

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

February 28, 1995

NRC INFORMATION NOTICE 95-14: SUSCEPTIBILITY OF CONTAINMENT SUMP  
RECIRCULATION GATE 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 containment sump recirculation gate valves to pressure locking at nuclear plants. 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

On January 26, 1995, Northeast Nuclear Energy Co., the licensee for Unit 2 of the Millstone Nuclear Power Station, determined that both containment sump recirculation motor-operated gate valves may experience pressure locking during a design-basis loss-of-coolant accident (LOCA) and fail in the closed position. This condition was discovered by the licensee after re-evaluation of all Unit 2 valves to address weaknesses in their previous evaluation criteria identified by the NRC Motor-Operated Valve Inspection at Millstone Unit 1 in March 1994. At Millstone Unit 2, failure of both of these valves would make a water source for the emergency core cooling system (ECCS) and containment spray unavailable during the recirculation phase of the LOCA (the recirculation phase occurs not sooner than about 45 minutes after the start of an event).

Millstone Unit 2 is a pressurized water reactor with two containment sump recirculation valves (one in each of two parallel paths). The sump piping paths join piping from the refueling water storage tank (RWST) leading to low pressure safety injection pump suction. The Millstone Unit 2 containment sump recirculation valves are parallel-wedge gate valves that are normally closed, leaving the containment sump side of the valve dry and exposed to the containment. The pump side of each valve is normally pressurized to approximately 345 kPa [35 psig] due to the static head of the RWST. The RWST water may leak past the pumpside gate valve disc and may fill the valve bonnet with water.

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updated on 3/1/95

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During a postulated LOCA at Millstone Unit 2, the sump side of each containment sump recirculation valve could be exposed to sump water (reactor coolant) with temperatures as high as 143 °C [289 °F] for some time prior to the valve being required to open to allow ECCS and containment spray recirculation cooling. Heating of the valve could heat the water trapped in the water-filled valve bonnet. A pressure increase of 410 kPa per °C [33 psi per °F] is predicted. The licensee has determined that a bonnet pressure of 1138 kPa [150 psig] (requiring only about a 3 °C [5 °F] temperature rise in a water solid bonnet) may prevent the valve from opening. Therefore, it might not be possible to establish recirculation cooling following a LOCA.

Millstone Unit 2 has been in a cold shutdown condition since October 1994. The licensee is considering various modifications to the valves to prevent pressure locking to be implemented prior to restart.

### Discussion

Pressure locking may occur in flexible-wedge and parallel-wedge 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 created across both valve discs by the pressurized fluid. For example, the fluid may enter the valve bonnet (1) during normal open and close valve cycling, (2) when a fluid differential pressure across a disc causes the disc to move slightly away from the seat, creating a path to either increase the fluid pressure or fill the bonnet with fluid, or (3) for a steamline valve, when differential pressure exists across the disc and the valve orientation permits condensate to collect and enter the bonnet. 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 mode that can render redundant trains of certain safety-related systems or multiple safety systems incapable of performing their safety functions.

The industry has issued several event reports describing safety-related gate valves failing to operate because of pressure locking. Several generic industry communications have given guidance for identifying susceptible valves and for performing appropriate preventive and corrective measures.

In March 1993, the NRC issued NUREG-1275, Volume 9, "Pressure Locking and Thermal Binding of Gate Valves." Further, the NRC staff held a public workshop on February 4, 1994, to discuss the subject. A summary of the public workshop is available in the NRC Public Document Room and contains both information on evaluating the potential for pressure locking and actions taken in response to the identification of susceptible valves. The NRC staff presentation at the workshop identified containment sump recirculation valves as potentially susceptible to pressure locking. In addition to pressure locking events at U.S. nuclear power plants, the French experience was documented in NUREG/CP-0137, "Proceedings of the Third NRC/ASME Symposium on Valve and Pump Testing," in July 1994. Related NRC generic communications are listed later in this notice.

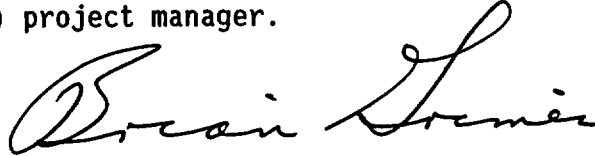
The two primary safety issues related to the pressure locking scenario described above are the potential loss of access to a water source for long-term reactor core cooling and the potential loss of a water source for containment spray. During a postulated large-break LOCA or under some small-break LOCA scenarios, the opening of the sump valves is relied on to set up a flow path from the sump to the safety injection and containment spray pumps. In this alignment, the safety injection pumps recirculate the water between the sump and the reactor for long-term core cooling and the containment spray pumps draw water from the sump to provide containment spray for the control of containment pressure, temperature, and fission products. If the sump valves are unable to open due to pressure locking, the core may be damaged in a short time. The containment pressure and temperature may also increase upon loss of containment spray. This could lead to containment failure. The loss of containment spray would also cause reduction of fission product scrubbing inside the containment. Additionally, the safety injection and containment spray pumps may be damaged by pump cavitation if the sump valves remain closed and the RWST is emptied.

#### Related Generic Communications

On April 2, 1992, the NRC staff issued Information Notice (IN) 92-26, "Pressure Locking of Motor-Operated Flexible Wedge Gate Valves." IN 92-26 referenced earlier NRC staff documents on pressure locking.

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 alerted licensees to the issue of pressure locking of gate valves. The staff also 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.

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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Division of Project Support  
Office of Nuclear Reactor Regulation

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(301) 415-2878

Eugene M. Kelly, Region I  
(610) 337-5111

Attachment: List of Recently Issued NRC Information Notices

*Attachment filed in Jacket*

LIST OF RECENTLY ISSUED  
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
95-13	Potential for Data Collection Equipment to Affect Protection System Performance	02/24/95	All holders of OLs or CPs for nuclear power reactors.
95-12	Potentially Nonconforming Fasteners Supplied by A&G Engineering II, Inc.	02/21/95	All holders of OLs or CPs for nuclear power reactors.
95-11	Failure of Condensate Piping Because of Erosion/Corrosion at a Flow-Straightening Device	02/24/95	All holders of OLs or CPs for nuclear power reactors.
95-10 Supp. 1	Potential for Loss of Automatic Engineered Safety Features Actuation	02/10/95	All holders of OLs or CPs for nuclear power reactors.
95-10	Potential for Loss of Automatic Engineered Safety Features Actuation	02/03/95	All holders of OLs or CPs for nuclear power reactors.
95-09	Use of Inappropriate Guidelines and Criteria for Nuclear Piping and Pipe Support Evaluation and Design	01/31/95	All holders of OLs or CPs for nuclear power reactors.
95-08	Inaccurate Data Obtained with Clamp-On Ultrasonic Flow Measurement Instruments	01/30/95	All holders of OLs or CPs for nuclear power reactors.
95-07	Radiopharmaceutical Vial Breakage during Preparation	01/27/95	All USNRC medical licensees authorized to use byproduct material for diagnostic procedures.

OL = Operating License  
 CP = Construction Permit

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**Original signed by Brian K. Grimes**  
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DOCUMENT NAME: 95-14.in

E-mailed to E. Kelly of Region I on 2/23/95 for review and comment.  
 E-mailed to E. Brown, AEOD, on 2/23/95 for review and comment.  
 C. Casto, Region II  
 J. Jacobson, Region III  
 T. Westerman, Region IV

\*See previous concurrence

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Attachments:

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

DOCUMENT NAME: G:\EJBI\PRESSLOC.IN

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NAME	EBenner	<i>R. Sanders</i>	EGoodwin	TScarbrough
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