UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
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MEMORANDUM FOR: Luis A. Reyes, Chief, Operations Branch

THRU: W. G. Guldemond, Chief, Operational Programs Section

FROM: F. A. Maura, Reactor Inspector

SUBJECT: AREAS OF DISAGREEMENT WITH DETROIT EDISON COMPANY - DIESEL GENERATOR MEETING OF JANUARY 24, 1986

At the January 24, 1986, diesel generator meeting with representatives of the Detroit Edison Company and its consultants, three areas of strong disagreement between myself and the licensee/vendor were discussed. These areas are:

1. The lack of a visual inspection of the upper crankshaft main bearing (loaded half) and journal surfaces following the planned demonstration runs on EDG Nos. 11 and 13,

2. The attitude of the licensee in response to a question concerning what action they planned, or would consider, if additional bearing failures occurred during the demonstration runs, and,

3. The implied cause of failure of EDG No. 13 connecting rod bearing No. 3.

My positions on each issue are as follows:

Need for Visual Inspection of Bearing and Journal Surfaces

Prior to the November-December 1985 bearing failures, I had accepted the vendor's method of identifying failed main bearings by the use of a 0.002" feeler gauge gap check. However, the latest series of severe bearing distress demonstrated to me that the gap check is only an indication that the bearing has been severely overheated. For example, all the bearing gap checks made on EDG #11 prior to its disassembly on December 1985 were satisfctory. Upon disassembly, main bearings #13 UT, 8 UT, and 5 UT were found severely distressed, #6 UT and 9 UT moderately distressed, and #3 UT lightly distressed. An inspection of the main journals showed large areas of aluminum transfer on #5 and 6, moderate on #8 and 9, and small on #3. Number 13 was not recorded. Following its reassembly on February 1985, the unit had undergone the post-maintenance bearing break-in test in accordance with the vendor's recommendations. It involved runs at various speeds and loads covering a total of 9 starts and 59 hours of operation. Prior to its inspection on December 1985, the new bearings and new shaft had accumulatd a total of 34 starts and 125 hours of operation.

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Another example of the gap check failing to warn of impending bearing failure occurred during the break-in run of EDG #11 in late December 1985. After 18.5 hours of operation and 6 slow starts, bearing #6 failed the gap check. All other bearings were gap checked satisfactorily . Following bearing #6's replacement, the break-in test was restarted and bearing #5 failed the gap check after only an additional 1.5 hours of operation and four slow starts.

During the meeting, neither the licensee nor the vendor would state what criteria defines a defective bearing; however, they did indicate that when aluminum is transferred to the journal, the bearing life is considerably shortened. Our consultants have stated that once metal transfer takes place, it aggravates itself and eventually the bearing will fail. However, the remaining bearing life, whether a few hours or a few days, cannot be predicted.

Because of these experiences and statements concerning bearing/journal condition, I strongly feel that the only way we can assure that the licensee has probably corrected the diesel problems, and that the diesels should perform satisfactorily for the duration of the envelope period, is to visually determine the condition of the bearing and journal surfaces at the completion of the demonstration run. Since the vendor strongly feels that removing the bearing loaded half for inspection destroys the beneficial effects of the break-in and seasoning runs, the licensee must repeat both runs following re-installation of the bearings. That should satisfy the vendor and our concerns.

During the conference call between Region III and NRR on January 28, 1986, the subject of what constitutes a "reliable" engine demonstration was discussed. Because of an apparent misunderstanding on the part of some of the participants as to what constitutes a reliability demonstration or qualification run on the diesels, I want to explain my position on this subject. Qualification and reliability runs are defined in IEEE Standard 387-1977 and Regulatory Guide 1.108, respectively. Fairbanks Morse diesel must have been qualified at the factory by the performance of 300 valid start and loading tests without exceeding three failures. (The test results are normally reviewed by NRR.) In addition, the Fermi 2 diesels were subjected to the reliability requirements of Reg. Guide 1.108 during the preoperational test program. We know that for some reason the Fermi 2 diesels are <u>not</u> performing like the units which were used in the vendor's qualification tests. Fermi 2 diesels' poor performance record could be used to invalidate their qualification. That being the case, 30 or 40 starts, as proposed by the licensee, fall far short of the requirements of IEEE 387-1977. One or two fuel cycles later the number of starts, assuming no bearing damage occurs, would still be short of the requirement. For that reason the licensee carefully chose to call their proposed test program a "demonstration run" and not a qualification or reliability test program.

The initial concept, discussed with the licensee in late December 1985, was to have a "lead engine" at Fermi which by the number of successful starts during its demonstration run (after bearing and journal inspection) somewhat guaranteed the performance of the other three. Since then a second engine has been added to the demonstration run. While I am not proposing a program of the extent required by IEEE 387-1977, I am of the opinion that the bearing and journal inspections must extend beyond one fuel cycle.

One last observation, a significant weakness exists in the Reg. Guide 1.108 definition of what constitutes an engine failure. In accordance with the Reg. Guide, an engine that destroys itself after one hour of successful loaded operation does not constitute a failure and is not reportable. Based on that definition, the Fermi 2 diesels are reliable engines irregardless of their repeated bearing problems. The Reg. Guide should be revised to correct that error.

Licensee's Planned Action If Demonstration Run Is Not Successful

In response to a question, the licensee stated that if additional bearing damage was experienced during the demonstration run they would just be replaced and another demonstration run performed. The licensee apparently has failed to recognize that what is at stake is the NRC's confidence in the reliability of their on-site emergency power source. The confidence in these engines is not regained by a "two-out-of-three" approach.

In the absence of an unquestionable explanation regarding the specific cause of future failures, specifically during the demonstration run or while in the envelope of that run during the first fuel cycle, serious consideration must be given to the replacement of those engines.

Implied Cause of Failure of EDG No. 13 Connecting Rod Bearing No. 3

During the meeting, the licensee stated the failure of the No. 3 connecting rod bearing on EDG No. 13 was caused by misassembly. The licensee's "evidence" consists of fretting found on the connecting rod and cap mating surfaces and a break-away torque reading of 100 ft. lbs. on one bolt nut. The other nut had a break-away torque of 210 ft. lbs. I consider the evidence extremely weak for the following reasons:

1. The fretting could have been caused after the beraing was destroyed since the engine experienced over 100 revolutions following the bearing damage and before it was shutdown.

2. Break-away torque readings are not an accurate measurement of actual torque values at the time of assembly for various reasons.

3. Other bolts were found with low torque readings similar to No. 3. Their bearings were not damaged and no fretting was noted in their cap surface. For example, No. 1 connecting rod on EDG #13 had break-away torque readings of 150 and 180 ft. lbs., and #3 connecting rod bearing on EDG #12 had readings of 100 and 175 ft. lbs. which overall are lower than those on the nuts of the damaged connecting rod.

4. The reinstallation procedures, signoff and QA witnessing of the bolt torquing indicate that everything was done correctly. If the licensee now says mistakes were made, then their own program for maintenance and operational quality control is questionable at best.

Based on the above, the licensee failed to explain why they are convinced that misassembly was the cause of the failure.

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