

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
WASHINGTON, DC 20555-0001

January 30, 2002

NRC INFORMATION NOTICE 2002-08: PUMP SHAFT DAMAGE DUE TO EXCESSIVE  
HARDNESS OF SHAFT SLEEVE

Addressees

All holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees of potentially serious damage that occurred to pump shafts manufactured by Bingham-Willamette. The damage resulted from harder-than-specified material used during the manufacture of the thrust sleeve installed on the pump shaft. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid problems. However, the suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

After discovering leakage from an outboard mechanical seal on the reactor core isolation cooling pump, Columbia Generating Station (CGS) personnel replaced the outboard mechanical seal. During post-maintenance testing, mechanics observed sparks coming from the pump near the outboard mechanical seal. The licensee disassembled the pump to investigate. On April 1, 2001, CGS personnel discovered significant damage to the thrust sleeve, throttle bushing, and pump shaft near the outboard mechanical seal. Further examination of the thrust sleeve revealed that the thrust sleeve had a through-wall crack along the entire axial length and had severely scored the pump shaft. The licensee also found degraded split rings and an eroded throttle bushing. The licensee concluded that, after the shaft sleeve cracked, the split rings loosened on the shaft and spun freely within a cavity next to the throttle bushing during pump operation. The spinning split rings eventually eroded the bronze throttle sleeve. The particles from the bronze throttle sleeve entered the outboard mechanical seal and caused the seal failure. From the condition of the shaft sleeve, including the amount of corrosion on the cracked surfaces, the licensee inferred that the shaft sleeve had been cracked for some time. The licensee determined that the shaft sleeve material was harder and more brittle than specified in the vendor manual.

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The reactor core isolation cooling pump at CGS is a Bingham-Willamette, 4-stage, centrifugal pump. Review of the inservice surveillance test records did not identify any evidence of pump degradation or adverse trends. On April 6, 2001, after reassembling the old impellers on a new shaft, balancing the impellers and replacing the mechanical seal, the licensee completed post-maintenance testing and declared the reactor core isolation cooling pump operable.

#### Discussion

NRC determined that Bingham-Willamette pumps this size have previously experienced similar problems. Specifically, at Quad Cities during inservice testing of the Bingham-Willamette 4 x 6 x 9B MSD reactor core isolation cooling pump the licensee identified degradation in the thrust sleeve and bushing (LER 50-265/94-001). The licensee identified two other power plants that had experienced similar problems with their reactor core isolation cooling pump. The inspectors also noted three licensee event reports addressing larger Bingham-Willamette pumps that had experienced similar cracking problems on the shaft sleeve (LERs 50-413/89-07, 50-498/88-32 and 50-528/88-13).

A common factor that contributed to these failures was harder, more brittle sleeve material than desired. In some cases the degraded shaft sleeve resulted in noticeable pump performance degradation; in other cases, although the shaft sleeve had degraded, the pumps continued to operate satisfactory.

#### Generic Implications

Multiple shaft sleeve failures on various models of Bingham-Willamette pumps have been attributed to excessively hard, brittle sleeve material. Further, inservice testing did not always reveal that the shaft sleeve had degraded. A degraded shaft sleeve has the potential to cause sudden unexpected pump failure.

This information notice requires no specific action or written response. If you have any questions about this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

*/RA/*

William D. Beckner, Program Director  
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| Information Notice No. | Subject  | Date of Issuance | Issued to  |
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| 2002-06                | Design Vulnerability in BWR Reactor Vessel Level Instrumentation Backfill Modification | 01/18/2002       | All holders of operating licenses or construction permits for boiling water reactors (BWRs).   |
| 2002-05                | Foreign Material in Standby Liquid Control Storage Tanks                               | 01/17/2002       | All holders of licenses for nuclear power reactors.  |
| 2002-04                | Wire Degradation at Breaker Cubicle Door Hinges  | 01/10/2002       | All holders of operating licenses for nuclear power reactors.  |
| 2002-03                | Highly Radioactive Particle Control Problems During Spent Fuel Pool Cleanout           | 01/10/2002       | All holders of operating licenses for nuclear power reactors, holders of licenses for permanently shutdown facilities with fuel onsite, and holders of licenses for non-power reactors.                  |
| 2002-02                | Recent Experience with Plugged Steam Generator Tubes                                   | 01/08/2002       | All holders of operating licenses for pressurized-water reactors (PWRs), except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor. |
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