

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

September 11, 1989

NRC INFORMATION NOTICE NO. 89-66: QUALIFICATION LIFE OF SOLENOID VALVES

Addressees:

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

Purpose:

This information notice is being provided to alert addressees to a potential problem, resulting from a common-mode failure, that may affect the operability of main steam line isolation valves or similarly designed components. The problem relates to control solenoid valves whose elastomer discs (seats) are exposed to temperatures higher than originally assumed in calculating their qualified life and which may be presently in service beyond their actual qualified service life. 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 a reactor trip in August 1989, the operators of Grand Gulf Unit 1 closed the main steam line isolation valves (MSIVs) manually. However, they observed that one outboard MSIV did not close until more than 15 minutes after a subsequent automatic closure set point (low vacuum) was reached. Upon investigating the event, the licensee found a piece of the elastomer seat from the solenoid valve used for control of that MSIV on an outlet screen. The licensee concluded that the piece had been lodged in the solenoid valve internals, thereby keeping the solenoid valve from venting control air and hence keeping the MSIV from closing. It is believed that after the piece of elastomer became dislodged from the internals, the MSIV closed.

Subsequent inspections by the licensee of all eight dual-coil solenoid valves piloting the MSIVs disclosed that all eight solenoid valves had degraded seats. Initial visual inspection did not reveal the degradations. However, the degradations became apparent under microscopic examination. The EPDM (ethylene propylene dimer) seats of all eight solenoid operated valves had cracking. However, on six of them, the raised portion of the seat formed by the annular

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impression made in the seat by the exhaust port was missing. Thus, it appears as if six of the eight solenoid valves had experienced similar sloughing of material from the seat. This had been sufficient to prevent one of the solenoid valves from operating properly, thereby preventing the MSIV from operating properly.

The solenoid valves in question are dual-coil solenoid valves manufactured by Automatic Switch Co. (ASCO Model NP8323). In 1985, the Grand Gulf licensee calculated the qualified life of these valves with EPDM seats using single-coil heatup data. The resultant qualified life was calculated at 5.9 years on inboard MSIVs. After the recent event, the licensee repeated the qualification calculations using heatup data for dual-coil solenoids (which became available in 1987) and estimated the life to be about 2.9 years. These solenoid valves had been in service for about 4.5 years.

Recent qualification calculations by the Perry licensee for their solenoid valves, which have operating conditions similar to those at Grand Gulf, found that NP8323 solenoid valves with Viton seats on the inboard MSIVs have an estimated service life of about two years. These solenoid operated valves are routinely changed every refueling outage at Perry.

#### Discussion:

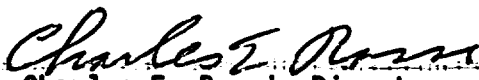
~~A number of operability problems have been associated with the dual-coil solenoid valve Model NP8323 manufactured by ASCO. Information Notice No. 88-43, "Solenoid Valve Problems," dated June 23, 1988, identifies older generic communications and describes potential common-mode failure mechanisms, for example, contamination, thermal degradation of the elastomer, sticky material, and deficient maintenance. ASCO issued a service bulletin dated May 23, 1989, which stated that rebuilding kits for the "NP" series valves were being discontinued. ASCO has also recently indicated that it plans to phase out the NP8323 solenoid valve and that two NP8320 nuclear qualified single-coil solenoid operated valves connected in series may be an acceptable substitute.~~

Since better and more recent temperature information is now available, it is important to note that the calculated maximum service period data supplied with solenoid valves used at both boiling water reactors and pressurized water reactors may be based on temperatures at the elastomer seat that are too low. Therefore, the calculated service life may be in error. Temperatures in the vicinity of the elastomer seat are dependent upon the plant-specific ambient temperatures, localized hot spot heat sources, and heat input from the solenoid coils during the time the solenoids are energized. A temperature rise of about 100°F above ambient temperature could be expected in the vicinity of the seat with the dual solenoid coils energized. ASCO has temperature profile data available for various solenoid valve designs. The temperature profile data vary for different solenoid valves under different operating conditions.

In a service bulletin dated April 12, 1988, ASCO stated that it had no evidence of elastomer degradation when Viton was used. General Electric Company issued SIL No. 481, dated February 14, 1989, which recommended that the elastomer be changed from EPDM to Viton. Regardless of the material used, the qualified life will be adversely affected by higher temperatures and may be significantly less than the initially determined qualified life and possibly even less than the actual operating time.

MSIVs are subject to different testing and surveillance requirements. Some licensees test MSIVs for operability once each quarter and others may use special slow-closing testing techniques such as that described in IN 88-43. Regardless of the testing or frequency, the MSIVs may be susceptible to a common mode of failure which could disable both MSIVs in a steam line. This failure, in itself, would not cause a significant accident; however, should the MSIV failures occur in conjunction with a steam line break, radioactivity released to the public could result in doses in excess of the guidelines of 10 CFR Part 100.

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.



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

Technical Contacts: J. Carter, NRR  
(301) 492-1194

H. Ornstein, AEOD  
(301) 492-4439

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED  
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
88-46, Supp. 4	Licensee Report of Defective Refurbished Circuit Breakers	9/11/89	All holders of OLs or CPs for nuclear power reactors.
89-65	Potential for Stress Corrosion Cracking in Steam Generator Tube Plugs Supplied by Babcock and Wilcox	9/8/89	All holders of OLs or CPs for PWRs.
89-64	Electrical Bus Bar Failures	9/7/89	All holders of OLs or CPs for nuclear power reactors.
89-63	Possible Submergence of Electrical Circuits Located Above the Flood Level Because of Water Intrusion and Lack of Drainage	9/5/89	All holders of OLs or CPs for nuclear power reactors.
89-62	Malfunction of Borg-Warner Pressure Seal Bonnet Check Valves Caused By Vertical Misalignment of Disk	8/31/89	All holders of OLs or CPs for nuclear power reactors.
89-61	Failure of Borg-Warner Gate Valves to Close Against Differential Pressure	8/30/89	All holders of OLs or CPs for nuclear power reactors.
88-48, Supp. 2	Licensee Report of Defective Refurbished Valves	8/22/89	All holders of OLs or CPs for nuclear power reactors.
89-60	Maintenance of Teletherapy Units	8/18/89	All NRC Medical Teletherapy Licensees.
89-59	Suppliers of Potentially Misrepresented Fasteners	8/16/89	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License  
CP = Construction Permit

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\*Tech Ed  
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\*EAB:DOEA:NRR  
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9/5/89

\*C:EAB:DOEA:NRR  
CChaughey  
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No specific action or written response is required by this information notice. If you have any questions about this matter, please contact one of the technical contacts listed below or the Regional Administrator of the appropriate regional office.

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Office of Nuclear Reactor Regulation

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EAB:DOEA:NRR  
TJCarter  
9/5/89

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9/5/89

*MA*  
C:EAB:DOEA:NRR  
CHAughney  
9/6/89

*Seen by Ray and comments incorporated*  
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*With noted change Rec'd via*  
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CHBerlinger HORNSTEIN  
9/6/89 9/5/89

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