliability

| With Belts classified as failures | Without Belts classified as failures |
|---|---|
| "A" Diesel = 95% reliability | "A" Diesel = 98% reliability |
| "B" Diesel = 97% reliability | "B" Diesel = 99% reliability |