

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

July 21, 1988

NRC INFORMATION NOTICE NO. 88-51: FAILURES OF MAIN STEAM ISOLATION VALVES

Addressees:

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

Purpose:

This information notice alerts addressees to potential problems discovered with main steam isolation valve (MSIV) operability surveillance tests. The loss of the isolation safety function for the containment/reactor creates the potential for failure to limit the release of radioactivity during a reactor transient or accident condition. 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:

Following an event at Dresden Unit 2 on December 24, 1987, in which the "1B" MSIV failed to close when the air supply line pulled out of the manifold on the valve operator, Commonwealth Edison Company (the licensee) designed a special test to respond to a Region III concern regarding MSIV operability on the loss of motive "air" pressure. The test was designed to evaluate whether the MSIVs would close, as expected, on spring force alone.

On May 16, 1988, the licensee performed a spring closure test, which required total isolation of the pneumatic supply to the MSIV actuators. The Dresden "air" or pneumatic system used to assist in MSIV closure is non-safety grade; air is supplied to the outboard MSIVs and nitrogen is supplied to the inboard MSIVs. Each of the inboard and outboard valves was tested and each failed to fully close.

On May 17, 1988, continuing with the MSIV special test program, the licensee performed a slow loss-of-air test that isolated supply nitrogen, but not the accumulator from the valve actuator, thus allowing stored nitrogen in the accumulator to assist in closing the MSIV. When the volume of gas under the piston was vented, the valve again failed to fully close. The same test was performed with similar results on all outboard isolation valves. At this point, all eight MSIVs were declared to be inoperable.

The licensee developed a series of tests to evaluate possible root causes of the problems observed regarding failure of the MSIVs to fully close. The root cause failure tests assessed air supply purity, accumulator check valve leakage, air/pneumatic manifold operability, MSIV spring forces, and valve packing adjustment. Initially it was believed that the MSIV failures were caused by the Automatic Valve Company (AVCO) 4-way solenoid valves moving to an intermediate position, where they "hung up," thus preventing proper venting of the gas volume from under the piston. Subsequently the results of the MSIV root cause failure tests showed that excessively tight MSIV chevron packing clamped the stem, preventing the valve from traveling freely to its closed position. Details may be found in Augmented Inspection Team Report No. 50-237/88013.

#### Discussion:

The MSIVs are 20-inch, air-spring-operated, balanced "Y" configuration Crane globe valves. Air or nitrogen is supplied under the actuator piston to open and to hold open the valve. When the supply is interrupted or when the MSIV main solenoid coils are de-energized, the accumulator air/nitrogen is routed to the top of the actuator and air/nitrogen from the bottom is vented, thereby assisting the spring in closing the MSIV. The action of the main solenoids causes an AVCO 4-way valve to reposition and open the pathway to the actuator. According to the Updated Safety Analysis Report, the valves are designed to close with either pneumatic or spring action; thus, the coil springs located around the shafts are used for closing the valves in the event of pneumatic supply failure.

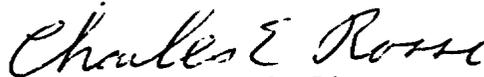
The Dresden Technical Specifications require quarterly functional testing to evaluate MSIV closure with combined actuator air and spring forces even though the pneumatic supplies are from non-safety grade sources. The most recent testing demonstrated that the MSIVs would not close with spring forces alone which is contrary to the plant's safety design basis. During a slow loss-of-air/nitrogen test, the over-tightened valve packing clamped the valve stem, and the 4-way solenoid valve "hung up" in a manner such that air/nitrogen did not assist in closing the MSIV. However, even with the loss of air-assisted closure, the valves should have closed on spring force only. It is because of this that the root cause of failure was attributed to the over-tightened chevron packing. Moreover, it was determined that post-maintenance testing was inadequate to detect the overly tight valve stem packing condition.

This event indicates that MSIV testing may be inadequate to detect certain deficiencies in design of the MSIV, its installation, or maintenance that could affect its design function. Excessive pressure on the gland rut may be maintained without problems for some types of packing; however, for certain self-setting-type chevron packing, such as that in use at Dresden Unit 2, the excessive friction will inhibit stem movement. Thus, the potential exists for a situation in which the design-basis closure requirements are not met.

This event emphasizes the need to consider carefully the adequacy of surveillances in establishing the operability of MSIVs or other similar valves. The

MSIVs passed the typical surveillance test of spring closure assisted by the pneumatic operator; however, on a slow depressurization, which is more typical of a leak of the pneumatic system, the valves could potentially fail to close if the packing is over-torqued.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the technical contact listed below or the Regional Administrator of the appropriate regional office.



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

Technical Contact: Carl S. Schulten, NRR  
(301) 492-1192

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED  
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
88-50	Effect of Circuit Breaker Capacitance on Availability of Emergency Power	7/18/88	All holders of OLs or CPs for nuclear power reactors.
88-49	Marking, Handling, Control, Storage and Destruction of Safeguards Information	7/18/88	All holders of OLs or CPs for nuclear power reactors and all other licensed activities involving a formula quantity of special nuclear material.
88-48	Licensee Report of Defective Refurbished Valves	7/12/88	All holders of OLs or CPs for nuclear power reactors.
88-47	Slower-Than-Expected Rod-Drop Times	7/14/88	All holders of OLs or CPs for PWRs.
88-46	Licensee Report of Defective Refurbished Circuit Breakers	7/8/88	All holders of OLs or CPs for nuclear power reactors.
88-45	Problems in Protective Relay and Circuit Breaker Coordination	7/7/88	All holders of OLs or CPs for nuclear power reactors.
88-44	Mechanical Binding of Spring Release Device in Westinghouse Type DS-416 Circuit Breakers	6/24/88	All holders of OLs or CPs for nuclear power reactors.
88-43	Solenoid Valve Problems	6/23/88	All holders of OLs or CPs for nuclear power reactors.
88-42	Circuit Breaker Failures Due to Loose Charging Spring Motor Mounting Bolts	6/23/88	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License  
CP = Construction Permit

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\*EAB:NRR  
CSchulten:db  
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\*EAB:NRR  
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06/24/88

\*C:EAB:NRR  
WLanning  
07/13/88

\*C:GCB:NRR  
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EAB:NRR  
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This event emphasizes the need to consider carefully the adequacy of surveillances in establishing the operability of MSIVs, or other similar service valves. Licensees may wish to review their current surveillance procedures for MSIVs in particular, and other valves which use non-safety grade pneumatic supplies to assist in valve operations required to meet safety analyses requirements, to ensure that tests provide an adequate assessment of the valve's operability in regard to the safety analysis requirements.

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