

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

August 3, 1995

NRC INFORMATION NOTICE 95-30: SUSCEPTIBILITY OF LOW-PRESSURE COOLANT
INJECTION AND CORE SPRAY INJECTION VALVES
TO PRESSURE LOCKING

Addressees

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

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to the potential susceptibility of boiling-water reactor low-pressure coolant injection (LPCI) and core spray injection (CSI) gate valves to pressure locking. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar events or problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

From May to July 1995, Georgia Power Company, the licensee for the Edwin I. Hatch Plant, experienced several valve failures in both units during testing of its inboard LPCI 24-inch flexible-wedge gate valves. These failures, which are still under investigation for root causes, involved shearing of the motor shaft and the pinion key, and overheating of the motor. Surveillance testing of the valves was conducted at power and the downstream check valve leakage which resulted in the reactor operating pressure on one face of the valve, may have contributed to the failures. During the investigation of the root causes for these failures and in responding to the NRC staff's inquiries, the licensee realized that because of backleakage of the downstream check valves, reactor system pressure could cause the LPCI valves to be susceptible to pressure locking during an accident. (See "Discussion" section of this information notice for a description of "pressure locking.")

The licensee reevaluated the operability of the LPCI valves and of the core spray injection 10-inch flexible-wedge valves because of their similar valve alignment. The licensee determined that one LPCI valve might not be capable of opening under pressure-locking conditions and declared this valve inoperable. The licensee installed a larger motor and different gearing in this valve. The licensee also made a similar modification to the valve located in the other train.

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Discussion

Pressure locking may occur in flexible-wedge and double-disk gate valves when fluid becomes pressurized within the valve bonnet and the actuator is not capable of overcoming the additional thrust requirements resulting from the differential pressure acting across both valve discs. This situation can occur, for example, when a check valve exposed to high reactor coolant pressure is in series with a gate valve. The check valve may meet leakage requirements, but, over time, the pressure in the piping between the check valve and the gate valve can increase. With time, the bonnet cavity pressure and the pipe pressure will tend to equalize at the reactor coolant pressure. If a large loss-of-coolant accident (LOCA) occurred, the pressure in the piping would be rapidly reduced. This occurrence would trap high-pressure fluid in the bonnet cavity. If no internal or external path is provided to lower the bonnet pressure, the valve may become pressure locked.

Pressure locking can cause a power-operated valve to fail to open, resulting in an inability of the associated safety train or system to perform its safety function. Pressure locking represents a potential common-cause failure mechanism that can render redundant trains of multiple safety systems incapable of performing their safety functions.

The NRC staff and the nuclear industry have been aware of pressure-locking problems in gate valves for many years. The industry has issued several event reports describing failures of safety-related gate valves to operate because of pressure locking. Several generic industry communications have given guidance for identifying susceptible valves and for taking appropriate preventive and corrective measures.

The NRC staff has provided information on pressure locking of gate valves to the industry and has discussed the safety significance of the potential for pressure locking of gate valves at public meetings.

- In March 1993, the NRC issued NUREG-1275, Volume 9, "Operating Experience Feedback Report-Pressure Locking and Thermal Binding of Gate Valves," which contains a discussion of the potential for pressure locking of LPCI and CSI valves when leakage past their check valves pressurizes the valve bonnet.
- A summary of a public workshop held by the NRC staff on February 4, 1994, is available in the NRC Public Document Room (Accession Number 9403020090). This summary contains information on evaluation of the potential for pressure locking and the actions taken in response to the identification of susceptible valves. The workshop proceedings will be issued soon as NUREG/CP-0146.
- In Enclosure 1 to Supplement 6 (March 8, 1994) of Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," the NRC staff described an acceptable approach for licensees to address the potential for pressure locking of motor-operated gate valves as part of their GL 89-10 programs.

The power-operated valves in the LPCI and CSI lines are designed to serve a vital safety-related function. During a postulated large-break LOCA, as well as under some small-break LOCA scenarios, the opening of these valves is relied upon to provide a flow path for cooling water to the reactor core. If these valves are unable to open because of pressure locking (or some other common-cause problem), reactor fuel might be damaged during a LOCA.

Entergy Operations, Inc., has developed a methodology to predict the thrust required to overcome pressure locking of flexible-wedge gate valves. However, the methodology is based on limited pressure-lock testing. The Georgia Power Company applied this methodology in predicting the thrust required to overcome pressure locking of their LPCI and CSI valves as the best available information at the time. The licensee is considering making modifications to these valves during the next outage. The Georgia Power Company also found that care must be taken in adapting the Entergy methodology to valves in each case, particularly with regard to the valve-specific forces across the hub of flexible-wedge gate valves.

The NRC staff will, in the near future, issue a generic letter that will ask licensees to verify that they (1) have performed or will perform evaluations and appropriate analyses and (2) will take appropriate corrective actions, as necessary, to ensure that safety-related power-operated gate valves that may be susceptible to pressure locking are capable of performing their required safety functions. A draft of this generic letter, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," was published in the Federal Register on April 26, 1995, (60 FR 15799) along with a request for public comment. The staff is issuing this information notice in advance of the generic letter because of the high safety significance of this issue and to indicate the susceptibility of the LPCI and CSI gate valves to pressure locking.

Related Generic Communications

On April 2, 1992, the NRC staff issued NRC Information Notice (IN) 92-26, "Pressure Locking of Motor-Operated Flexible Wedge Gate Valves," which discusses the failure of an LPCI valve at the James A. FitzPatrick Nuclear Power Plant as a result of pressure locking following a hydrostatic pressure test of the LPCI piping. IN 92-26 also referenced earlier NRC staff documents on pressure locking.

Recently, the NRC staff issued IN 95-14 (February 28, 1995), "Susceptibility of Containment Sump Recirculation Gate Valves to Pressure Locking," and IN 95-18 (March 15, 1995) and Supplement 1 (March 31, 1995), "Potential Pressure Locking of Safety-Related Power-Operated Gate Valves," to alert licensees to potential pressure locking of pressurized-water reactor containment sump recirculation valves and safety injection valves identified at the Millstone Nuclear Power Station and the Haddam Neck Nuclear Plant, respectively.

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


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Information Notice No.	Subject	Date of Issuance	Issued to
94-66, Supp. 1	Overspeed of Turbine-Driven Pumps Caused by Binding in Stems of Governor Valves	06/16/95	All holders of OLs or CPs for nuclear power reactors.
95-29	Oversight of Design and Fabrication Activities for Metal Components Used in Spent Fuel Dry Storage Systems	06/07/95	All holders of OLs or CPs for nuclear power reactors.
95-28	Emplacement of Support Pads for Spent Fuel Dry Storage Installations at Reactor Sites	06/05/95	All holders of OLs or CPs for nuclear power reactors.
95-27	NRC Review of Nuclear Energy Institute, "Thermo-Lag 330-1 Combustibility Evaluation Methodology Plant Screening Guide"	05/31/95	All holders of OLs or CPs for nuclear power plants.
95-26	Defect in Safety-Related Pump Parts due to Inadequate Heat Treatment	05/31/95	All holders of OLs or CPs for nuclear power reactors.
94-61, Supp. 1	Corrosion of William Power Gate Valve Disc Holders	05/25/95	All holders of OLs or CPs for nuclear power reactors.
95-25	Valve Failure during Patient Treatment with Gamma Stereotactic Radiosurgery Unit	05/11/95	All U.S. Nuclear Regulatory Commission Medical Licensees.
95-24	Summary of Licensed Operator Requalification Inspection Program Findings	04/25/95	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
 CP = Construction Permit

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orig /s/'d by DMCrutchfield

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