SSINS No.: 6835
IN 86-57

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

July 11, 1986

IE INFORMATION NOTICE NO. 86-57: OPERATING PROBLEMS WITH SOLENOID OPERATED VALVES AT NUCLEAR POWER PLANTS

Addressees:

All nuclear power reactor facilities holding an operating license or a construction permit.

Purpose:

This notice is to advise recipients of a series of valve failures that have occurred recently at several nuclear power plants. It is expected that recipients will review the events discussed below for applicability to their facilities and consider actions, if appropriate, to preclude similar valve failures occurring at their facilities. However, suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

The NRC has received reports from licensees of operating nuclear power plants involving failures of certain valves that are actuated by solenoid operated valves (SOVs) to operate properly. These failures have adversely affected the intended functions of the main steam isolation system, pressure relief and fluid control systems. Attachment 1 to this information notice describes the failure events and the corrective actions taken.

Discussion:

In most of the cases described in Attachment 1, the cause for triggering the event was attributed to a malfunctioning SOV that served as a pilot valve. This in turn resulted in the malfunction of the associated main valve. The failures of the SOVs can be traced to the following different causes: (1) potentially high-temperature ambient conditions are not being continuously monitored in areas where SOVs are installed and operating in an energized state, (2) hydrocarbon contaminants, probably because backup air systems (e.g., plant service or shop air systems) are being used periodically and are not designed to "oil-free" specifications as required for Class IE service, (3) chloride contaminants causing open circuits in coils of the SOVs, possibly as a result of questionable handling, packaging, and storage procedures, (4) an active replacement parts program associated with the elastomers and other short-lived subcomponents used in SOVs has not been adequately maintained, and (5) lubricants have been used excessively during maintenance. ASCO provides installation and maintenance

b. Viton has superior high-temperature performance when compared to EP and is impervious to hydrocarbons. Its major disadvantage is that it is less resistant to radiation than EP by a factor of ten. ASCO recommends Viton for applications that are not oil-free and where radiation levels do not exceed 20 megarads.

On the basis of a licensee review of the Brunswick Station maintenance history, which showed the performance of Viton to be satisfactory in ASCO valves, and the available literature and industry experience, the licensee replaced all Unit 2 dual solenoid valves with valves having Viton seats and seals. Because Viton has a 20-megarad limit, the licensee plans to replace these elastomers every 3.3 years to meet environmental qualification requirements for the MSIV application.

After replacing the faulty valves with valves having Viton disc and seal material, the licensee experienced several SOV failures resulting from open circuits of the dc coils on Unit 2. (Brunswick Station employs ASCO NP8323A36V valves that use one ac coil and one dc coil in applications using the subject dual solenoid valve.)

On October 5, 1985, the dc coils of two MSIVs failed during the performance of post-maintenance testing of the MSIVs. Investigation into the failures indicated an open circuit in the dc coils. The coils were replaced and the valves subsequently retested satisfactorily.

On October 15, 1985, an unplanned closure of an MSIV occurred while Unit 2 was operating at 99 percent full power. Closure of the MSIV occurred when the ac solenoid coil portion of the MSIV associated SOV was de-energized in accordance with a periodic test procedure. It was not known then that there was an open circuit in the associated dc solenoid coil portion of the dual SOV. Consequently, when the ac coil was de-energized, closure of the MSIV resulted. The failed dc coil was replaced and then retested satisfactorily.

Investigation into the failures of the dc coil by the licensee determined that the failures appeared to be separation of the very fine coil wire at the junction point where it connects to the much larger field lead. This connection point is a soldered connection that is then taped and lacquered.

Further analysis of the coils (two failed dc coils plus five spares from storage) by the CP&L Research Center indicated the separation might be corrosion induced by chloride contaminants. To date, the licensee and ASCO are unable to determine the source of the chloride. However, followup investigation by the NRC revealed that ASCO had previously experienced similar dc coil open circuit anomalies after a surface shipment of SOVs overseas to Japan. At that time, ASCO believed that the salt water ambient conditions during shipping may have been the source of the chlorine-induced failures. ASCO recommends specific handling, packaging, and storage conditions for spare parts and valves at facilities.

The licensee initiated a temporary surveillance program to monitor operability of the solenoid coils on October 16, 1985. A modification was performed to install a voltage dropping resistor in the individual coil circuits so that they can be monitored directly from cabinets in the control room. This allows continuity of the coil circuitry to be verified by measuring a voltage drop across the resistor. According to the licensee, until the cause for failure can be determined, plans are to check the coil circuitry for continuity on a daily basis.

2. Scram Discharge Solenoid Valve Failure

In November 1985, Carolina Power and Light's Brunswick facility experienced problems with several scram discharge SOVs. The problems were identified during periodic surveillance testing to determine the single rod insertion times and resulted in several rods with slow insertion times. Initial troubleshooting isolated the problem to the SOVs in the scram discharge line for two of the control rods, which were subsequently replaced and tested satisfactorily.

The licensee disassembled the failed SOVs, which were manufactured by ASCO (Model HV-90-405-2A), for failure analysis. When the valves were disassembled, it was noted that copious amounts of silicone lubricant had been applied by the licensee to all gaskets, seals, and diaphragms internal to the valves during previous routine maintenance. The licensee believes that the excessive amount of lubricant may have blocked some of the valves' internal passages or caused sticking of the diaphragms, thereby contributing to the slow insertion times. The technical manual for the subject valves states that body passage gaskets should be lubricated with moderate amounts of Dow Corning's Valve Seal Silicone Lubricant or an equivalent high-grade silicone grease.

The licensee conducted successful scram tests on all other rods. A periodic retest of 10 percent of the control rods every 120 days as required by the Technical Specifications provides sufficient assurance that this problem does not exist in other SOVs. In addition, the licensee stated that maintenance procedures and practices would be reviewed and modified, as required, to prevent the application of excessive amounts of lubricant during repair or overhaul of components.

Haddam Neck Nuclear Power Plant

On September 10, 1985, the Haddam Neck Nuclear Power Plant was operating at 100 percent power when one of the six SOVs in the auxiliary feedwater system (AFW) failed to change state when de-energized. This failure was detected during the performance of a preventive maintenance procedure developed to periodically cycle each of the six SOVs to prevent a sticking problem similar to SOV failures previously experienced on November 2, 1984. In that earlier event, two feedwater bypass valves failed to open automatically and the cause was determined to be sticking SOVs. The faulty SOV was ASCO Model NP8320A-185E and the licensee has been unable to determine the cause of the malfunction. The

Attachment 2
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LIST OF RECENTLY ISSUED
IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
86-56	Reliability Of Main Steam Safety Valves	7/10/86	All PWR facilities holding an OL or CP
86-55	Delayed Access To Safety-Related Areas And Equipment During Plant Emergencies	7/10/86	All power reactor facilities holding an OL or CP
86-54	Criminal Prosecution Of A Former Radiation Safety Officer Who Willfully Directed An Unqualified Individual To Perform Radiography	6/27/86	All holders of by-product, source, or special nuclear material
86-53	Improper Use Of Heat Shrinkable Tubing	6/26/86	All power reactor facilities holding an OL or CP
86-52	Conductor Insulation Degradation On Foxboro Model E Controllers	6/26/86	All power reactor facilities holding an OL or CP
86-51	Excessive Pneumatic Leakage In The Automatic Depressurization System	6/18/86	All BWR facilities holding an OL or CP
86-50	Inadequate Testing To Detect Failures Of Safety-Related Pneumatic Components Or Systems	6/18/86	All power reactor facilities holding an OL or CP
86-49	Age/Environment Induced Electrical Cable Failues	6/16/86	All power reactor facilities holding an OL or CP
86-48	Inadequate Testing Of Boron Solution Concentration In The Standby Liquid Control System	6/13/86	All BWR facilities holding an OL or CP

OL = Operating License
CP = Construction Permit