

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

March 22, 1990

NRC INFORMATION NOTICE NO. 90-21: POTENTIAL FAILURE OF MOTOR-OPERATED  
BUTTERFLY VALVES TO OPERATE BECAUSE  
VALVE SEAT FRICTION WAS UNDERESTIMATED

Addressees:

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

Purpose:

This information notice is intended to alert addressees to the potential for motor-operated butterfly valves to fail to open on an electrical signal as a result of friction forces exerted on the valve seats that exceed the values assumed when selecting the motor actuators and setting the torque switches. 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 do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

In October 1988, at Catawba Nuclear Station Unit 1, a motor-operated butterfly valve in the service water system failed to open under high differential pressure conditions. Following the valve failure, the licensee concluded that the valve manufacturer, BIF/General Signal Corporation, had underestimated the degree to which the material used in the valve seat would harden with age (the responsibility for these valves has been transferred to Paul-Munroe Enertech). This underestimation of the age hardening had led the manufacturer to assume valve seat friction forces that were less than the actual friction forces in the installed valve. To overcome the larger-than-anticipated friction forces, the licensee's engineering staff recommended the open torque switch for 56 butterfly valves be reset to the maximum allowable value. These valves are required to open to satisfy their safety function and were supplied by this manufacturer to Catawba Units 1 and 2. The systems in which these valves are located include the component cooling water system, service water system, and various ventilation systems.

By July 26, 1989, the torque switch adjustments were completed at Catawba Units 1 and 2. After reviewing the final settings, the licensee's engineering staff determined that the actuators for three butterfly valves in the component

cooling water system might not be able to overcome the friction forces resulting from maximum seat hardening. On December 13, 1989, the licensee determined that the failure of these BIF/General Signal motor-operated valves (MOVs) could cause a loss of cooling water to residual heat removal system heat exchangers. To resolve the concern regarding the operability of these BIF/General Signal valves, a torque switch bypass was installed on two of the actuators to allow full motor capability during opening. The third actuator was considered to be operable because of a recent replacement of the seat material, but an open torque switch bypass will be installed in that actuator at a later date. This situation is described in detail in Catawba Licensee Event Report 89-29, dated January 15, 1990.

Discussion:

The underestimation of the friction forces that occur as a result of age hardening of the seat material could lead to the common mode failure of a large number of motor-operated butterfly valves to open on an electrical signal. In the Catawba case, the licensee determined that the torque switches of 56 valve actuators in several important plant systems required adjustments. A database search shows 12 other reactor units having a combined total of approximately 300 butterfly valves from this manufacturer. The affected valves are located in such plant systems as high pressure coolant injection, service water, and standby gas treatment.

In addition to the BIF/General Signal valves, motor-operated butterfly valves supplied by other manufacturers might fail to operate properly if the manufacturers underestimated friction forces during the selection of the motor actuators and the trip setpoints for the torque switches. For example, in Information Notice 88-94, dated December 2, 1988, "Potentially Undersized Valve Actuators," the staff stated that past inaccuracies in the method used to predict valve friction forces had led to the potential for undersized actuators on certain motor-operated butterfly valves manufactured by Fisher Controls International. As a result, the concern with regard to the effect of various friction losses on the operability of motor-operated butterfly valves is applicable to all such valves.

On June 28, 1989, the NRC issued Generic Letter 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," to all holders of nuclear power plant operating licenses and construction permits. In the generic letter, the NRC staff requested that the addressees establish a program to provide for the testing, inspection, and maintenance of safety-related MOVs and certain other MOVs in safety-related systems. The scope of Generic Letter 89-10 includes motor-operated butterfly valves in safety-related systems. One of the factors contributing to the need for the generic letter was the uncertainty in the analytical techniques used by licensees and valve vendors in selecting motor actuators for valves and setting their torque switches. The potential failure of butterfly valves discussed in this information notice is evidence of that uncertainty.

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



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

Technical Contacts: Thomas G. Scarbrough, NRR  
(301) 492-0916

John W. Thompson, NRR  
(301) 492-1175

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED  
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
90-20	Personnel Injuries Resulting from Improper Operation of Radwaste Incinerators	3/22/90	All NRC licensees who process or incinerate radioactive waste.
90-19	Potential Loss of Effective Volume for Containment Recirculation Spray at PWR Facilities	3/14/90	All holders of OLs or CPs for PWRs.
90-18	Potential Problems with Crosby Safety Relief Valves Used on Diesel Generator Air Start Receiver Tanks	3/9/90	All holders of OLs or CPs for nuclear power reactors.
90-17	Weight and Center of Gravity Discrepancies for Copes-Vulcan Valves	3/8/90	All holders of OLs or CPs for nuclear power reactors.
89-59, Supp. 2	Suppliers of Potentially Misrepresented Fasteners	3/7/90	All holders of OLs or CPs for nuclear power reactors.
90-16	Compliance with New Decommissioning Rule	3/7/90	All materials licensees.
90-15	Reciprocity: Notification of Agreement State Radiation Control Directors Before Beginning Work in Agreement States	3/7/90	All holders of NRC materials licenses which authorize use of radioactive material at temporary job sites.
90-14	Accidental Disposal of Radioactive Materials	3/6/90	All U.S. NRC byproduct material licensees.
90-13	Importance of Review and Analysis of Safeguards Event Logs	3/5/90	All holders of OLs or CPs for nuclear power reactors.
90-12	Monitoring or Interruption of Plant Communications	2/28/90	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License  
 CP = Construction Permit

UNITED STATES  
 NUCLEAR REGULATORY COMMISSION  
 WASHINGTON, D.C. 20555

OFFICIAL BUSINESS  
 PENALTY FOR PRIVATE USE, \$300

FIRST CLASS MAIL  
 POSTAGE & FEES PAID  
 USNRC  
 PERMIT No. G-67

120555026886 1 11A11B1C01CY1  
 US NRC-OIRM  
 DIV OF INFO SUP SVCS  
 MICROGRAPHICS SPECIALIST  
 RECORDS SERVICES BRANCH  
 W/FP-1-21  
 WASHINGTON DC 20555