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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
Washington, DC 20555

May 20, 1986

IE INFORMATION NOTICE NO. 86-39: FAILURES OF RHR PUMP MOTORS AND
PUMP INTERNALS

Addressees:

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

Purpose:

This notice is provided to alert licensees to serious damage which has occurred at a licensed nuclear power plant to residual heat removal (RHR) pumps manufactured by Bingham-Willamette with motors supplied by General Electric. The damage identified at the Philadelphia Electric Co. (PECO), Peach Bottom facility involved failure of motor bearings and/or failure of pump impeller wear rings.

It is expected that recipients will review this notice 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 requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On November 2, 1985, during core reload of PECO's Peach Bottom Unit 3, a fire occurred in the 3C RHR pump motor which totally engulfed the motor and rendered the pump inoperable. A lower guide bearing high temperature alarm had been received for 3 days prior to the pump failure, but this warning of potential pump failure went unnoticed by personnel because of the large number of other alarms that were received during the shutdown. The motor, a 2000 HP GE vertical induction model 5K6348XC29, and pump, a Bingham-Willamette single stage centrifugal model 18x24x28 CVIC (Figure 1), were uncoupled, disassembled and inspected for damage. Results of the inspection identified that the motor lower guide bearing was destroyed, the rotor bars were gouged and scorched, and the stator windings were burned and gouged. The pump internals were found to have sustained internal damage. Specifically, the lower impeller wear ring (Figure 1) was separated from the impeller and fused to the casing wear ring. No other wear surfaces indicated wear or damage. On November 16, 1985, while replacing the lower pump casing gasket on the 3A RHR pump, PECO personnel discovered that the lower pump impeller wear ring was separated from the impeller and cracked in three places. Subsequent inspections of the remaining two unit 3 RHR pumps and two unit 2 pumps (2A and 2C) revealed similar wear ring failures in three of the pumps inspected.

On December 22, 1985, after several overcurrent alarms with pump 2D from Unit 2, PECO inspected this pump and discovered the lower pump impeller wear ring separated and cracked, a 6-inch piece of wear ring missing, and the impeller vanes damaged. Not all failures noted above were as severe as the ones identified on pumps 3C and 2D. However, the similarity was evident.

The RHR pump impeller wear rings are press fit to the impeller and attached with eight dowel pins. The wear rings provide a wearing surface on the pump impeller. The wear rings are 410 stainless steel, A 182 grade F6 with a Rockwell C hardness of 33 to 39. Metallurgical examinations of the wear ring fracture surfaces indicate the presence of intergranular stress corrosion cracking (IGSCC). PECO has classified the wear ring failures as IGSCC. On November 26, 1985, PECO made an INPO Network notification regarding these RHR pump failures. PECO has repaired all affected pumps by replacement of damaged motors and pump internals. Tennessee Valley Authority's Browns Ferry Units 1, 2, and 3 utilize the identical pumps for RHR service. Similar motor and pump impeller wear ring failures have occurred at these facilities, but not to the extent identified at Peach Bottom. Pumps of similar design, but different size, are utilized for core spray service both at Peach Bottom and Browns Ferry. However, these pumps use the "integral" impeller wear ring design, i.e., extended impeller part replaces separate wear ring and forms a single unit, and therefore are not susceptible to the type of wear ring failure previously described.


Discussion:

These multiple events are of concern because of the potential for common-mode failures of all pumps in the same system. At Peach Bottom, six of eight pumps inspected exhibited degraded pump impeller wear rings and internals. These flaws could lead to pump hydraulic degradation and, under the worst conditions, complete pump failure. The motor guide bearing failures are significant because they could cause failure of the pump motors and pump internal damage.

The full extent to which this type of pump may be used in safety-related services at other facilities is not known with complete certainty. According to information ascertained from Bingham-Williamette records and confirmed by contact with affected sites, other plants utilizing this type of pump in the RHR system include the following: Cooper, Pilgrim 1, and Vermont Yankee.

The exact cause of the pump internal failures has not been fully determined, except that there is evidence that IGSCC has contributed to the impeller wear ring failures. Operating pumps with inadequate flow and lubrication, whereby high internal temperatures develop, is also a likely contributor, e.g., pump cavitation. PECO is continuing to pursue root causes and wear ring redesigns to prevent such occurrences in the future.

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


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

Technical Contact: Ronald M. Young
(301) 492-8985

Attachments:

1. Figure 1 - Typical CVIC RHR Pump
Sectional Assembly
2. List of Recently Issued IE Information Notices

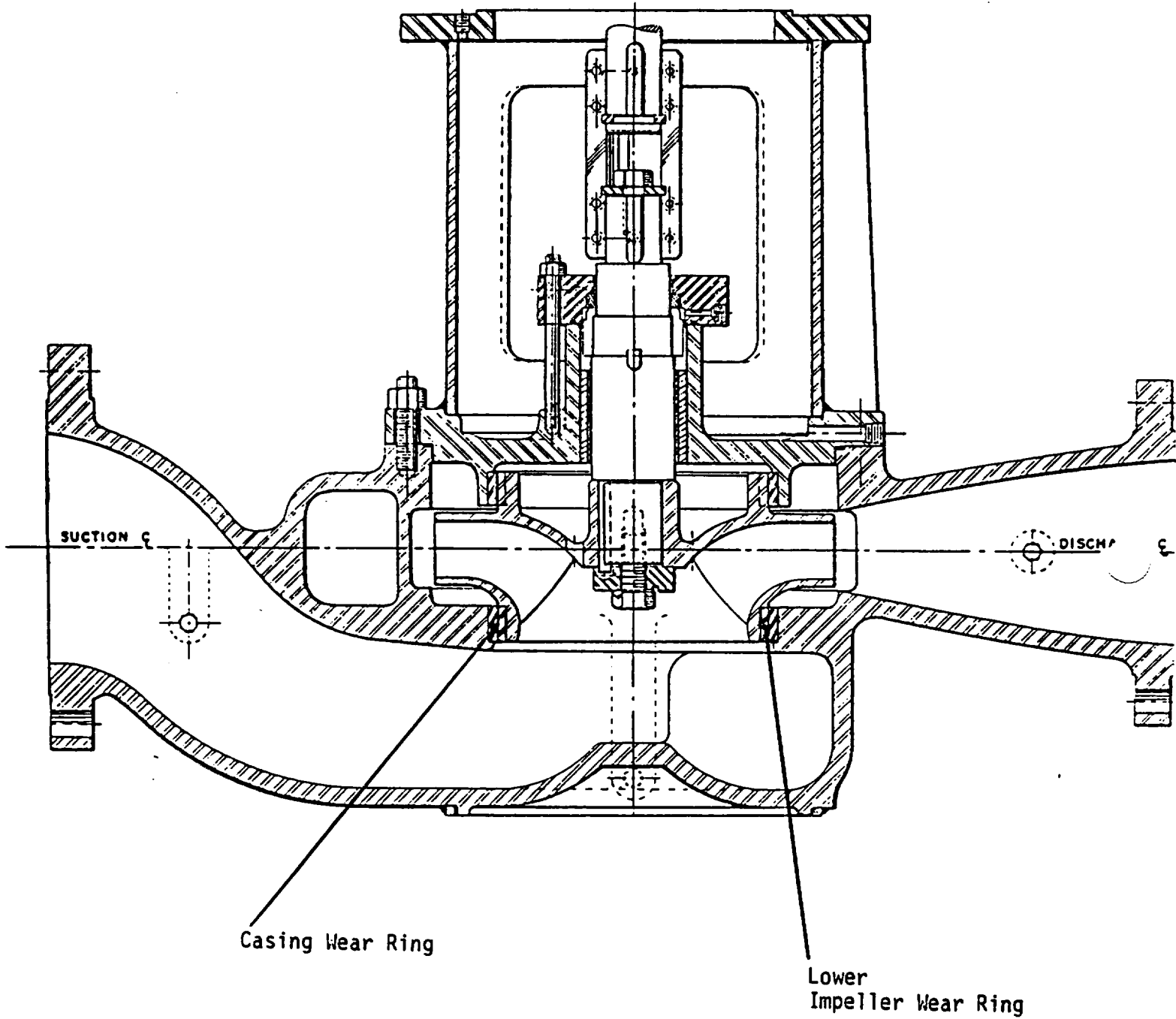


FIGURE 1 - Typical CVIC RHR Pump
Sectional Assembly

LIST OF RECENTLY ISSUED
IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
86-38	Deficient Operator Actions Following Dual Function Valve Failures	5/20/86	All power reactor facilities holding an OL or CP
86-37	Degradation Of Station Batteries	5/16/86	All power reactor facilities holding an OL or CP
86-36	Change In NRC Practice Regarding Issuance Of Confirming Letters To Principal Contractors	5/16/86	All power reactor facilities holding an OL or CP
86-35	Fire In Compressible Material At Dresden Unit 3	5/15/86	All power reactor facilities holding an OL or CP
86-34	Improper Assembly, Material Selection, And Test Of Valves And Their Actuators	5/13/86	All power reactor facilities holding an OL or CP
86-33	Information For Licensee Regarding The Chernobyl Nuclear Plant Accident	5/6/86	Fuel cycle licensees and Priority 1 material licensees
86-32	Request For Collection Of Licensee Radioactivity Measurements Attributed To The Chernobyl Nuclear Plant Accident	5/2/86	All power reactor facilities holding an OL or CP
86-31	Unauthorized Transfer and Loss of Control of Industrial Nuclear Gauges	5/6/86	All power reactor facilities holding an OL or a CP
86-30	Design Limitations of Gaseous Effluent Monitoring Systems	4/29/86	All power reactor facilities holding an OL or a CP

OL = Operating License
CP = Construction Permit