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PEACH BOTTOM—THE POWER OF EXCELLENCE

D. M. Smith
Vice President

November 6, 1989
Docket No. 50-277

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: Licensee Event Report
Peach Bottom Atomic Power Station - Unit 2

This LER concerns a closure of a Main Steam Isolation Valve during testing which resulted in a reactor scram from full power.

Reference:	Docket No. 50-277
Report Number:	2-89-023
Revision Number:	00
Event Date:	10/05/89
Report Date:	11/06/89
Facility:	Peach Bottom Atomic Power Station RD 1, Box 208A, Delta, PA 17314

This LER is being submitted pursuant to the requirements of 10 CFR 50.73(a)(2)(iv).

Sincerely,

cc: J. J. Lyash, USNRC Senior Resident Inspector
W. T. Russell, USNRC, Region I

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1/1

NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Peach Bottom Atomic Power Station - Unit 2	0 5 0 0 0 2 7 7	1 OF 0 5

TITLE (4) Mechanical Binding of MSIV "DC" Solenoid Pilot Valve Causes Reactor Scram During Testing

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
1 0	0 5	8 9	8 9	— 0 2 3	— 0 0	1 1	0 6	8 9		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): N

POWER LEVEL (10): 1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

	20.402(b)		20.405(c)	X	50.73(a)(2)(iv)		73.71(b)
	20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)		73.71(c)
	20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)		OTHER (Specify in Abstract below and in Text, NRC Form 366A)
	20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		
	20.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		
	20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (AREA CODE)
T. E. Cribbe, Regulatory Engineer	7 1 7 4 5 6 - 7 0 1 4

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

At 1806 hours on 10/5/89, with Unit 2 at 99.5% thermal power, ST 1.3A-2 "PCIS Group I Logic System Functional Test" was in progress. As part of the test, the Outboard Main Steam Isolation Valve (MSIV) AC solenoid pilot valves were de-energized, which resulted in the unexpected closure of the "D" outboard MSIV. Subsequently, an automatic reactor scram occurred at 1806 hours due to an APRM High Flux Signal upon the resultant rapid increase in reactor pressure. A reactor water clean up isolation occurred shortly after the scram. Other safety systems operated as designed. The cause of the "D" MSIV closure was the binding of its DC solenoid pilot valve plunger in the vented position thus allowing the MSIV to close when the AC solenoid valve was de-energized. The root cause of the failure was incomplete technical guidance supplied by the solenoid manufacturer for the installation of the plunger spring in the solenoid valve. The correct technical information has been received from the manufacturer and the maintenance procedure used to install these solenoid valves on the MSIV's will be revised to reflect this information. The "D" DC solenoid valve was replaced. ST 1.3A-2 was completed satisfactorily prior to returning Unit 2 to service. The Unit 3 solenoid valves will be inspected prior to Unit 3 restart.

Requirements for the Report

This report is required pursuant to 10 CFR 50.73(a)(2)(iv) due to an Engineering Safeguard Feature actuation (i.e., scram).

Unit Status at Time of Event

Unit 2 was in the Run Mode at 99.5% thermal power in steady state operation. There were no structures, systems or components that were known to be inoperable that contributed to this event.

Description of Event

At 1806 hours on 10/5/89 with Unit 2 at 95.5% thermal power, ST 1.3A-2 "PCIS Group I Logic System Functional Test" was inprogress (performed on a six month frequency per Technical Specifications). The inboard Main Steam Isolation Valves (MSIVs) (EIIS:ISV) portion of the test had already been completed. When the outboard MSIV AC solenoid pilot valves (EIIS:PSV) were de-energized as part of the testing procedure, the "D" outboard MSIV unexpectedly closed. This caused a rapid increase in indicated reactor pressure to approximately 1001 psi. The pressure increase caused steam voids to collapse, thus inserting positive reactivity causing reactor power to increase to approximately 115% and an automatic scram at 1806 hours due to an APRM high flux signal.

Within five seconds of the scram, reactor water level dropped to an indicated narrow range level of +1" (just above the bottom of steam separator shroud) causing the "C" Primary Containment Isolation System (PCIS) (EIIS:JM) channel to trip (setpoint of 0" reactor level). However, a full Group II/III isolation did not occur. Reactor water level rapidly increased until the "A", "B" and "C" Reactor Feed Pump Turbines (RFPTs) (EIIS:JK) were manually tripped just prior to the automatic main turbine trip on high reactor water level (+45").

The bypass valves were observed to be full open shortly after the scram (exact time unknown) which caused an indicated reactor water level decrease to +8" and a subsequent swell to +70" following the RFPT trip. Additionally, a Reactor Water Cleanup (RWCU) (EIIS:CE) isolation on low RWCU System flow occurred (exact time unknown), which is also attributed to the opening of the bypass valves and the resultant drop in reactor pressure and indicated level. The EHC pumps were shutdown in order to close the bypass valves.

Main Steam Line Drains, Turbine Sealing Steam, and Turbine Stop/Control Valve Lead Drains were used to control pressure below 960 psig until the "A" EHC pump was started. The "A" and "B" EHC pressure regulators "In Control" lights were observed to be swapping between the "A" and "B" regulators. After attempts to bias the "B" regulator in control were unsuccessful, the "A" pressure transmitter was valved out of service and vented in order to successfully place the "B" pressure regulator in control.

Post scram investigation revealed that the DC Solenoid Pilot Valve (AVCo model 6910-020) on the "D" outboard MSIV was mechanically binding in the vented position. The solenoid valve was replaced, the MSIVs were verified to remain in the open position

with the "AC" solenoid pilot valves de-energized. Additionally, ST 1.3A-2 was performed satisfactorily. Unit 2 was returned to service on 10/9/89.

Cause of Event

The proximate cause of this event was closure of the "D" outboard MSIV resulting from a component failure of the associated DC solenoid valve.

The root cause of the component failure was incomplete technical information supplied to PECo by the valve manufacturer, Automatic Valve Company (AVCo). Examination of the solenoid valve removed from the "D" outboard MSIV revealed that the plunger spring was slightly tapered. Because removal of the solenoid valve from the MSIV requires that the valve be disassembled, the as found spring position is unknown. Bench testing of the solenoid valve was performed with the plunger spring in each of the two possible positions. With the spring installed with the smaller end toward the solenoid coil, testing showed that the plunger would bind sporadically when the solenoid was energized (the frequency of the binding increased with operating temperature). However, in none of these tests did the valve fail to return to the vented position (de-energized state). With the spring installed in the reverse direction (large end of spring toward solenoid coil), the valve operated correctly each time the solenoid was energized. The manufacturer indicated that this is the correct position.

Conversations between PECo and AVCo following this discovery revealed that AVCo had changed the design of the plunger spring from cylindrical to tapered to enhance the retention of the spring on the plunger shaft during assembly. Vendor information supplied by AVCo to PECo on these valves did not reference this change and therefore did not include guidance relative to the spring orientation.

It is believed that the orientation of the spring was inadvertently reversed during the installation of the solenoid valve on the MSIV. Because site maintenance engineering personnel were unaware of the change to the plunger spring by AVCo, the installation procedure for these valves did not indicate the correct spring orientation. Additionally, the slight taper of the spring is not readily noticeable upon observation.

The cause of the bypass valves remaining full open and the subsequent control problems have been attributed to the "A" EHC pressure transducer. A physical inspection of the "A" pressure transducer revealed some water damage. Testing of the "A" EHC pressure regulator circuitry indicated that the circuitry was sluggish in responding to changes in input pressure. After the reactor scram, the "A" pressure regulator circuitry was slow to respond to the decreasing reactor pressure, and thus, continued to produce an 'open' signal to the bypass valves.

Analysis of the Event

No safety consequences occurred as a result of this event.

The Reactor Protection System (RPS) operated properly throughout this transient. Other safety systems operated as designed.

Since the installation of the solenoid pilot valve plunger spring in the reverse direction causes the valve to remain in the vented (safe) condition, automatic closure of the "D" MSIV was at no time inhibited. Therefore, the primary containment pressure boundry was not comprimised.

Because the other three outboard MSIVs remained open during this transient and during post scram testing, it is believed that their associated 'DC' pilot solenoid valves are properly assembled. Additionally, previously in test, the inboard MSIVs were tested satisfactorily. An 'AC' solenoid pilot valve of the same type and model as the ones used on the MSIVs was tested in the same manner as the 'DC' solenoid. Spring orientation did not affect the proper operation of the "AC" valve. This is apparently the result of the greater solenoid thrust force since the AC solenoid valves have higher operating current. Therefore, the 'AC' solenoids are not believed to be susceptible to this problem.

The Main Steam Safety Relief Valves utilize a similar type of solenoid valve. Incorrect plunger spring orientation on these valves has been determined not to be a concern because these valves are replaced as a unit and are not disassembled during installation at the plant and the manufacturer is aware of preferential orientation of the spring during assembly. Additionally, the valves are tested by the manufacturer prior to being shipped.

Corrective Actions

The "D" outboard MSIV DC pilot solenoid valve was replaced and verified operable prior to returning Unit 2 to service. Additionally, ST 1.3A-2 was completed satisfactorily prior to returning Unit 2 to service.

The manufacturer of the solenoid valve has been involved in the investigation of this problem. Both the "A" and "B" EHC pressure transducers were replaced with recently refurbished transducers.

The following corrective actions are planned:

1. The maintenance procedure for the installation of both AC and DC solenoid pilot valves on the MSIVs (M-1.5) will be revised to specify the correct orientation of the plunger spring.

2. The Unit 3 MSIV pilot solenoid valves will be inspected to ensure the plunger springs are installed correctly and any discrepancies will be corrected prior to the restart of Unit 3 from its current outage. The solenoid valves are normally replaced every refuel outage as part of the Preventive Maintenance Program

3. A preventive maintenance task will be developed to refurbish the EHC pressure transducers on a frequency determined appropriate to improve the reliability of these transducers.

Previous Similar Events

There were no previous similar LERs in that a scram resulted from incomplete installation information provided by the manufacturer.

There have been 3 previous similar LERs involving scrams resulting from loss of AC power with DC solenoid valve already inoperable (open circuit coil failures) (LERs 3-85-18, 2-86-03, 3-86-16). The corrective actions in these LERs were electrical in nature (replacement of the inoperable electrical coil) and therefore would not have been expected to prevent this event.