

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

April 2, 1992

NRC INFORMATION NOTICE 92-26: PRESSURE LOCKING OF MOTOR-OPERATED  
FLEXIBLE WEDGE GATE VALVES

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 describe a mechanism by which flexible wedge gate valves could become inoperable because of pressure locking. 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 are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

In July 1991, the New York Power Authority, licensee for the James A. Fitzpatrick Nuclear Power Plant, was performing a 2100 psig hydrostatic test of the piping in the low pressure coolant injection (LPCI) system. The piping being tested was between the inboard and outboard LPCI injection valves. The inboard valve is a motor-operated 24-inch flexible wedge gate valve manufactured by William Powell Company. Upon completing the test, the licensee depressurized the piping between the valves and filled and vented the system to return it to service. About 10 hours after the test was completed, a control room operator attempted to open the inboard valve. The valve actuator energized for approximately 30 seconds, after which the motor actuator circuit breaker tripped. (The valve normal stroke time is about 120 seconds.) The licensee determined the root cause of the actuator motor failure to be pressure trapped between the wedges of the flexible wedge gate valve. This phenomenon is known as "pressure locking" (see Figure 1). The licensee determined that other flexible wedge gate valves at its plant are susceptible to this failure mechanism.

The licensee identified a concern that the flexible wedge gate valves could become pressure locked during normal plant operation and may not function during an accident. For example, if a check valve is exposed to high reactor coolant pressure and is in series with a gate valve, the gate valve can become pressure locked in the following manner. The coolant can leak past the check valve and, over time, the pressure in the piping between the check valve and gate valve can increase. Eventually, the pressurized side of the flexible disk moves slightly away from its seat, allowing fluid to enter the bonnet cavity.

9203270028

PDR IFE Notice 92-026

920402

Updated on 920409

IDR-11C

With time, the bonnet cavity pressure and pipe pressure will tend to equalize at reactor coolant pressure. If an accident such as a loss-of-coolant-accident (LOCA) occurred, the pressure in the piping would be rapidly reduced. The pressurized side of the disk would move back against its seat, trapping high pressure fluid in the bonnet cavity. If no internal or external path is provided to equalize the pressure in the bonnet, the valve may become pressure locked.

Prior to the event at Fitzpatrick, the plant had experienced problems with pressure locking of double disk gate valves in 1988, but did not recognize the potential problems with flexible wedge gate valves. The licensee believed that its flexible wedge gate valves would not become pressure locked because any pressure trapped in the valve bonnet cavity would cause the wedge to compress and would allow the pressure within the bonnet cavity to decrease. This proved not to be the case.

In taking corrective action, the licensee modified the valve by providing a vent path to release the high pressure between the disks and in the bonnet cavity.

On October 18, 1991, the Pennsylvania Power and Light Company, licensee for the Susquehanna Steam Electric Station, Units 1 and 2, similarly reported that some of its motor-operated flexible wedge gate valves were susceptible to this pressure locking phenomenon. The licensee for Susquehanna also provided a pressure relief path from the valve cavities to prevent an internally pressurized condition.

### Discussion

The recent reports for the Fitzpatrick and Susquehanna plants indicate that previous operating experience feedback has not been completely effective in addressing the problem of hydraulic locking at all plants.

The potential for valve operability problems caused by excessive pressure in the valve bonnet has been known for many years in the nuclear industry. The NRC documented the problem in 1977 in NRC IE Circular 77-05, "Liquid Entrapment in Valve Bonnets." In 1981, IE Information Notice 81-31, "Failure of Safety Injection Valves to Operate Against Differential Pressure," was issued based on a 1981 San Onofre event involving the Safety Injection MOVs. In July of 1984, AEOD issued a study on the pressure locking phenomenon, AEOD/S402, "Pressure Locking of Flexible-Disk Wedge-Type Gate Valves." Again, in September 1988, the NRC issued Information Notice 88-72, "Inadequacies in the Design of DC Motor-Operated Valves." This information notice discussed both pressure locking and thermal binding of gate valves, but was primarily concerned with valve operator problems.

Once a valve has been identified as susceptible to hydraulic locking, all safety functions performed by that valve need to be carefully evaluated to determine the appropriate solution. Changing the size of the operator or using a different valve design may be appropriate. Providing a vent path may be an acceptable solution, but only after a careful review of all the functions of the valve. For example, a vent path will not be acceptable if leaktightness in both directions is required.

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 Office of Nuclear Reactor Regulation (NRR) project manager.

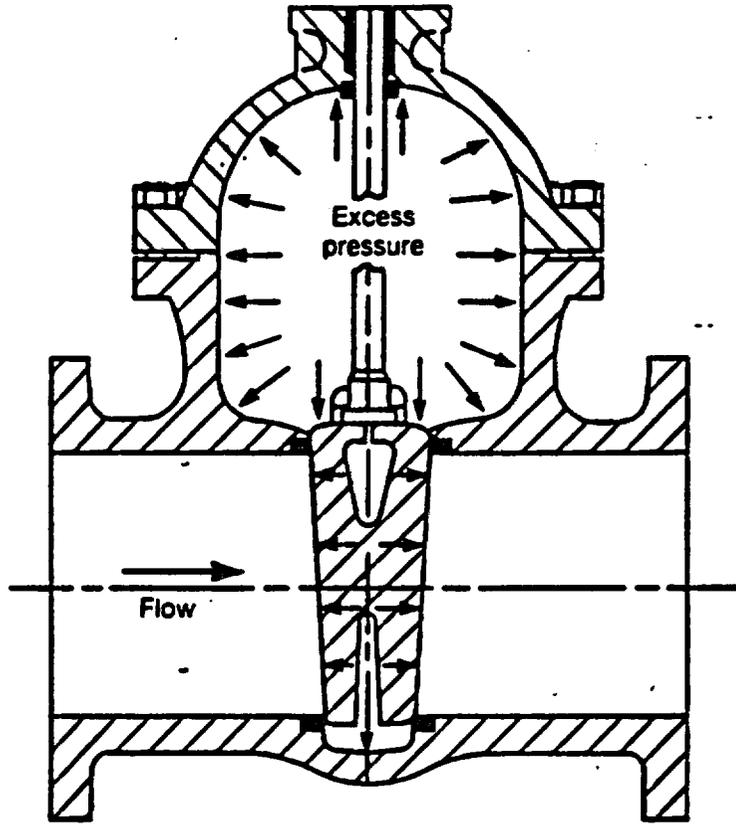
*Charles E. Rossi*  
Charles E. Rossi, Director  
Division of Operational Events Assessment  
Office of Nuclear Reactor Regulation

Technical contact: T. Greene, NRR  
(301) 504-1175

Attachments:

1. Figure 1, Pressure Locking Flexible-Wedge Gate Valve
2. List of Recently Issued NRC Information Notices

*Computer Printout: see jacket*



**Pressure Locking**  
**Flexible-Wedge Gate Valve**  
**Figure 1**

LIST OF RECENTLY ISSUED  
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
92-25	Potential Weakness in Licensee Procedures for A Loss of the Refueling Cavity Water	03/31/92	All holders of OLs or CPs for nuclear power reactors.
92-24	Distributor Modification to Certain Commercial-Grade Agastat Electrical Relays	03/30/92	All holders of OLs or CPs for nuclear power reactors.
92-23	Results of Validation Testing of Motor-Operated Valve Diagnostic Equipment	03/27/92	All holders of OLs or CPs for nuclear power reactors and all vendors of motor-operated valve (MOV) diagnostic equipment.
92-22	Criminal Prosecution and Conviction of Wrongdoing Committed by A Commercial-Grade Valve Supplier	03/24/92	All holders of OLs or CPs for nuclear power reactors.
92-21	Spent Fuel Pool Reactivity Calculations	03/24/92	All holders of OLs or CPs for nuclear power reactors.
92-20	Inadequate Local Leak Rate Testing	03/03/92	All holders of OLs or CPs for nuclear power reactors.
92-19	Misapplication of Potter & Brumfield MDR Rotary Relays	03/02/92	All holders of OLs or CPs for nuclear power reactors.
92-18	Potential for Loss of Remote Shutdown Capability during A Control Room Fire	02/28/92	All holders of OLs or CPs for nuclear power reactors.
92-17	NRC Inspections of Programs being Developed at Nuclear Power Plants in Response to Generic Letter 89-10	02/26/92	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License  
CP = Construction Permit