

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

February 28, 1990

NRC INFORMATION NOTICE NO. 90-11: MAINTENANCE DEFICIENCY ASSOCIATED
WITH SOLENOID-OPERATED VALVES

Addressees:

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

Purpose:

This information notice is intended to alert addressees to a potential problem resulting from improper maintenance that may affect the operability of main steamline isolation valves (MSIVs), main steamline relief valves (MSRVs) or similarly designed components. The problem relates to solenoid-operated valves (SOVs) that may not have been properly maintained or tested after maintenance. 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:

During an inspection at Automatic Valve Corporation (AVC) in Novi, Michigan, the NRC staff learned that a nuclear power plant licensee may have performed improper maintenance on SOVs, possibly by using an obsolete set of instructions. AVC manufactures pneumatic control assemblies (PCAs) that are assembled on actuators (manufactured by others) which in turn operate safety-related valves. An evaluation of this situation led to the discovery of a failure mechanism for SOVs that had not been considered previously. The NRC staff determined that updated maintenance instructions consistent with current replacement parts design were not provided to all users of these SOVs. As a result, AVC sent a letter dated February 1, 1990, to utilities known to use SOVs supplied directly by AVC, Atwood & Morrill and Target Rock (valve manufacturers that use solenoids supplied by AVC), and General Electric (a nuclear steam system supplier that supplied original equipment or subsequent parts for MSIVs and MSRVs). This letter alerted organizations that received SOVs from AVC of the design change and potential problem which could be caused by not using the proper tool; the letter also provided a copy of the current maintenance instructions. AVC obtains SOVs from a subtier supplier and may either incorporate them in an AVC PCA, or provide only the SOVs.

Discussion:

The PCA directs air to the actuator to operate MSIVs and MSRVs. Multiple SOVs in the PCA are arranged in a design such that with a single failure involving one of the SOVs, the MSIVs and MSRVs are to go to or remain in the preferred position following the single failure. However, a single failure was discovered that could prevent an MSIV from achieving the preferred position; an MSRV would remain closed, but would not be able to be opened. Even though the following discussion is limited to MSIVs, it applies in an analogous manner to the MSRVs. Therefore, the problem should not be considered to be limited to MSIVs.

In one design arrangement for an MSIV, the PCA has two SOVs controlling air to and from a four-way air valve which in turn directs motive air under a piston operator to open the MSIV or on top of the piston to drive the MSIV closed. Should one of the two SOVs mechanically bind in the energized position, the four-way air valve cannot be moved; therefore, the MSIV would fail to close when required, even though the other SOV was in the proper (de-energized) position.

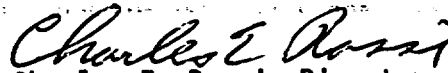
Mechanical binding was found to be a reasonable and potential possibility because interchangeable parts with a different design were provided to licensees without concurrent notification that a revised installation and maintenance procedure should be followed. In the original design, "flats" were used as a means of exerting a force to screw two metal pieces together. The new design required a spanner wrench. Use of pliers or vise-grips (as designated in the earlier procedure) on a thin walled guide tube could deform the tube and prevent a plunger actuated by the solenoid from moving freely inside the tube. It was reported that pliers or vise-grips may have been used at one utility during either disassembly or assembly of an SOV.

Sticking of the plunger within the guide tube (another binding mechanism) can also occur without deformation of the tube if an improper lubricant is used. Lubricants, as well as other materials, have been known to become sticky, cause other problems and prevent proper operation of an SOV after extended time in a high-temperature or excessive radiation environment. For example, Super O Lube, which is usually used by AVC in their valves, as well as by Ralph A. Hiller in their pneumatic/hydraulic operators, will begin to solidify after exposure to a radiation dose of about 1.9 MegaRads. Another lubricant, Houghton 620, used in qualification testing, has been subsequently identified by the manufacturer as "Non-compatible" with unanodized aluminum, the material used in AVC PCAs. There has been no unanimity as to which lubricant to use or its service life. Lubricant and some of its effects are discussed in Information Notice 88-43, "Solenoid Valve Problems," dated June 23, 1988.

Gross damage or failures caused by the use of improper maintenance procedures should be detected during post maintenance testing. However, less than gross damage might only cause the SOV to operate in a sporadic and unpredictable manner. This is particularly true because not all PCAs are installed with the same orientation (e.g., vertical versus horizontal) or in the same environment (e.g., temperature, radiation field, and humidity). A review by the NRC staff of plant equipment failure and maintenance records shows that not all licensees adequately evaluate or compare actual service conditions with those intended or used to qualify these components.

A review may be required of the purchase documentation for MSIVs and MSRVs, along with any replacement parts, to establish whether licensees have the potential for the above-described failure mechanism. Because of the nature of the control assembly used on MSIVs and MSRVs, several different vendors and suppliers are involved in the manufacture, assembly, and procurement of the PCA. Therefore, licensees may not readily recognize the vendor mentioned in this information notice as a supplier of a portion of one of their safety-related components.

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 NRR project manager.



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Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
90-10	Primary Water Stress Corrosion Cracking (PWSCC) of Inconel 600	2/23/90	All holders of OLs or CPs for PWRs.
90-09	Extended Interim Storage of Low-Level Radioactive Waste by Fuel Cycle and Materials Licensees	2/5/90	All holders of HRC materials licenses.
88-30, Supp. 1	Target Rock Two-Stage SRV Setpoint Drift Update	2/2/90	All holders of OLs or CPs for nuclear power reactors.
90-08	Kr-85 Hazards from Decayed Fuel	2/1/90	All holders of OLs or CPs for nuclear power reactors and holders of licenses for permanently shut-down facilities with fuel on site.
88-23, Supp. 2	Potential for Gas Binding of High-Pressure Safety Injection Pumps During a Loss-of-Coolant Accident	1/31/90	All holders of OLs or CPs for PWRs.
90-07	New Information Regarding Insulation Material Performance and Debris Blockage of PWR Containment Sumps	1/30/90	All holders of OLs or CPs for nuclear power reactors.
90-06	Potential for Loss of Shutdown Cooling While at Low Reactor Coolant Levels	1/29/90	All holders of OLs or CPs for nuclear power reactors.
90-05	Inter-System Discharge of Reactor Coolant	1/29/90	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
 CP = Construction Permit

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