

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

August 14, 1985

IE INFORMATION NOTICE NO. 85-68: DIESEL GENERATOR FAILURE AT CALVERT
CLIFFS NUCLEAR STATION UNIT 1

Addressees:

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

Purpose:

This information notice is provided to alert licensees of a potentially significant safety problem involving cracked interpolar connecting bars that connect the damper circuit of each rotor pole to the damper circuit of the adjacent rotor pole of the emergency diesel generator.

It is suggested that recipients review this information for applicability to their facilities and consider actions, if appropriate, to preclude similar problems 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:

On May 14, 1985, Calvert Cliffs Unit 1 was shut down for refueling. An overspeed test on the No. 11 emergency diesel generator (EDG) was initiated with the generator not connected to its essential bus. During the test, plant personnel who were stationed in the proximity of the EDG* heard loud, metallic rapping sounds coming from the generator section of the EDG and immediately terminated the overspeed test. Examination of the generator revealed that insulation on the stator windings had been rubbed and abraded to the point where one stator winding had been exposed. Further examination determined the cause of the failure to be a broken interpolar connecting bar on the rotor. The bar initially had broken free on one end and damaged the stator windings. Because the generator was not connected to its essential bus, electrical field

*Calvert Cliffs is a 2-unit PWR station with three EDGs that are designated as follows: Unit 1 (EDG 11), Unit 2 (EDG 21), and shared (EDG 12).

excitation had not been applied and no electric arcing occurred when the stator windings were damaged. The damaged generator was replaced with a spare generator and a detailed investigation was undertaken involving the vendor, Louis Allis, and the licensee.

A metallurgical analysis on the failed interpolar connecting bar determined the predominant cause of failure to be high stresses resulting from periodic centrifugal loading. To a lesser degree, bending of the connecting bar, during initial installation, and thermal expansion also were considered to be contributing factors in the failure. The licensee reports that the analysis indicated the problem was of a design nature and not the result of a material defect. Radiographic testing on the damaged generator showed several cracks in the remaining interconnecting bars.

The investigation into the generator design determined that the interpolar connections between rotor poles are not necessary (a) if the EDGs are not operated in parallel, which could cause power pulsations between units, and (b) if the plant is operating with a balanced three-phase electrical load. Calvert Cliffs does not operate its EDGs in parallel with each other. Analysis shows that the potential three-phase electrical load unbalance factor (i.e., single-phase load) does not exceed 10% of the emergency three-phase load; therefore, it is not considered a concern. Consequently, the licensee initiated a program to remove the interpolar connecting bars from the three EDGs in service at Calvert Cliffs Units 1 and 2.

On the basis of these findings, the licensee removed EDG No. 21 from Unit 2 service on May 26, 1985 to determine if the interpolar connections on that EDG were degraded in a similar manner. Test results indicated cracks were evident. On this basis, the EDG No. 12 (which applies emergency power to either Units 1 or 2) was declared inoperable. Under this set of conditions, Calvert Cliffs Unit 2, which was operating at 100% full power, started shutting down. In order to continue power operation of Unit 2, the replacement EDG from Unit 1 was connected and aligned to Unit 2 to provide the necessary emergency power source and the shutdown was terminated.

The licensee's corrective action, to terminate the limiting condition for operation, discussed above, involved the immediate removal of the interpolar connections from EDGs 12 and 21. Postmodification qualification testing, conducted on both EDGs, proved to be satisfactory.

The licensee's longer term corrective action plans are to remove the interpolar connections from the replacement (spare) EDG.

Discussion:

Typically, a diesel generator that employs the continuous damper circuit design (i.e., using interpolar connecting bars) uses 16 connecting bars. These bars are installed so that each of the eight rotor poles on the generator has two connecting bars, one installed on the front and one on the back of each rotor pole. Noncontinuous damper circuit design does not employ interpolar connections between the damper circuits on the rotor poles.

The safety concern of this event is the common cause failure mechanism if similar cracked connecting bars exist on all diesel generators at a nuclear power plant (as was the case at Calvert Cliffs). Cracked connecting bars can lead to a condition that adversely affects the operating voltages which are necessary to operate essential equipment during accident conditions.

Because of the generic implications of the Calvert Cliffs event, the vendor, Louis Allis, issued a 10 CFR 21 report on the potential problem to the NRC on May 21, 1985. A followup letter, dated May 29, 1985, from Louis Allis to the NRC, briefly discussed the problem and identified other facilities that use similar Louis Allis generator units. Colt Industries also forwarded a Louis Allis report dated June 3, 1985, that identified the major cause for interpolar connecting bars cracking and provided a basis for requesting removal of the interconnecting bars from similarly designed generators in service at other facilities. The June 3, 1985 report from Louis Allis to Colt Industries also was sent to end-users of the Louis Allis generator units.

As a result of the early notifications discussed above, the licensees of TMI/1, Vermont Yankee, and Peach Bottom Units 2 and 3 all report that they have either removed the interpolar connections or have established plans to have them removed from the affected generator units in service at their facilities.

Although no similar interpolar connecting bar failures have been reported, related to other generator units, generators supplied by manufacturers other than Louis Allis may have similar design features.

Additionally, licensees are reminded that if corrective actions are taken to resolve observed degradation of interpolar connecting bars this action should be reported to the NRC using the existing reporting requirements specified in 10 CFR 50.72 and 10 CFR 50.73.

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



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

Technical Contact: Vincent D. Thomas, IE
(301) 492-4755

Attachment: List of Recently Issued IE Information Notices

LIST OF RECENTLY ISSUED
IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
85-42 Rev. 1	Loose Phosphor In Panasonic 800 Series Badge Thermo-luminescent Dosimeter (TLD) Elements	8/12/85	Materials and fuel cycle licensees
85-67	Valve-Shaft-To-Actuator Key May Fall Out Of Place When Mounted Below Horizontal Axis	8/8/85	All power reactor facilities holding an OL or CP
85-66	Discrepancies Between As-Built Construction Drawings And Equipment Installations	8/7/85	All power reactor facilities holding an OL or CP
85-65	Crack Growth In Steam Generator Girth Welds	7/31/85	All PWR facilities holding an OL or CP
85-64	BBC Brown Boveri Low-Voltage K-Line Circuit Breakers, With Deficient Overcurrent Trip Devices Models OD-4 and 5	7/26/85	All power reactor facilities holding an OL or CP
85-63	Potential for Common-Mode Failure of Standby Gas Treatment System on Loss of Off-Site Power	7/25/85	All power reactor facilities holding an OL or CP
85-62	Backup Telephone Numbers to the NRC Operations Center	7/23/85	All power reactor facilities holding an OL and certain fuel facilities
85-61	Misadministrations to Patients Undergoing Thyroid Scans	7/22/85	All power reactor facilities holding an OL and certain fuel facilities
85-60	Defective Negative Pressure Air-Purifying, Fuel Facepiece Respirators	7/17/85	All power reactor facilities holding an OL or CP

OL = Operating License
CP = Construction Permit