UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

December 1, 1995

NRC INFORMATION NOTICE 95-53: FAILURES OF MAIN STEAM ISOLATION VALVES AS A RESULT OF STICKING SOLENOID PILOT VALVES

Addressees

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

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to a potential problem involving the failure of main steam isolation valves (MSIVs) to close because of sticking solenoid pilot valves. 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 are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On February 18-19, 1995, while LaSalle County Station, Unit 2, was entering into a refueling outage, the control room was unable to close two outboard MSIVs. The MSIVs at LaSalle use Ralph A. Hiller electrically operated pneumatic actuators. The actuator has a pneumatic control assembly, which was designed to use an Automatic Switch Company (ASCO) Model NP8323 solenoid-operated valve (SOV) as the pilot valve to control the opening and closing of the MSIVs. The ASCO NP8323 SOV (see Figure 1) is a dual-coil, 3-way solenoid valve, which is commonly used in both foreign and domestic MSIV applications. The testing interval for the MSIVs that failed had been extended to 118 days from the usual period of 92 days.

On June 11, 1995, LaSalle Unit 1 experienced a similar failure in that one of the outboard MSIVs failed its 30-day surveillance test. Two internal parts of the SOV (the core and the plugnut) stuck together for approximately 15 seconds.

Discussion

Commonwealth Edison (ComEd), the licensee for LaSalle County Station, initiated an investigation and determined that the ASCO solenoid valves had failed to operate because the core (item 9 in Figure 1) and the plugnut (item 8) had stuck together. The root cause of the sticking of the two pieces appeared to be the presence of a lubricant (Nyogel 775A) and a thread sealant (Loctite PST 550 or Neolube 100), which had formed an adhesive film between the core and the plugnut (see NRC Inspection Reports 50-373 & 50-374/95003, 4, 5, and 9 covering inspections at LaSalle between February and July 1995, and 99900369/95-01 which provides details of an NRC vendor inspection at ASCO on March 13-14, 1995).

Neither ComEd, ASCO, General Electric (GE), nor the NRC inspectors were able to conclusively determine how the lubricant or thread sealant got on the core and the plugnut. The thread sealant cures only under anaerobic conditions. If the thread sealant was improperly installed on any of the connecting pipe fittings, or not allowed to cure for 24 hours before air was blown through the pneumatic actuator, some of the uncured thread sealant could migrate through the system. Additionally, on the basis of NRC staff observations of the ASCO assembly techniques and discussions with ASCO personnel, it was concluded that the ASCO NP8323 assembly and testing methods could have allowed inadvertently applied lubricant (Nyogel 775A) to be transferred to the core and/or plugnut during fabrication or operational testing activities.

Extensive testing was performed by both ComEd and ASCO in an attempt to determine the root cause of the sticking SOVs. ComEd concluded that the Nyogel 775A lubricant used during assembly at the factory was applied in sufficient quantity to deposit a film on the core and plugnut interface. Although the Nyogel 775A alone would not cause the SOV to stick, the licensee believes that the Nyogel film acted as a collection point for microscopic amounts of uncured thread sealant that migrated through the pneumatic actuators, and over time enough thread sealant accumulated to cause the SOVs to stick. The licensee noted that all three of the installed valves that failed were found to have Nyogel present at the core and plugnut interface.

GE and ASCO determined from their testing that Nyogel 775A lubricant would not develop sufficient adhesive force between the core and the plugnut to cause them to stick. However, their testing showed that uncured thread sealant applied to the core and plugnut interface could cause the core and the plugnut to stick together and prevent operation of the SOV.

Long-term corrective measures taken by LaSalle personnel included better control of the use of thread sealant and the replacement of ASCO NP8323 solenoid valves with valves made by a different manufacturer (Valcor). Four of the eight Unit 2 MSIV solenoid valves were replaced with the new valves. The remaining four MSIV solenoid valves had the same model ASCO valves reinstalled. Before installation, the licensee returned the valves to ASCO for inspection and cleaning. During inspection at the factory before the valves were cleaned, some lubricant was found on the plugnut of one of the returned valves. To ensure only clean valves would be used, new valves were assembled without using internal lubricants and returned to LaSalle.

After the event of June 11, 1995, ComEd did not have enough ASCO valves for the Unit 1 replacement and obtained four additional valves from an east coast utility. One of the valves from the other utility was found to have a material that appeared (and was subsequently analyzed) to be Nyogel 775A on the core. This utility had 45 valves left in stock. Other utilities also had a supply of the valves.

Problems with sticking of model NP8323 valves in MSIV applications were first identified in the mid to late 1980s. Some boiling-water reactor (BWR) plants experienced failure of the valves as a result of degradation of the ethylene propylene elastomers and contamination of the valve internals by a foreign material. The foreign material was not present in sufficient amounts to be identified at the time. ASCO issued a field notification to the industry that it was discontinuing the NP8323 product line on October 27, 1989, mainly because of concerns over the degradation of the elastomers. The vendor recommended that NP8323 valves be removed from MSIV applications in as timely a manner as possible, and as an interim measure manufactured NP8323 valves with Viton elastomers (because of its superior performance at high temperatures) until September 1, 1990.

After the LaSalle event in February 1995, the vendor issued a service bulletin recommending that any plant continuing to use the NP8323 valves for MSIV applications reconsider such usage.

<u>Related Generic Communications</u>

Problems with lubricants or thread sealants contaminating solenoid valve internals are not new. The staff issued Generic Letter 91-15, "Operating Experience Feedback Report, Solenoid-Operated Valve Problems at U.S. Reactors," to distribute NUREG-1275, Volume 6, to the industry. This document contained the NRC staff analysis of recent experience with SOVs at U.S. light-water reactors (primarily 1984-1989). Appendix D to NUREG-1275, Volume 6, listed NRC generic communications on SOVs. Five of the information notices listed discuss the sticking of solenoids as a result of contamination of valve internals from maintenance activity by the licensee or manufacturer assembly.

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 Office of Nuclear Reactor Regulation (NRR) project manager.

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Attachments:
1. Figure 1 - ASCO NP8323 3-Way Pilot Solenoid Valve
2 List of Recently Issued NRC Information Notices

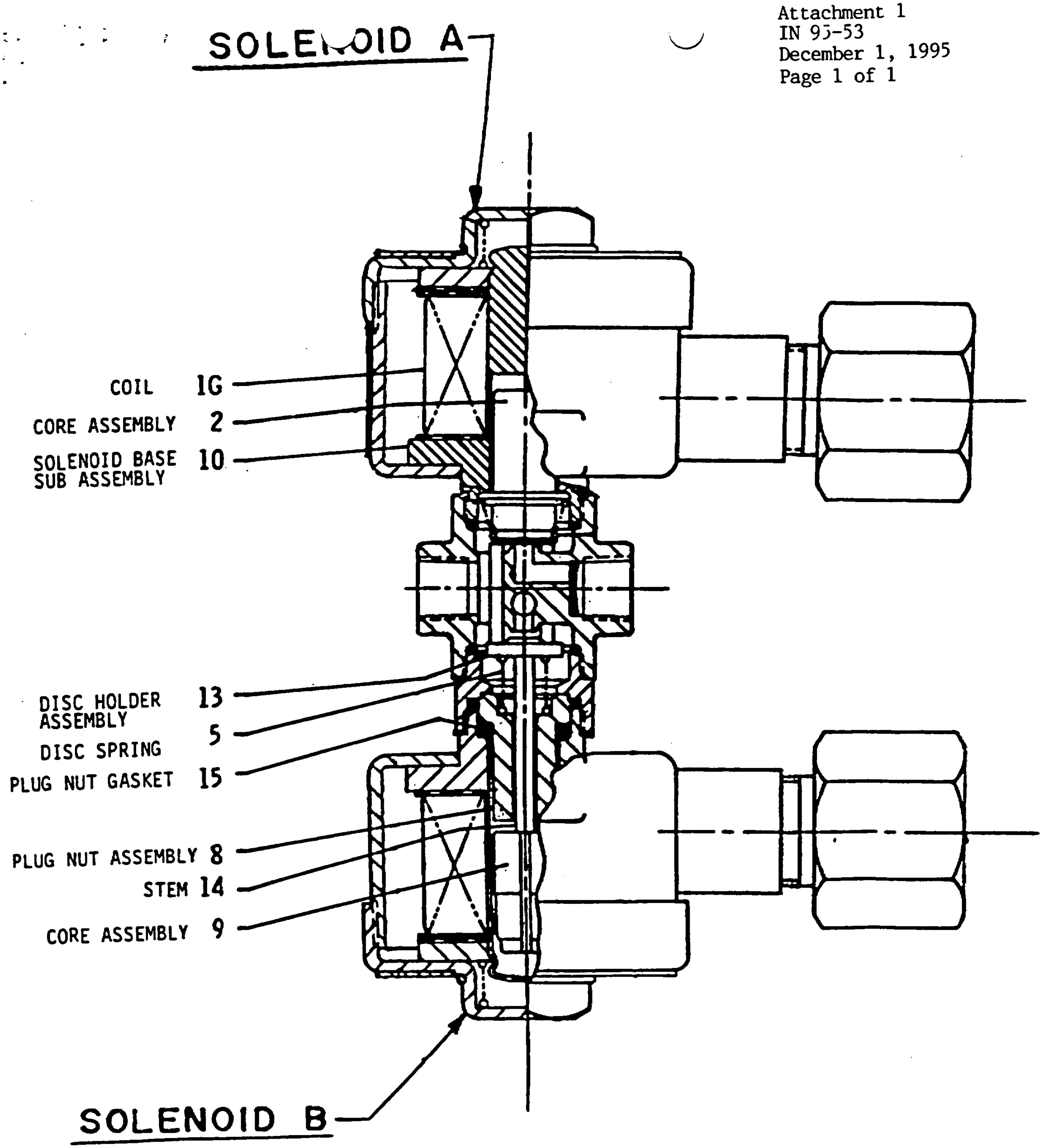

Figure 1 - ASCO NP8323 3-Way Pilot Solenoid Valve

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
95-47, Rev. 1	Unexpected Opening of a Safety/Relief Valve and Complications Involving Suppression Pool Cooling Strainer Blockage	11/30/95	All holders of OLs or CPs for nuclear power reactors.
94-13, Supp. 2	Control and Oversight of Contractors during Re-fueling Activities and Clarificaiton of Applica-bility of Section 50.120 of Title 10 of The Code of Federal Regulations to Contractor Personnel	11/28/95	All holders of OLs or CPs for nuclear power reactors.
95-13, Supp. 1	Potential for Data Collection Equipment to Affect Protection System Performance	11/22/95	All holders of OLs or CPs for nuclear power reactors.
91-29, Supp. 3	Deficiencies Identified during Electrical Distribution System Functional Inspections	11/22/95	All holders of OLs or CPs for nuclear power reactors.
94-86, Supp. 1	Legal Actions Against Thermal Science, Inc., Manufacturer of Thermo-Lag	11/15/95	All holders of OLs or CPs for nuclear power reactors.
95-52	Fire Endurance Test Results for Electrical Raceway Fire Barrier Systems Constructed from 3M Company Interam Fire Barrier Materials	11/14/95	All holders of OLs or CPs for nuclear power reactors.
95-51	Recent Incidents Involving Potential Loss of Control of Licensed Material	10/27/95	All material and fuel cycle licensees.

OL = Operating License
CP = Construction Permit

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Attachments:
1. Figure 1 - ASCO NP8323 3-Way Pilot Solenoid Valve
2. List of Recently Issued NRC Information Notices

Attachments filed in Jacket

TechEd reviewed this document via email 10/31/95.
* Previously concurred

OFC	PECB:DRPM	C/PECB:DRPM	D/DRPM
NAME	DSkeen*	AChaffee*	DCrutchfield
DATE	10/31/95	11/13/95	11/27/95

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OFC	PECB:DRPM	R-III	PSIB:DISP	D/DISP
NAME	DSkeen*	ESchweibinz*	JPetrosino*	FGillespie*
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DATE	11/13/95	/ /95

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OFC	C/PECB:DRPM	D/DRPM
NAME	~~AChaffee~~ ACC	DCrutchfield
DATE	11/13/95	/ /95

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