UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

December 21, 1990

NRC INFORMATION NOTICE NO. 90-80: SAND INTRUSION RESULTING IN TWO DIESEL GENERATORS BECOMING INOPERABLE

Addressees:

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose:

This information notice is intended to alert addressees to the potential damage that may occur to emergency diesel generator (EDG) equipment as the result of the use of abrasive material during maintenance operations. This information notice is based on an event in which sand (aluminum oxide) intruded into the cylinders of two diesel engines at the Susquehanna Steam Electric Station as a result of maintenance related cleaning of the diesel engine intercoolers. The affected diesel generators were subsequently declared inoperable because of damage to the cylinder liners and piston rings caused by the abrasive action of the aluminum oxide particles. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On August 30, 1990, with both Units 1 and 2 operating at 100-percent power, the 'B' EDG at the Susquehanna Steam Electric Station was declared inoperable when plant personnel, performing periodic chemical analysis of EDG lubricating oil samples, found a high concentration of chromium in the 'B' EDG oil samples. Boroscopic examination of the EDG cylinders revealed significant scoring of numerous cylinder liners and piston rings. The licensee concluded that the source of chromium in the lubricating oil was from the scored cylinder liners. Previously the licensee had found similar scoring of the cylinder liners and piston rings on the 'D' EDG. Further inspection by plant personnel identified the presence of abrasive material (sand) in the intake air manifolds of both the 'B' and 'D' diesel engines.

A root cause analysis concluded that the sand had entered the EDGs during recent maintenance operations involving the cleaning and coating of the inner

surface of the tubes in the intercoolers (heat exchangers). The intercoolers are located between the turbocharger air compressor discharge and the intake air manifolds. The intercoolers consist of a shell side through which intake air passes and a tube side through which cooling water passes. As part of normal maintenance, the intercoolers are periodically cleaned and treated with a corrosion-preventive agent. Maintenance personnel clean the inner surface of the intercooler tubes by airblasting with fine particles of aluminum oxide. Prior to performing the cleaning, maintenance personnel had removed the intercoolers from the EDGs and prepared them for sandblasting by covering the shell side with plywood and taping the edges. Four bolts were used to secure the plywood cover to the intercooler. Apparently, the plywood cover warped and dislodged the tape allowing the aluminum oxide particles to enter the shell side of the intercoolers. After the intercoolers were reinstalled, combustion intake air picked up the residual sand and carried it inside the engine. Once inside the engine, the sand settled between the piston rings and cylinder liners, resulting in the heavy scoring.

Other occurrences of abrasive material intrusion include a 1985 event at Catawba in which metallic particles were found embedded in the bearing shells and in the lubricating oil system of one EDG. The metallic particles were analyzed and found to be identical to shotblasting material used during piping modifications and repairs to the lubricating oil system.

Discussion of Safety Significance:

These events reveal the vulnerability of the EDGs to damage from foreign material, such as the aluminum oxide particles, which may enter the engine through the combustion air, lubricating oil, fuel oil, or jacket coolant water systems. In addition, these events underscore the importance of implementing strict cleanliness specifications when performing maintenance activities on these subsystems. The application of generally accepted industry practices for maintaining equipment cleanliness levels through the incorporation of cleanliness requirements into maintenance procedures and the training of work crews in the methods for meeting those requirements are considered effective. The fact that the licensee detected the degradation of the cylinder liners as a consequence of required periodic chemical analysis of the lubricating oil is evidence of the value of performing regular lubricating oil analyses.

Other options for cleaning heat exchanger tubes are available in the industry. For example, cleaning the tubes with a mild acidic solution is an accepted and widely used technique especially with EDG intercoolers where the consequences of contamination can have major safety significance. It is noteable that, because of the manufacturers recommendations, the intercooler of EDG 'E' was not cleaned by sandblasting and the engine was not affected by the above condition.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact the technical contact listed below or the appropriate NRR project manager.

Charles E. Rossi

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contact: J. Rajan, NRR
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Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
90-79	Failures of Main Steam Isolation Check Valves Resulting in Disc Separation	12/20/90	All holders of OLs or CPs for nuclear power reactors.
90-78	Previously Unidentified Release Path from Boiling Water Reactor Control Rod Hydraulic Units	12/18/90	All holders of OLs or CPs for boiling water reactors (BWRs).
90-77	Inadvertent Removal of Fuel Assemblies from the Reactor Core	12/12/90	All holders of OLs or CPs for pressurized-water reactors (PWRS).
88-23, Supp. 3	Potential for Gas Binding of High-Pressure Safety Injection Pumps During A Loss-Of-Coolant Accident	12/10/90	All holders of OLs or CPs for pressurized-water reactors (PWRs).
90-76	Failure Of Turbine Overspeed Trip Mechanism Because Of Inadequate Spring Tension	12/7/90	All holders of OLs or CPs for nuclear power reactors.
90-75	Denial Of Access To Current Low-Level Radicactive Waste Disposal Facilities	12/5/90	All Michigan holders of NRC licenses.
90-74	Information on Precursors To Severe Accidents	12/4/90	All holders of OLs or CPs for nuclear power reactors.
90-73	Corrosion Of Valve-To-Torque Tube Keys In Spray Pond Cross Connect Valves	11/29/90	All holders of OLs or CPs for nuclear power reactors.
90-72	Testing of Parallel Disc Gate Valves In Europe	11/28/90	All holders of OLs or CPs for nuclear power reactors.
90-71	Effective Use of Radiation Safety Committees to Exercise Control Over Medical Use Programs	11/6/90	All NRC licensees authorized to use by-product material for medical purposes.

OL = Operating License
CP = Construction Permit