U.S. NUCLEAR REGULATORY COMMISSION

REGION I

Report Nos. 50-387/84-35; 30-388/84-44

Docket Nos. 50-387 (CAT C); 50-388 (CAT B2)

License Nos. NPF-14; NPF-22

Licensee: Pennsylvania Power and Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Facility Name: Susquehanna Steam Electric Station

Inspection At: Salem Township, Pennsylvania

Inspection Conducted: October 13 - 22, 1984

Inspectors:	Jack Strosnider for R. H. Jacobs, Senior Resident Inspector	11/15/84 date
	Jack Strosnider for L. R. Plisco, Resident Inspector	11/15/84 date
Approved by:	Jack Strosnider Jack Strosnider, Chief, Reactor Projects Section 1C, DPRP	11/15/84 date

Inspection Summary: Inspection conducted on October 13 - 22, 1984 (Report No. 50-387/83-35)

Areas Inspected: A special safety inspection was performed by the Resident Inspectors (93 hours) of the circumstances involved with the failure of four scram pilot solenoid valves during individual rod scram testing on Unit 1 on October 6, 1984. The inspection consisted of a review and evaluation of: scram pilot solenoid valve (SPSV) function, licensee actions following identification of the SPSV failures, scram time surveillance testing, SPSV maintenance history and Unit 1 scram discharge volume vent and drain pilot valve inoperability.

DETAILS

1.0 Sequence of Events

10/06/84 Unit 1 at 60% power. Individual rod scram testing performed on 10% of rods on Unit 1. Two rods failed to scram. Testing was expanded to include all 185 rods. Final results were 4 rods failed to scram and 9 rods hesitated before scramming.

10/07 The four failures were determined to be caused by the scram pilot solenoid valve (SPSV). These four valves were replaced.

10/07 Licensee formed a task force to investigate SPSV failures. One valve was sent to GE and one to Franklin Institute for analysis.

10/12 GE informed PP&L that the SPSV failures were due to the disc holder subassembly adhering to the valve seat. The disc material was polyurethane. GE recommended that the polyurethane be replaced with Viton-A.

10/12 Unit 1 commenced a reactor shutdown at 9:10 p.m. since all other SPSVs also had polyurethane discs. Unit 2 commenced a reactor shutdown at 9:50 p.m. Ninety-three of the 185 Unit 2 SPSVs had polyurethane disc material. ENS calls were properly made on the above.

10/13 Unit 1 in Hot Shutdown at 4:00 a.m., Unit 2 in Hot Shutdown at 5:12 a.m.

10/14-15 New disc holder subassemblies with the Viton-A material were installed in all 185 SPSVs on Unit 1.

10/16 Meeting in Bethesda with PP&L, GE, Region I and NRR to discuss SPSV problem.

10/17 Unit 1 reactor critical at 12:34 a.m. Unit 2 reactor critical at 9:45 p.m. following replacement (and/or inspection) of all SPSV disc holder subassemblies. NRC issued Confirmatory Action Letter (CAL).

10/18 Unit 1 conducting individual rod scram testing of all rods. The licensee discovered that the 18 month surveillance interval on the scram discharge volume (SDV) vent and drain valve timing was past due. At 9:21 p.m., Unit 1 was manually scrammed from 55 percent power to perform the surveillance. The SDV vent valve closed in 32.4 seconds exceeding the Technical limit of 30 seconds.

10/19-20 The pilot solenoid valve for the Unit 1 SDV vent valve was replaced with a pilot solenoid valve manufactured by Valcor. Unit 2 conducting rod testing.

10/21 Unit 1 returned to criticality at 3:52 a.m. and was scrammed at 1:29 p.m. to meet the SDV vent and drain valve surveillance requirement following the pilot valve replacement.

10/22 Unit returned to criticality at 12:35 a.m. and increased power to continue rod testing.

2.0 Description of Scram Pilot Solenoid Valves

The Scram Pilot Solenoid Valves (SPSV) are a three-way, solenoid-operated, normally energized valve. During normal reactor operations, each of the two channels of the Reactor Protection System (RPS) energizes one of the pilot valve solenoids. When energized, the pilot valve allows instrument air to be supplied to the diaphragm actuators of the inlet and outlet scram valves, holding these valves shut. Upon initiation of a scram, both channels of the RPS de-energize and both pilot valve solenoids de-energize, rapidly venting air pressure from the scram inlet and outlet valves, and allowing them to open to scram the control rod.

To prevent inadvertent scrams of a single rod, both pilot valve solenoids must be de-energized before air is vented from the scram valves. De-energizing only one of the two solenoids will not result in a scram because the remaining coil is sufficient to maintain the valve in a configuration that allows air to continue to be supplied to the scram valves through the pilot valve. There are 185 scram pilot solenoid valves installed on each unit (1 per control rod.)

For added reliability, the Control Rod Drive (CRD) Instrument Air System has two DC solenoid operated, three-way air valves installed on the supply header called backup scram valves. The air supplied to the Hydraulic Control Units (HCUs) and the scram discharge volume vent and drain valves passes through these two valves. As a backup to the individual SPSV and scram discharge volume vent and drain valves, the backup scram valves are energized by the Reactor Protection System (RPS) on a scram and vent the entire CRD Instrument Air System.

Units 1 and 2 utilize an Automatic Switch Company (ASCO) three-way, diaphragm type, redundant piloted solenoid valve (ASCO Part No. HV-176-816-1, GE Part No. 9220138) for the SPSV. The valves are of brass construction. Figure 1 shows internal components of the valve. When the valve is energized (both solenoids), the inlet port from the external air supply (instrument air) is open to the scram inlet and outlet valves, and the exhaust port is closed. The disc holder subassembly contains a polyurethane disc which covers the valve exhaust port on the 'B' solenoid side. When both solenoids de-energize, the disc holder subassembly moves away from the exhaust port and the core assembly of the A solenoid closes the air inlet port, this action allows air to bleed off the scram inlet and outlet valves thus causing control rod insertion.

3.0 Licensee Actions

3.1 October 6, 1984 Surveillance Test and Followup Actions

On October 6, 1984, the licensee commenced quarterly individual rod scram testing on ten percent of the Unit 1 rods as required by Technical Specification (T.S.) 4.1.3.2. At approximately 9:05 a.m. control rod 42-23 failed to insert after the test switches were placed in the test position. The test was repeated three times and each time the rod failed to scram. Instrument and Controls (I&C) technicians investigated the problem and when they tapped the solenoid valve the rod scrammed. The rod was then full withdrawn and retested. The retest at 9:40 a.m. was satisfactory. When rod testing continued, rod 42-39 also initially failed to insert at 10:30 a.m. and when an operator tapped the solenoid valve, the rod inserted as designed.

The licensee then decided to individually scram test all 185 Unit 1 rods. Two additional rods (i.e. 58-31 and 38-39) failed to scram during this testing and 9 other rods hesitated initially when tested. Rods 38-39 and 58-31 subsequently scrammed when operators tapped their solenoid valves and then passed a retest when withdrawn again. Of the rods that hesitated, none exceeded the required maximum insertion time of seven seconds.

During the testing the appropriate T.S. Limiting Condition for Operation (LCO) was properly entered when individual rods were determined to be inoperable. The LCO's were cleared following successful retests.

On October 7, the scram pilot solenoid valves (SPSV) were replaced on the four rods which did not scram. The licensee set up a task force consisting of plant staff and Nuclear Plant Engineering (NPE) engineers to investigate the SPSV failures. One of the replaced SPSVs was sent to GE, San Jose, California for analysis of the failure mechanism and another was sent to Franklin Institute.

3.2 GE Analysis Results and Plant Shutdowns

On October 12, 1984, GE informed PP&L that it was GE's judgement that the SPSV failed due to the disc holder subassembly disc sticking to the seat on the valve body. The sticking was due to a degradation of the polyurethane disc material. GE, as a product upgrade changed the disc material to Viton-A. The Viton-A material was subsequently incorporated into ASCO spare part kits for these valves, beginning in 1982, although an immediate replacement for existing valves apparently was not deemed necessary. Viton-A was an environmentally qualified material. The polyurethane disc was designed for temperatures up to 220° F. However, based on the service temperatures of the valves, the polyurethane material apparently degrades at temperatures near 160 F. Licensee testing found that the skin temperature of the SPSV when energized was approximately 140° F.

Based on this information and the determination that most if not all of the SPSVs on both units were affected, the licensee decided to shutdown both Units 1 and 2. Unit 1 shutdown was commenced at about 9:10 p.m. on October 12 and the unit was in Hot Shutdown at 4:00 a.m. October 13. Unit 2 shutdown was commenced at about 9:50 p.m. on October 12 and Hot Shutdown was achieved at 5:17 a.m. October 13. Unit 2 subsequently went to Cold Shutdown at about 5:00 p.m. to conduct unrelated maintenance.

3.3 Component Replacement

ASCO spare part kits containing the Viton-A disc were obtained by the licensee and the disc holder subassemblies were extracted from the spare part kits and installed in all 185 SPSVs on Unit 1 during October 13 thru October 15. These valves were functionally tested by observing the scram inlet and outlet valves stroking when the individual rod test switches were actuated. Additionally, individual rod testing was performed while shutdown. The backup scram valves and the scram discharge volume (SDV) vent and drain pilot valves on Unit 1 were also rebuilt with new Viton-A discs. Subsequently, on October 17, Unit 1 returned to power and individual rod testing on all rods was conducted at approximately 50 percent power.

On Unit 2, the licensee determined that 93 of the SPSVs had been previously rebuilt in April 1983 using ASCO spare part kits containing the Viton-A disc. The licensee installed the new disc subassembly in the remaining SPSVs and also inspected the ones that were previously rebuilt to ensure that they contained the Viton-A disc. New disc holder subassemblies were also installed in the backup scram valves. The Unit 2 scram discharge volume vent and drain pilot valves, manufactured by Valcor were not affected.

Inspector review of these activities identified no unacceptable conditions.

4.0 NRC Response (Region I and Headquarters)

NRC Headquarters was notified, via ENS call on October 12, of the defective SPSVs and of the licensee's decision to shutdown Units 1 and 2. On October 15, at the request of Region I, the licensee committed to remain below 5% power pending the results of a meeting in Bethesda, Maryland on the following day to discuss the SPSV problem. At the meeting, the licensee committed to the following actions:

-- scram-time test all 185 rods, on each unit, when a 50 - 60% power level is reached

-- develop a surveillance procedure to unambiguously assess scram pilot valve operability, to be submitted to and approved by NRC prior to implementation, and performed every 4 to 6 weeks

-- trend and report immediately to NRC, via the ENS network, any failures or anomalies found during scram solenoid valve operability tests, or individual control rod scram time testing (normally performed for a 10% rod sample every 4 months)

-- provide the failure analysis results from Franklin Research Center and General Electric testing on the original valves which failed

On October 17, Region I issued a Confirmatory Action Letter confirming the above commitments. These actions will be reviewed in subsequent inspections. (387/84-35-01)

5.0 NRC Followup Review (Resident Onsite)

Inspector review of the SPSV failures focused on the following aspects: (1) monitoring licensee actions to replace the SPSV disc holder subassemblies, (2) determining the reportability aspects of the October 6 SPSV failures, (3) review of maintenance history of SPSVs (4) review of scram timing history, and (5) post-maintenance testing. Item (1) was discussed in section 3.0. The remaining items are discussed below.

5.1 Reportability

Following discovery of the SPSV failures on October 6, the licensee prepared Significant Operating Occurrence Report (SOOR) 1-84-370. The SOOR did not indicate that this occurrence was reportable by 10 CFR 50.72 and no ENS call was made. The inspector reviewed the 50.72 reportability criteria and discussed reportability with the licensee. Based on the inspector's review, no report of this occurrence was required per 50.72. 10 CFR 50.72 reports were made on October 12, informing the NRC of initiation of plant shutdown.

5.2 Maintenance History

The inspector reviewed maintenance records of SPSV maintenance on Units 1 and 2 to determine if previous indications of SPSV sticking existed.

In August 1981, prior to licensing, new SPSVs were installed in all Unit 1 HCUs because of a powdered granular substance (apparently rust) found in four of the valves. In June and July 1982, just prior to Unit 1 licensing, new SPSVs were installed on half of the Unit 1 HCUs and the other half were obtained from Unit 2, rebuilt and installed on Unit 1. This action was taken because of a concern with Buna-N parts. GE Service Information Letter (SIL) 128 recommended rebuilding these valves periodically to ensure Buna-N parts are not used in excess of seven years. The rebuild kits did not contain the Viton-A disc material. Other maintenance on SPSVs since that time has consisted of replacement of SPSVs on several HCUs due to air leaks and burned up solenoids. No maintenance due to sticking SPSVs was noted in the document review on Unit 1.

With respect to Unit 2, as noted in Section 3.3, only one half of the SPSVs had polyurethane discs. In April 1983, I&C personnel had rebuilt about one half of the Unit 2 SPSVs for replacement of Buna-N parts. The spare part kits used for these valves contained discs made of Viton-A material. The remainder of the Unit 2 valves were replaced with new SPSVs which apparently did not contain the Viton-A disc. These actions were taken because of recommendations in SIL No. 128.

Other maintenance involved replacement of SPSVs on several HCUs due to air leaks. In April 1984, during rod testing conducted during initial fuel loading, two rods (i.e., 38-03 and 58-23) failed to insert when the test switches were replaced in test. The SPSVs for these HCUs were replaced. The inspector examined the removed valves. These valves had small crimps in one solenoid shaft which may have been caused by someone stepping on the valves during construction. The polyurethane disc in the valves was not degraded. Hence, this valve problem is not considered a precursor to the October 6 SPSV problem. Another rod (rod 38-15) had a slow scram time during the April rod testing. Valve stroking of scram valves on this HCU was checked with no problems found.

5.3 Scram Time History

5.3.1 Surveillance Testing

The inspector reviewed the licensee's surveillance testing program utilized to measure the maximum and average scram insertion times of each control rod in accordance with Technical Specifications 4.1.3.2, 4.1.3.3, and 4.1.3.4, which delineate the timing requirements for the control rods.

Surveillance Requirement 4.1.3.2 states that the scram insertion time of the control rods shall be demonstrated through measurement, with reactor coolant pressure greater than or equal to 950 psig for: (1) all control rods prior to exceeding 40 percent thermal power after reactor shutdowns greater than 120 days; (2) specifically affected individual control rods following maintenance or modification; and (3) at least 10% of the control rods, on a rotating basis, at least once per 120 days of operation. The maximum scram insertion time is measured from the de-energization of the scram pilot valve solenoids as time zero, with the rod fully withdrawn.

The following three surveillance procedures were reviewed to ascertain whether the procedure was adequate to meet the Technical Specification requirements:

-- SR-155-001, Revision 0, Scram Time Measurement of All Operable Control Rods

-- SR-155-002, Revision 0, Scram Time Measurement of Rods Following Maintenance or Modification

-- SR-155-003, Revision 0, Scram Time Measurement of Rods Every 120 Days

Due to Susquehanna's unique configuration, the scram times can be obtained by two different methods. One method utilizes a recorder plugged into the Control Rod Test Instrument Panel in the control room. The panel senses when the scram pilot solenoids are de-energized, and records the odd (i.e., 45, 39, etc.) notch positions of the rod as it inserts into the core. The insertion times are calculated by analyzing the strip charts from the recorder. The second method utilizes the General Electric Transient Analysis Recording System (GETARS) computer, which monitors sensor inputs and stores the applicable data, even during an unscheduled full reactor scram. This method must be corrected due to the GETARS scan rate, and because of the time response of the relays that the computer senses. This time correction is properly reflected in the procedure.

The inspector reviewed the completed documentation for the last three Unit 1 surveillance tests which were used to meet the Technical Specification requirements performed prior to October 6, 1984.

On June 13, 1984, Unit 1 scrammed from full power due to the loss of startup transformer T-10. During the unscheduled trip, GETARS obtained scram time data for the 147 control rods that were fully withdrawn. On June 25, this data was utilized to meet Technical Specification surveillance requirements 4.1.3.2, 4.1.3.3, and 4.1.3.4. The surveillance was signed off as being complete and meeting all of the acceptance criteria on July 26 by the individual performing the surveillance and his supervisor.

NRC review of the completed surveillance data on October 18 determined that one of the acceptance criteria of the surveillance was not satisfied. Technical Specification 3.1.3.4 establishes maximum average scram insertion times from the fully withdrawn position to four specific notch positions for the three fastest control rods in each group of four control rods arranged in a two-by-two array. During the scram of June 13, the four rod array containing control rods 38-39, 38-43, 42-39 and 42-43 exceeded the allowable average scram insertion time from the fully withdrawn position (notch 48) to notch 45. The Technical Specification requires the average insertion time not to exceed 0.45 seconds, but the average scram insertion time of the three fastest rods in this array was 0.462 seconds. The following table shows the applicable data:

Position Inserted from Fully Withdrawn	TS Limit on Average Scram Insertion Time (Sec)	Average Scram Insertion Time During June 13 Scram for 4 Rod Array (Sec)
45	0.45	0.462
39	0.92	0.795
25	2.05	1.561
05	3.70	2.641

These data indicated a hesitation of the rods at the initiation of the scram, but the rods fully inserted within the required time. The two slowest rods (38-39 and 42-39) of the four rod array later failed to insert during the rod scram testing on October 6, 1984. The anomaly in the June 13 scram times appears to be a precursor to the October 6 event.

The calculations which determined the scram insertion data were performed by computer. One page of the computer printout specifically indicated that this rod array exceeded the required average scram insertion times. The four rods and the average time were listed under a page heading which stated: "Four Rod Array with Average Three Fastest Rods Exceeding T.S. 3.1.3.4 Limit". On the test data sheet for the surveillance, the individual who performed the surveillance, was required to indicate (by circling YES and initialing) that the acceptance criteria had been satisfied. The fact that the four rod array did not meet the Technical Specification was not noted by either the individual performing the surveillance nor the applicable supervisor who reviewed the completed surveillance. In discussions held with the individual who performed the surveillance, he indicated that he had assumed that since the rods had satisfactorily met the maximum and average scram insertion times that the two-by-two array numbers would also be satisfied. This surveillance test was the first time the individual, and the work group (i.e. Reactor Engineering) had performed the test. Previously it had been performed by the plant engineering staff.

The Technical Specifications required that the control rods with the slower than average scram insertion times be declared inoperable until an analysis was performed to determine that the required scram reactivity remained for the slow four control rod group and to increase the surveillance frequency to at least once per 60 days. Otherwise, the plant was to be in at least Hot Shutdown within the next 12 hours.

During the scram of June 13, 1984, five rods were significantly slower in reaching the notch 45 position than the average of all of the rods. The average time for all of the rods to reach notch 45 was 301 milliseconds, but these five rods exceeded 500 milliseconds. Of these five rods, four of them were the same four that failed to scram and one was one of the nine that hesitated during the surveillance testing on October 6.

The plant restarted on June 14, but the scram timing data was not analyzed until June 25 when the surveillance was performed. Therefore, the inoperability of the four rod array was not identified prior to the startup. A thorough review of the scram time data is normally not performed after each scram, nor is it required. On June 25 when the surveillance was completed, the appropriate Action Statement was not entered since the inoperability was not identified.

The plant operated continuously until another unscheduled scram occurred on July 3, 1984. Inspector review of rod insertion data for that scram indicated that all rod scram insertion times met the Technical Specification requirements. Data was also obtained on a July 15 scram which indicated that all Technical Specification requirements were met. The data from the July 15 scram was also used to meet the surveillance requirement.

With the capabilities of the GETARS, all of the fully withdrawn rods are timed on each scram, and far more data is available than required by Technical Specifications. For example, on the June 13, 1984 scram, data for 147 rods was input into the computer for analysis, but the Technical Specifications only require 19 rods to be tested every 120 days. If the normal quarterly surveillance had been performed instead of using all of the scram data, it is very probable that the Technical Specification nonconformance would not have been detected. During the October 6, 1984 surveillance, the problem again may not have been detected if two of the four failed rods had not been in the 20 rod sample selected.

It should be noted that the data reviewed indicates that the pilot valve hesitation and sticking phenomenon occurred during the June 13 scram, after an 82 day continuous run, and during the October 6, 1984 testing, after a 78 day con-

tinuous run. The mechanism appears to be time dependent and primarily occurs after a long period of operation.

5.3.2 Scram Data Review

The inspector reviewed the GETARS scram insertion time data for eleven scrams on Unit 1 which occurred in the 18 months prior to the October 6, 1984 surveillance testing. Several of the scrams were utilized to meet the surveillance requirements as noted in section 5.3.1. The scram data not utilized for the surveillance was reviewed to determine if any evidence of hesitation occurred during previous scrams. Additionally, the computer generated control rod scram time history file for each individual control rod was reviewed.

The average time of all the control rods to reach notch 45 from the fully withdrawn position was approximately 260 to 270 milliseconds throughout the 18 month time period. The average scram insertion time required by Technical Specifications for the same position is 430 milliseconds.

Several occurrences of rod insertion times greater than 430 milliseconds were noted during the data review:

DATE	ROD	TIME(MS)
March 22, 1983	58-31	626
October 31, 1983	42-27	432
June 13, 1984	42-23	584
	54-47	752
	58-31	975
	42-39	891
	38-39	668
July 3, 1984	58-31	507
	54-47	556
July 15, 1984	54-47	444

Although the above rods apparently hesitated, all of the rods met the Technical Specification maximum and average scram insertion times (except for the four rod array on June 13 noted in section 5.3.1). Of the six rods that hes-

itated, four of them failed to scram and two hesitated on October 6, 1984.

5.4 Post Maintenance Test Witnessing

Between October 18 and 24, 1984, the licensee conducted individual rod scram testing on both Units 1 and 2 from power levels between 50% and 60%. The testing was conducted in accordance with Surveillance Procedures SR-155-002 and SR255-002, "Scram Time Measurement of Rods Following Maintenance or Modification", Revision 0. The inspectors witnessed portions of the testing. No unacceptable conditions were noted. The inspectors will review the test results when available.

6.0 Scram Discharge Volume Vent and Drain Pilot Valve Inoperability

At 2:15 p.m. on October 18, 1984, the licensee discovered that surveillance procedure SO-155-003, SDV Vent and Drain Valve Eighteen Month Operability, was overdue by approximately 15 months. A documentation review identified that the surveillance, which is required by Technical Specification 4.1.3.1.4 every 18 months, was last performed on January 23, 1982. At some unknown time during 1983, it was identified that the original surveillance documentation was misplaced, and on June 2, 1983, a new surveillance authorization cover sheet, with the associated test data attached was generated and signed. Due to an administrative error, the date the form was reproduced (i.e. June 2, 1983) was entered into the surveillance tracking system as the completion date of the surveillance. Therefore, according to the tracking system, the surveillance was not due until December 2, 1984 instead of July 23, 1984.

Technical Specification Surveillance Requirement 4.1.3.1.4.a states that the scram discharge volume shall be determined operable by verifying that the drain and vent valves close within 30 seconds after receipt of a signal for control rods to scram, and open when the scram signal is reset, at least once per 18 months from a normal control rod configuration of less than or equal to 50% rod density. With the SDV system inoperable, the Action statement requires the plant to be in at least Hot Shutdown within 12 hours.

The licensee immediately declared the SDV system inoperable when the overdue surveillance was identified and made the appropriate 10 CFR 50.72 ENS notification. The licensee conducted a data search to determine if documentation was available from previous reactor scrams to show that the vent and drain valves had operated properly, but none was found. At 9:21 p.m. October 18, 1984, the plant was manually scrammed from 55% power in order to conduct the surveillance test.

During the scram, the SDV vent valve closed in 32.4 seconds and the drain valve closed in 26.9 seconds. Since the vent valve did not meet the acceptance criteria of 30 seconds, the SDV remained inoperable and investigation commenced on the cause for the slow stroke time of the vent valve. NRC Region I requested the licensee to inform them of the corrective actions

completed to resolved the inoperability, and to demonstrate that the valves operated in less than 30 seconds prior to the Unit 1 startup.

Two redundant vent valves (XV-1F010A and XV-1F010B) are installed on the 1 inch SDV vent line and each is operated by a separate dual solenoid pilot valve (SV-1F009A and SV-1F009B). The pilot valves also operate their associated drain valve. Currently one vent and one drain valve (XV-1F010B and (XV-1F011B) are mechanically locked open, based on a commitment made in licensee letter PLA-1038, dated April 7, 1981, which discussed IE Bulletin 80-17. The valves are blocked open pending completion of the installation of the redundant vent and drain valve systems required by the end of the first refueling outage by license condition 2.C(17). The redundant valves are to ensure that an uncontrolled loss of reactor coolant would not result in the event of a single active failure. The SDV vent and drain pilot solenoid valves are ASCO, dual-solenoid valves (Part No. HT8323A22), and the vent valves are Hammeldahl Conoflow 500 Series 1 inch globe valves.

On October 18 the licensee issued Work Authorization S44954 to investigate the cause for vent valve XV-1F010A slow stroking. The maintenance technicians initially lubricated the stem and checked the packing, and the valve then operated in 31.5 seconds. Next the air actuator was disassembled, with no deficiencies identified. To retest the vent valve a temporary rig consisting of eight feet of 1/4 inch plastic tubing was used to operate the valve. The vent valve operated in eight seconds. The normal supply line was reinstalled, and the valve operated in 32 seconds. Based on this information the problem was assumed to be with the time required for the pilot valve to vent the approximately 45 feet of one inch air supply header.

A different model of pilot solenoid valve is installed in Unit 2, and preoperational test data indicated that these valves, which are much larger than the ASCO valve, vented the air header significantly faster. The Unit 2 preoperational test, P255.1A, performed on September 24, 1983, found that the vent valve closed in 7.46 seconds from when the scram signal was initiated. The associated drain valve operated in 14.7 seconds.

Initially, it was conceived that this problem could be related to the scram pilot solenoid valve disc material phenomenon, since the pilot valve was also an ASCO pilot solenoid of similar design to the SPSVs. Based on the test data showing the valve consistently operated in 32 seconds, and the fact that the polyurethane disc subassemblies originally installed in the valve were replaced with Viton-A, the reason for the failures does not appear to be related to the SPSV failures.

In order to correct the venting problem, the licensee replaced the ASCO pilot solenoid valve with a Valcor 3-way solenoid valve (Part No. V70900-45) on October 20, 1984. Shutdown testing of the valve following the installation demonstrated that the vent valve would close in approximately six seconds after pilot de-energization.

In addition to replacing the pilot solenoid valve, the licensee conducted a 100 percent documentation review to ensure that no other similar administrative errors were present in their surveillance tracking system. No other deficiencies were found. The licensee also modified the surveillance documentation forms to emphasize the date on which the surveillance was performed rather than the date of the form and created a full time surveillance documentation auditor position. These actions are intended to reduce the potential for incorrect data entries in the surveillance tracking computer system.

The licensee required an emergency Technical Specification change prior to startup, which was issued on October 19, because the Unit 1 Technical Specifications did not allow the unit to be started up with the SDV vent and drain valves inoperable, but the surveillance test required the plant to be at less than 50 percent rod density. The Technical Specification change allowed the unit to enter Operational Condition 2 provided the surveillance was performed within 12 hours after achieving 50 percent rod density.

Based on a review of the test results and discussions with Region I, the licensee restarted Unit 1 and reached criticality at 3:52 a.m. October 21, 1984. At 1:29 p.m. on October 21, the unit was manually scrammed from approximately 7 percent power to perform the Technical Specification surveillance test. The vent valve closure time for the test was 5.2 seconds. Unit 1 returned to criticality at 12:35 a.m. on October 22.

7.0 Technical Specification Adherence

As noted in section 5.3.1, the Technical Specifications require that while in Operational Condition 1 or 2, the average scram insertion time, from the fully withdrawn position for the three fastest control rods in each group of four control rods arranged in a two-by-two array, based on deenergization of the scram pilot valve solenoids as time zero, shall not exceed 0.45 seconds for notch position 45. The applicable action statement requires that with the average scram insertion times of control rods exceeding the insertion time limits, the control rods with the slower than average scram insertion times are to be declared inoperable until an analysis is performed to determine that required scram reactivity remains for the slow four control rod group. Additionally, the surveillance frequency for scram insertion times is to be increased to 60 days. Otherwise the plant is to be in at least Hot Shutdown within the next 12 hours.

Contrary to the above, on June 25, 1984, Surveillance Procedure SR-155-003 was performed using data from a June 13 scram to meet the requirement of Technical Specification 3.1.3.4. The data indicated that the four rod array containing control rods 38-39, 38-43, 42-39 and 42-43 exceeded the allowable average scram insertion time to notch 45, in that the insertion time of the three fastest rods was 0.462 seconds. Since the data was not properly reviewed, and the inoperability not identified, the applicable Action requirements were not completed. This condition remained until a

subsequent reactor scram on July 3, 1984. The surveillance was not reperformed until July 15, 1984.

As noted in section 6.0, Technical Specification Surveillance Requirement 4.1.3.1.4.a states that the scram discharge volume shall be determined operable by verifying that the drain and vent valves close within 30 seconds after receipt of a signal for control rods to scram at least once per 18 months from a normal control rod configuration of less than or equal to 50 percent rod density.

Contrary to the above, at 2:15 p.m. on October 18, 1984, the licensee discovered that Surveillance Procedure SO-155-003, SDV Vent and Drain Valve Eighteen Month Operability, was last performed on January 23, 1982, and was therefore overdue by approximately 15 months. This violation was identified by the licensee and promptly reported to the NRC by an ENS notification. Inspector review determined that the corrective action completed and planned should prevent recurrence. Additionally, it was not a violation that could reasonably be expected to have been prevented by the licensee's corrective action for a previous violation.

Since the criteria for licensee identified violations stated in 10 CFR Part 2 Appendix C have been satisfied, a notice of violation will not be issued, but the corrective actions implemented by the licensee will be reviewed in a subsequent inspection. (387/84-35-03)

8.0 Safety Significance

The event discussed in section 5.2 and 7.0 involved one 2 x 2 rod array exceeding the average scram insertion time from the fully withdrawn position to notch 45. The rods exceeded this time by 10 milliseconds and they met the scram insertion times for the remainder of the rod travel.

The inspector discussed the significance of this event with NRR (members of the Reactor Systems and Core Performance Branches) and reviewed T.S. bases and the FSAR. The purpose of the T.S. scram insertion times are to ensure that the control rods insert reactivity at a rate within the bounds of that assumed in transient and accident analysis. The reactivity insertion rates must bring the reactor subcritical at a rate fast enough to prevent the Minimum Control Power Ratio (MCPR) from becoming less than 1.06 during the limiting power transient analyzed in FSAR chapter 15. The NRR reviewers indicated that exceeding the average scram insertion time during the first few notches of rod insertion has no effect on transient and accident analysis since very little reactivity is inserted. The reactivity insertion rates assumed in analyses are not affected unless the rods are slow in reaching approximately 50 percent rod insertion to the core.

The rod scram time data for the July 3 and July 15 scrams indicate that this four rod array met T.S. insertion times. Based on the time dependency of the failure mechanism of the SPSVs (section 5.3.1), it can also be assumed that these rods would have met the insertion time requirements immediately after the June 13 scram. Hence, the safety significance of these rods not inserting within the required time is minimal.

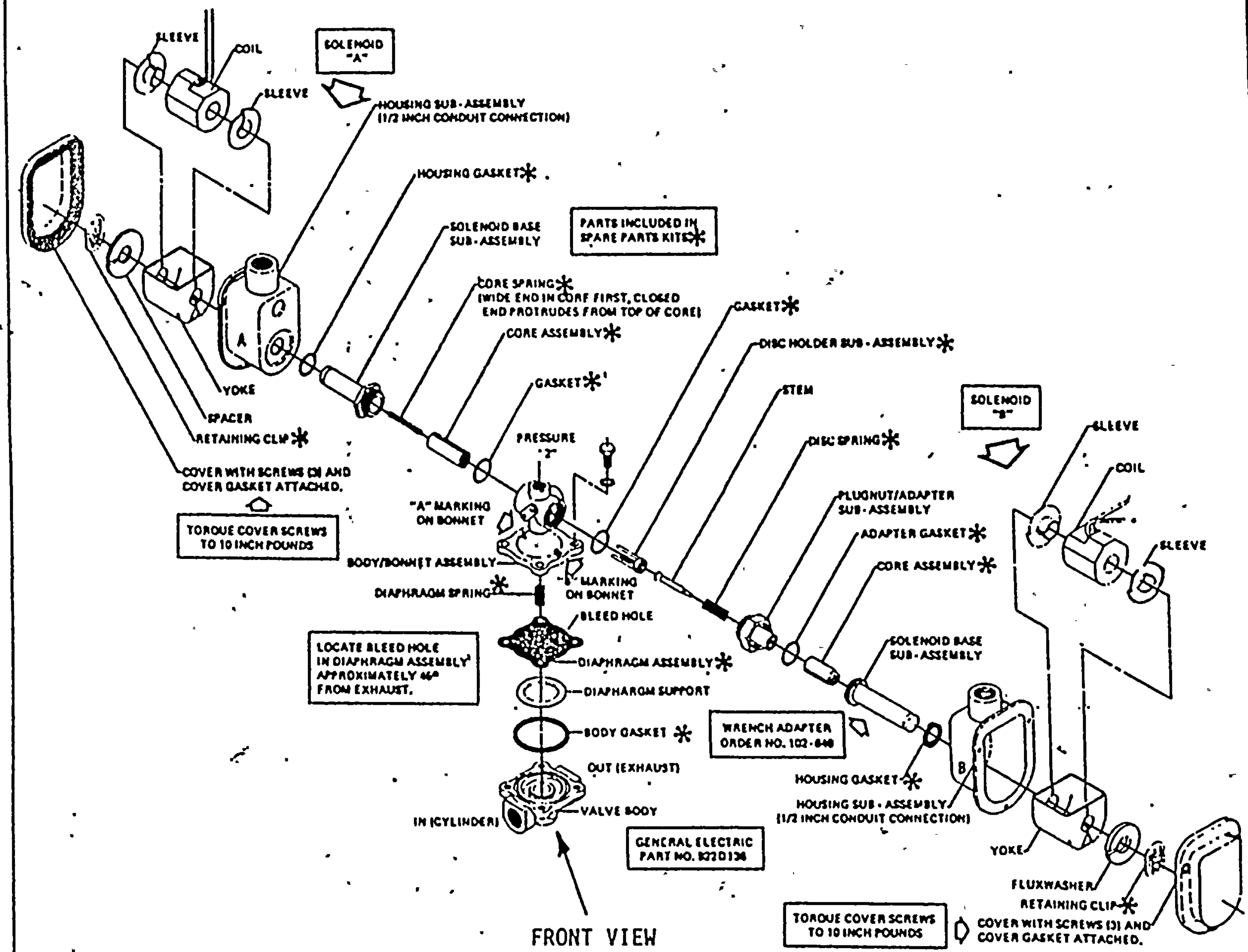
Nevertheless, the event is significant from the point of view that it involved the improper review of surveillance data and the fact that two of the affected rods identified in this occurrence later failed to insert during testing on October 6, 1984.

Since each control rod drive mechanism has its own scram and pilot valves, only one drive can be affected if a scram valve fails to open. In other words, a single failure in a hydraulic control unit would result in the failure of only one control rod. Due to the presence of the inadequate polyurethane material in the SPSV, the potential did exist, however, that a common mode failure could have caused a significant number of rods to be inoperable. The mechanism that could have possibly identified the problem earlier, the surveillance procedure, was not properly reviewed, and therefore the precursor event on June 13 was not investigated. It should also be noted that due to the superior capabilities of the plants computer systems, significantly more data is available, and much more than the required testing is actually completed.

In the event that a large number of individual SPSV's were to fail to open on a scram, the entire air header that supplies the SPSV can be depressurized by either Backup scram valve (SV-1F110A and SV-1F110B). Although the rods would scram at a much slower rate, due to the venting process, the control rods would insert. The four rods did not scram during the October 6 surveillance testing, because only the local test switches were utilized to scram the rod. During the preoperational testing of Unit 1, the time to depressurize the air header for each backup scram valve was 43.3 seconds for F110A and 28.21 seconds for F100B. The backup scram valves are not included in T.S. required surveillance testing. In response to an unrelated issue, the plant intends to test these valves on a refueling interval basis although they have not yet been retested since the preoperational test program.

9.0 <u>Exit Meeting</u>

On October 26, 1984, the inspectors discussed their findings with the Assistant Plant Superintendent and members of his staff.



SLEEVE
COIL
SLEEVE
SOLENOID "A"
HOUSING SUB-ASSEMBLY (1/2 INCH CONDUIT CONNECTION)
HOUSING GASKET*
SOLENOID BASE SUB-ASSEMBLY
PARTS INCLUDED IN SPARE PARTS KITS*
CORE SPRING* (WIDE END IN CORE FIRST, CLOSED END PROTRUDES FROM TOP OF CORE)
CORE ASSEMBLY*
GASKET*
GASKET*
DISC HOLDER SUB-ASSEMBLY*
STEM
DISC SPRING*
YOKE
SPACER
RETAINING CLIP*
COVER WITH SCREWS (3) AND COVER GASKET ATTACHED.
TORQUE COVER SCREWS TO 10 INCH POUNDS
PRESSURE "2"
"A" MARKING ON BONNET
"B" MARKING ON BONNET
BODY/BONNET ASSEMBLY
DIAPHRAGM SPRING*
BLEED HOLE
LOCATE BLEED HOLE IN DIAPHRAGM ASSEMBLY APPROXIMATELY 45° FROM EXHAUST.
DIAPHRAGM ASSEMBLY*
DIAPHARGM SUPPORT
BODY GASKET *
OUT (EXHAUST)
VALVE BODY
IN (CYLINDER)
FRONT VIEW
GENERAL ELECTRIC PART NO. 822D136
SOLENOID "B"
SLEEVE
COIL
SLEEVE
PLUGNUT/ADAPTER SUB-ASSEMBLY
ADAPTER GASKET*
CORE ASSEMBLY*
SOLENOID BASE SUB-ASSEMBLY
WRENCH ADAPTER ORDER NO. 102-848
HOUSING GASKET*
HOUSING SUB-ASSEMBLY (1/2 INCH CONDUIT CONNECTION)
YOKE
FLUXWASHER
RETAINING CLIP*
TORQUE COVER SCREWS TO 10 INCH POUNDS
COVER WITH SCREWS (3) AND COVER GASKET ATTACHED.

FIGURE 1