

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF INSPECTION AND ENFORCEMENT  
WASHINGTON, D.C. 20555

April 22, 1985

IE INFORMATION NOTICE NO. 85-32: RECENT ENGINE FAILURES OF EMERGENCY DIESEL GENERATORS

Addressees:

All nuclear power reactor facilities holding an operating license (OL) or a construction permit (CP).

Purpose:

This information notice is provided to alert recipients of potentially significant problems pertaining to engine failures of emergency diesel generators. It is expected that recipients will review the information for applicability to their facilities and consider actions, if appropriate, to preclude a similar problem occurring at their facilities. However, suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

During the last few months, engine failures of emergency diesel generators have occurred at three reactor sites. These events are significant because more than one diesel generator had been affected at two of the sites and because of the extent of damage caused by the failures.

On January 10, 1985, the Detroit Edison Company notified the NRC of a trip on low lube oil pressure of the number 11 emergency diesel generator engine at the Enrico Fermi Atomic Power Plant Unit 2 (Fermi). Subsequent inspection revealed damage to connecting rod bearings and main bearings on the upper crankshaft as well as to some pistons. The upper crankshaft was scored. The upper crankshaft; upper main and connecting rod bearings; upper pistons numbers 2, 3, and 4; and cylinder liners numbers 2, 3, and 4 were replaced.

The other three diesel generator engines at Fermi were inspected. On the number 12 engine, some of the upper bearings had been damaged; all upper bearings were replaced. The number 13 and number 14 engines showed preliminary signs of wear, but no repairs were necessary.

At North Anna Power Station Unit 2, both diesel generators experienced engine failures over the last several months. On December 9, 1984, both diesel generators were inoperable at the same time. Inspection of the 2J diesel generator engine revealed that upper pistons, numbers 2 and 3, were leaking

and the number 11 cylinder liner seal was leaking. The upper pistons, numbers 2, 3, and 11, and cylinder liner number 11 were replaced. The 2H diesel generator engine was found to have shattered rings on the number 10 lower piston. The number 10 lower piston and rings were replaced.

On February 2, and again on February 4, 1985, the jacket water tank for one of the diesel generator engines at North Anna Power Station Unit 1 was found to be empty. On the second occasion, water leakage in the engine was observed. Subsequent inspection revealed jacket water in other cylinders and in the engine lube oil, severe scoring of the number 3 cylinder liner and upper piston, seizure of the number 3 upper piston, and three failed upper main bearings. The apparent cause of trouble on the engine was the failure of a jacket water seal, which resulted in loss of lubrication to the number 3 cylinder and engine lube oil dilution of which, in turn, caused bearing damage. There appears to be a similarity between this failure and the Unit 2 engine failures in December 1984 as well as the Unit 2 engine failure in June 1983.

On March 15, 1985, the 2J engine at North Anna Power Station Unit 2 tripped on high crankcase pressure. Subsequent inspection revealed that two cylinder liners were leaking coolant; they were replaced. Several upper piston insert assemblies also required replacement parts. The lower pistons of the cylinders with damaged parts were inspected, but no abnormal wear was found.

In February 1985, a diesel generator engine at William B. McGuire Nuclear Station Unit 2 tripped on low lube oil pressure. During subsequent testing, excessive engine vibration prompted plant operators to manually trip the diesel. Brass metal was found on the oil screens. Four of eleven main bearings were damaged; all main and connection rod bearings were replaced as a precaution. One piston and the crankshaft also are being replaced because of scoring. Following inspection of the other diesel engine, the licensee replaced all main bearings as a precaution because scoring and close tolerances were noted.

#### Discussion:

Detroit Edison Company has attributed the Fermi engine failure to inadequate lubrication during fast starts. The engines at Fermi are Fairbanks-Morse Model Number 38D8 1/8 of the opposed-piston design. Each engine has a keep-warm system, a manually controlled prelube system, and a lube oil booster for the upper crankshaft. The booster is filled with two gallons of oil that is forced by starting air pressure into the upper crankline bearings. The booster was installed in 1982 for the number 11 and number 12 engines and in 1983 for the other two. Detroit Edison Company discontinued manual prelubrication in January 1984. Engine number 11 has experienced approximately 100 starts without manual prelubrication.

In consultation with the engine manufacturer, Detroit Edison Company has made, or plans, the following changes as a result of this problem:

1. Revise surveillance test procedures and Technical Specifications to
  - a. prelube all planned starts
  - b. start engine at idle speed, run for five minutes, and then increase to synchronous speed
  - c. increase load in incremental steps
  - d. on shutdown, decrease load in incremental steps
2. Inspect and replace oil filters and inspect strainers on a quarterly basis.
3. Conduct bearing inspections (after 20 unplanned starts or after 18 months, whichever comes first) to detect any future problems.
4. Analyze oil samples, including an analysis for metallics on a monthly basis for the next 18 months for trend determination.
5. Perform a spectrographic analysis of lube oil filter media and any deposits that are found during the quarterly replacement.


The engines at North Anna Units 1 and 2 were also manufactured by Fairbanks-Morse. The cause of the water leaks have not been determined.

The engines at McGuire Unit 2 were manufactured by Nordberg. It appears that misalignment of the lower crankcase bed contributed to the damage at McGuire. In this case, it is of interest that oil samples taken some months ago had some metal products in them, which at the time were considered to be the result of normal bearing wear-in. Oil samples taken recently had higher levels of contaminants.

The above identified engine problems occurred in engines that were far from the end of their normal design lives. While the exact causes of these premature failures have not been determined, there is reason to believe that the testing requirements may have aggravated existing situations. Good operating practices, coupled with careful maintenance and periodic inspections, therefore are important. In addition, it is apparent that minimizing stress and wear on the diesel generator engines by testing, in accordance with the manufacturer's recommendations, also is essential. As part of Generic Letter 84-15, "Proposed Staff Actions to Improve and Maintain Diesel Generator Reliability," the staff proposed measures to reduce the severity of engine starts and loadings. In responding to the generic letter, many licensees apparently did not elect to consider changes to fast start and fast loading test requirements.

In light of the above problems, licensees may want to reconsider the desirability of reducing the severity of engine starts and loading by proposing changes to the Technical Specifications to accomplish the goals of Generic Letter 84-15. Furthermore, facility owners may desire to reevaluate the adequacy of their maintenance, testing, and operating practices for the required engine service and to take steps to monitor wear on key engine parts such as bearings.

No specification response is required by this information notice. If you have any questions about this matter, please contact the Regional Administrator of the appropriate NRC regional office or this office.

  
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Attachment: List of Recently Issued IE Information Notices

LIST OF RECENTLY ISSUED  
 IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
85-31	Buildup Of Enriched Uranium In Ventilation Ducts And Associated Effluent Treatment Systems	4/22/85	All uranium fuel fabrication licensees
85-30	Microbiologically Induced Corrosion Of Containment Service Water System	4/19/85	All power reactor facilities holding an OL or CP
85-29	Use Of Unqualified Sources In Well Logging Applications	4/12/85	All well logging source licensees
85-03 Sup. 1	Separation Of Primary Reactor Coolant Pump Shaft And Impeller	4/9/85	All power reactor facilities holding an OL or CP
85-28	Partial Loss Of AC Power And Diesel Generator Degradation	4/9/85	All power reactor facilities holding an OL or CP
85-27	Notifications To The NRC Operations Center And Reporting Events In Licensee Event Reports	4/3/85	All power reactor facilities holding an OL or CP
85-26	Vacuum Relief System For Boiling Water Reactor Mark I And Mark II Containments	4/2/85	All BWR facilities having a Mark I or Mark II containment and holding an OL or CP
85-25	Consideration Of Thermal Conditions In The Design And Installation Of Supports For Diesel Generator Exhaust Silencers	4/2/85	All power reactor facilities holding an OL or CP
85-24	Failures Of Protective Coatings In Pipes And Heat Exchangers	3/26/85	All power reactor facilities holding an OL or CP

OL = Operating License  
 CP = Construction Permit