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IN 86-26

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

April 17, 1986

INFORMATION NOTICE NO. 86-26: POTENTIAL PROBLEMS IN GENERATORS MANUFACTURED BY ELECTRICAL PRODUCTS INCORPORATED

Addressees:

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

Purpose:

This notice is to alert recipients to a potentially significant problem involving the failure of Electrical Products Incorporated (EPI) diesel generators without prior warning during an emergency demand. Actions taken by licensees to prevent recurrence also are discussed. It is expected that recipients will review this 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 information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

Washington Public Power Supply System (WPPSS) Unit 2

On July 21, 1983, emergency diesel generator (DG) 1A had high vibration level readings accompanied by sparks from the rotor shaft bearing area. Upon disassembly it was determined that a shim, required to maintain clearance at the thrust bearing, was missing. Inspection of DG 1B showed that the same shim was missing. The two generators were returned to EPI (Cleveland, Ohio) where the missing shim was installed and the damaged areas refurbished. The original design, which placed electrical insulation between the rotor shaft and the slip-ring end bearing inner race, was maintained.

On July 9, 1984, during monthly surveillance testing, a high vibration alarm was observed on emergency DG 1B. Investigation after completion of the 4-hour test revealed that the slip-ring end bearing had turned on the shaft insulation destroying the insulation. The reduction in insulation cross sectional thickness allowed the rotor shaft to drop slightly and rub on the bearing housing. The corrective action employed after this failure was a design modification. The insulation between the bearing and the shaft was removed and the bearing was mounted directly on the shaft. The bearing housing was insulated to provide the required electrical insulation. No failure has been reported since the reported test failure in July 1984.

Grand Gulf Unit 1

At Grand Gulf Unit 1, the high pressure core spray pump is powered by a dedicated DG. On July 13, 1985, during surveillance testing, the generator failed and was observed to be emitting sparks. Power Systems Division (PSD) of Morrison Knudsen, the supplier of the DG unit, determined that the electrical insulation between the inner race of the cylindrical roller bearing at the slip-ring end and the rotor shaft had degraded. The degradation allowed the shaft to drop down and rub the inner and outer oil seals causing the sparks. EPI and PSD have developed a procedure to implement the same design modification at Grand Gulf as used previously at WPPSS.

Watts Bar Unit 2

On June 10, 1983, during the performance of a test, the generator shaft was observed to be rubbing against the inner and outer oil seals at the slip-ring end. Examination after disassembly revealed that the thickness of the oil thrower was less than specified, causing a mismatch between the inner and outer races of the slip-ring end bearing that resulted in the inner race breaking loose and turning on the underlying electrical insulation.

The repairs at a Tennessee Valley Authority (TVA) workshop consisted of rebuilding oil seals, polishing the shaft under the oil seals, replacing the insulation material under the bearing, machining the bearing housing cap to correct the alignment, adding a shim to restrain the outer race, and installing new bearings. TVA inspected four other generators and made similar modifications.

Background:

The failures occurred in electrical generators manufactured at EPI located in Cleveland, Ohio. EPI was a division of Portec from 1969-1979. In 1979, Portec sold EPI to Northern Electrical Industries-Parsons Peebles (NEI-Peebles) of Great Britain. The manufacturing operations at Cleveland ceased in the Fall of 1984. Currently, EPI furnishes spare parts and modifications to existing units.

Discussion:

The failures described above have all occurred at the slip-ring end of the tandem diesel engine configurations. Installation of the insulation between the rotor shaft and the bearing also is used for single engine applications and in some cases it is installed under the shaft bearing at the other end of the generator as well. The purpose of the insulation (3M Scotchply brand, type 1009, glass/epoxy composite tape) is to prevent circulating currents through the generator shaft. This insulation method was limited by EPI to 8-pole 900-rpm machines. The initiating failure mechanism of the insulation has been attributed by various sources to insulation creep fatigue, misalignment of the engines, poor insulation workmanship, or inadequate original design. The first WPPSS and the Watts Bar failures appear to be isolated cases of improperly machined pieces; however, the failures manifest themselves in a similar manner and may be discovered during the checks for insulation damage.

PSD has stated that a procedure to monitor shaft movement will have to be specific for each plant because of design differences that impact the allowable movement and the jacking force. Jacking the shaft up and down and recording the movement will determine the vertical play between the shaft and bearing housing, but care should be taken to use a load cell or circle force gauge between the jack and the generator shaft to prevent damage.

Other suppliers that have used EPI generators include Stewart & Stevenson, Alco and Bruce GM (EMD). See Attachment 1 for a list of facilities identified by EPI and PSD as recipients of the subject generators. Some of the generators have been resold from the original customer or user and some have been cancelled; therefore specific plant applications may be different than originally supplied.

No specific action or written response is required by this notice. If you have any questions regarding this notice, please contact the Regional Administrator of the appropriate NRC regional office or this office.

Edward L. Jordan, Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

Technical Contacts: James C. Stewart, IE
(301) 492-9061

K.R. Naidu, IE
(301) 492-4179

Attachments:
1. List of EPI 900 RPM Generators
2. List of Recently Issued IE Information Notices

Domestic EPI 900 RPM Generators

Customer/Site	No. Units	D/G Supplier
Arkansas P&L/Nuclear 1	2	Stewart & Stevenson
Boston Edison/Pilgrim 1	2	ALCO
Duke Power/Oconee	1	PSD
Florida P&L/St. Lucie	2	PSD
Houston L&P/Allens Creek	1 (See Note 1)	PSD
Jersey Central P&L/Oyster Creek	2 (See Note 2)	PSD
Mississippi P&L/Grand Gulf	2	PSD
Mississippi P&L/Grand Gulf	2	Bruce GM (EMD)
New York State Power Authority/FitzPatrick	4	Bruce GM (EMD)
Pacific G&E/Diablo Canyon	5	ALCO
Portland G&E/Trojan	2	PSD
Public Service of Oklahoma/Black Fox	2 (See Note 3)	PSD
Puget Sound/Skaggit	1	PSD
SMUD/Rancho Seco	2	Bruce GM (EMD)
TVA/Hartsville, Phipps Bend	6 (See Note 4)	PSD
TVA/Sequayah	4	Bruce GM (EMD)
TVA/Sequayah	1	PSD
TVA/Watts Bar	6	PSD
Vepco/North Anna	4	Stewart & Stevenson
WPPSS/Hanford 1	2	Stewart & Stevenson

Notes:
1. Generator returned to PSD
2. Obtained from TVA
3. One unit sent to foreign plant, one unit spare
4. Two units to Oyster Creek, three units sent to foreign plants, one unit sent to NASA

LIST OF RECENTLY ISSUED IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
86-25	Traceability And Material Control Of Material And Equipment, Particularly Fasteners	4/11/86	All power reactor facilities holding an OL or CP
86-24	Respirator Users Notice: Increased Inspection Frequency For Certain Self-Contained Breathing Apparatus Air Cylinders	4/11/86	All power reactor facilities holding an OL or CP; research and test reactor facilities; fuel cycle licensees and Priority 1 material licensees
86-23	Excessive Skin Exposures Due To Contamination With Hot Particles	4/9/86	All power reactor facilities holding an OL or CP
86-22	Underresponse Of Radition Survey Instrument To High Radiation Fields	3/31/86	All power reactor facilities holding an OL or CP and research and test reactors
86-21	Recognition Of American Society Of Mechanical Engineers Accreditation Program For N Stamp Holders	3/31/86	All power reactor facilities holding an OL or CP and all recipients of NUREG-0040 (white book)
86-20	Low-Level Radioactive Waste Scaling Factors, 10 CFR Part 61	3/28/86	All power reactor facilities holding an OL or CP
86-19	Reactor Coolant Pump Shaft Failure At Crystal River	3/21/86	All power reactor facilities holding an OL or CP
86-18	NRC On-Scene Response During A Major Emergency	3/26/86	All power reactor facilities holding an OL or CP

OL = Operating License
CP = Construction Permit