

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Brunswick Steam Electric Plant Unit 2										DOCKET NUMBER (2) 0 5 0 0 0 3 2 4 1 OF 0 5										PAGE (3) 1 OF 0 5																													
TITLE (4) Failure of Main Steam Line Isolation Valves B21-F028A, F022C, and F028C, to Fast Close During Operability Testing																																																	
EVENT DATE (5) MONTH DAY YEAR 0 9 2 7 8 5										LER NUMBER (6) YEAR SEQUENTIAL NUMBER REVISION NUMBER 8 5 0 0 8 0 0										REPORT DATE (7) MONTH DAY YEAR 1 0 2 5 8 5										OTHER FACILITIES INVOLVED (8) FACILITY NAMES DOCKET NUMBER(S) 0 5 0 0 0 0 0 0																			
OPERATING MODE (9) 4										THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5. (Check one or more of the following) (11)																																							
POWER LEVEL (10) 0 0 0										20.402(b)										20.406(c)										50.73(a)(2)(iv)										73.71(b)									
										20.406(a)(1)(i)										50.36(c)(1)										<input checked="" type="checkbox"/> 50.73(a)(2)(iv)										73.71(c)									
										20.406(a)(1)(ii)										50.36(c)(2)										50.73(a)(2)(vii)										OTHER (Specify in Abstract Below and in Text, NRC Form 366A)									
										20.406(a)(1)(iii)										50.73(a)(2)(i)										50.73(a)(2)(viii)(A)																			
										20.406(a)(1)(iv)										50.73(a)(2)(ii)										50.73(a)(2)(viii)(B)																			
										20.406(a)(1)(v)										50.73(a)(2)(iii)										50.73(a)(2)(v)																			
LICENSEE CONTACT FOR THIS LER (12)																																																	
NAME M. J. Pastva, Jr., Regulatory Technician																				TELEPHONE NUMBER AREA CODE 9 1 9 4 5 7 - 2 3 1 5																													
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)																																																	
CAUSE										SYSTEM										COMPONENT										MANUFACTURER										REPORTABLE TO NRC									
SUPPLEMENTAL REPORT EXPECTED (14)																																																	
YES (If yes, complete EXPECTED SUBMISSION DATE)																				<input checked="" type="checkbox"/> NO										EXPECTED SUBMISSION DATE (15)																			
																														MONTH DAY YEAR																			

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

Surveillance testing of Unit 2 main steam isolation valves (MSIVs) on 9/27/85, at 2300, revealed MSIVs F028A, F022C, and F028C would not fast close. The unit was in cold shutdown following a controlled shutdown from power on 9/26/85 as a precautionary measure in advance of then approaching hurricane Gloria.

The failures of the subject MSIVs to fast close are attributed to disc-to-seat sticking of the valves' operators' double solenoid valves, ASCO Model No. 8323A36E. The failure mechanism is believed to result from hydrocarbon contamination, temperature effects, and internal geometry acting upon the valves' seating material, ethylene propylene (EP). The MSIV double-acting solenoid valves on Units 1 and 2 have been replaced with others utilizing viton seating material. An inspection of other ASCO solenoid valve applications did not reveal deterioration of the valves' seat sealing materials.

During the next scheduled outage for either unit of sufficient length following six months of operation, a sampling of the MSIV double solenoid valves will be replaced. The removed solenoids will be evaluated as part of the continuing failure analysis of the ASCO solenoids.

8510310065 851025
PDR ADOCK 05000324
S PDR

JE22

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104

EXPIRES 8/31/85

FACILITY NAME (1) Brunswick Steam Electric Plant Unit 2	DOCKET NUMBER (2) 0 5 0 0 0 3 2 4	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		8 5	- 0 0 8	- 0 0 0	2	OF	0 5

TEXT (If more space is required, use additional NRC Form 366A's) (17)

During surveillance testing of Unit 2 main steam isolation valves (MSIVs) on September 27, 1985, at 2300, MSIVs 2-B21-F028A, F022C, and F028C failed to fast close. Unit 2 was placed in cold shutdown on September 26, 1985, as a precautionary measure to then approaching hurricane Gloria.

Initial investigation determined a problem existed within the double solenoid valve on the actuator of MSIV F028A. In addition, a subsequent fast closure test of MSIV F028C revealed a closure time of approximately 45 seconds. A decision was made not to troubleshoot the F022C valve until it could be removed and disassembled. On September 28, 1985, engineers from the company metallurgy unit assisted plant system engineers in disassembly, visual inspection, and collection of samples of foreign materials in the double solenoid valves of the three subject MSIVs. Table 1 reflects the results of the performed visual inspection.

Table 1
Visual Inspection Results

1. F028C - The valve disc on the dc solenoid portion of the valve appeared to be very brittle and had a piece missing from its center. This piece was found wedged in the valve exhaust port, thus blocking it off. The valve O-ring on that side was also very brittle and came out in small pieces. The valve disc and O-ring in the ac end of the valve was not degraded to the same extent encountered on the dc solenoid side of the valve. The O-ring on the ac end came out in one piece; however, its lower half was stuck to the valve body. The valve disc on the ac end had minor indentations where it had contacted the supply port but it was intact. This disc is normally not in contact with the supply port seat. The disc on the dc end of the valve is normally pushed against the exhaust port seat. The valve body appeared discolored and there was a fine layer of dust on its internal surfaces.
2. F022C - The valve disc on the dc end of the valve was found adhered to the exhaust port. When the disc was freed, it was found to have a severe indentation where it had contacted the exhaust port and a raised nipple existed in the center of this region. The valve disc was removed in one piece. The valve O-rings were intact and the disc on the ac end of the valve and the valve body appeared to be similar to that encountered on the F028C valve.
3. F028A - The valve disc on the dc end of the valve also had a piece missing from its center as encountered with F028C; however, this piece could not be located. The condition of the valve O-rings, the ac solenoid valve disc, and the valve body were similar to those found on the F028C valve solenoid.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104
EXPIRES 8/31/85

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (5)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
Brunswick Steam Electric Plant Unit 2	0 5 0 0 0 3 2 4	8 5	— 0 0 8	— 0 0 0	3	OF	0 5

TEXT (If more space is required, use additional NRC Form 388A's) (17)

From the visual inspection, it was concluded the F028C valve had failed to fast close due to the exhaust port being blocked. However, during subsequent testing, the valve closed due to actuation air losses in the piping connection from the solenoid valve to the four-way pilot valve. The F022C valve failed to fast close because the solenoid valve disc was adhered to the valve seat and the valve could not move. The F028A valve failed either because the solenoid valve disc was stuck to its seat or because disc material had broken off and plugged the exhaust port. It is felt the missing seating material was forced out the exhaust port during the troubleshooting of the valve. Consequently, the solenoid valve functioned properly during the subsequent fast closure test.

Two other MSIV actuator solenoid valves were disassembled and inspected. One of these had been recently removed from Unit 1. The other valve was from Unit 2. Neither of these solenoid valves had encountered a failure. These valves appeared normal except for a noticeable dimple on the Unit 2 valve disc that is held in contact with the exhaust port.

An evaluation of the solenoid valve from the F028C by the valve vendor, ASCO, concluded the valve elastomer had degraded due to contamination. This conclusion was based upon evidence that the elastomer only degraded where it was in contact with the brass pieces of the valve. The valve disc on the ac solenoid portion of the valve, which is normally open and therefore not in contact with the supply port, was not nearly as degraded as the other dc solenoid valve disc. The valve O-ring on the ac end was stuck to the brass body; however, the portion that contacted stainless steel was removed in one piece. The vendor did not determine the contaminant; however, it is felt it was not introduced during manufacture or assembly of the solenoid valve assembly.

On September 28, 1985, a systems engineering task force was established to determine the cause of the failures and to recommend and implement corrective actions. The significant findings produced by the task force are summarized below.

A. History

The valves that failed are ASCO Model 8323A36E double solenoid valves. Each valve has one ac and one dc coil. Both solenoids must be deenergized for the valve to close the supply port and open the exhaust port. The valves operate with both solenoids normally energized. This model was installed in Unit 1 in June 1983 and in Unit 2 in August 1984. They are environmentally qualified replacements for nearly identical valves which used Buna N as the elastomer. These valves utilize ethylene propylene (EP) in place of the Buna N. The EP material is rated for higher temperature use and has much higher radiation resistance than Buna N. There are no recorded failures of the old valves attributable to the Buna N material. There is one recorded instance of a failure of a Unit 1 valve which may have been caused by failure of the EP disc. This event occurred in August 1984; however, the exact failure mode was not

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104

EXPIRES 8/31/85

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
Brunswick Steam Electric Plant Unit 2	0 5 0 0 0 3 2 4	8 5	— 0 0 8	— 0 0	0 0	4 OF	0 5

TEXT (If more space is required, use additional NRC Form 366A's) (17)

determined. Prior to this event, there were no recorded events involving the newer type valves on Unit 2 which indicated a failure of the EP discs.

B. Materials

1. Buna N - This material is rated for use up to 250°F. It is resistant to petroleum products but degrades when exposed to radiation.
2. Ethylene Propylene - Rated for service to 300°F, EP is resistant to high levels of radiation and is therefore the material of choice for environmentally qualified (EQ) applications. However, EP absorbs hydrocarbons and like a sponge, softens and swells up. This exposure also lowers its melting point. It is undesirable in applications where exposure to hydrocarbons is likely. Overheating of EP causes it to turn brittle. General Electric (GE) is utilizing EP in its EQ programs.
3. Viton - This material is rated for use to 400°F and is impervious to hydrocarbons. Its major disadvantage is that it is less resistant to radiation than EP by a factor of ten. GE recommends viton for applications that are not oil-free.

C. Industry Experience

A prior nuclear industry event appears to be similar to the failure encountered at the Brunswick plant. This event occurred in a fire protection system at the Virgil C. Summer Nuclear Station. The ASCO valves in this system utilized EP elastomers which apparently came in contact with hydrocarbons, swelled and caused the valve to bind. IEN 80-11, which described this event, recommended replacement of the EP with viton.

D. Laboratory Analysis

Laboratory analysis of the three subject solenoid valves showed a significant amount of hydrocarbons in the valve body of the F028C solenoid valve. The precise hydrocarbon has not yet been identified. Tests of new samples of EP show that the material fails at 675°F in a mode nearly identical to the failure observed in the MSIV solenoid valves. During the tests, all the elastomer is gone, leaving only the carbon black filler material. Tests of viton at 675°F show no such degradation.

Laboratory testing will continue to attempt to duplicate the failure at temperatures that are believed to occur in the plant. Instrumentation of a solenoid valve tested at the lab showed that temperatures internal to the valve under worst-case steady-state conditions do not exceed 285°F.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104

EXPIRES 8/31/85

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
Brunswick Steam Electric Plant Unit 2	0 5 0 0 0 3 2 4	8 5	- 0 0 8	- 0 0	0 5	OF	0 5

TEXT (If more space is required, use additional NRC Form 366A's) (17)

Preliminary Conclusions

The precise failure mechanism of the elastomer material has not yet been identified. It is felt temperature, contamination, and internal geometry play a part in the failure mechanism. Temperature alone can reproduce the failure mechanism but not at a temperature that is reasonably expected to occur in the plant. The physical evidence showed signs of swelling of EP, which is known to occur when it is exposed to hydrocarbons. The geometry is such that the EP can swell and fill the exhaust port, thus blocking that path and providing a frictional force in opposition to the valve opening force. Exposure to hydrocarbons may cause the elastomer in EP to vaporize at a lower temperature. Actuation air pressure at 115 psig air may also have the same effect. In any case, valves that are not subjected to the same conditions of temperature, contamination, and internal geometry are not expected to experience this failure.

Corrective Actions Taken

The Unit 2 MSIV solenoid valves have been replaced with valves utilizing viton as the elastomer. The valves on Unit 1 were replaced during the ongoing 1985 Unit 1 refueling/maintenance outage by valves utilizing viton. Viton is impervious to the hydrocarbon contamination and our tests have shown that it can withstand temperatures that will degrade EP. While the geometry of the viton valves is the same as the EP, reduction of two of the three effects provides an increased degree of confidence that the viton valves will not fail in this mode.

Future Actions Planned

During the next scheduled outage for either unit of sufficient length following six months of operation, a sampling of the MSIV double solenoid valves will be replaced. The removed solenoids will be evaluated as part of the continuing failure analysis of the ASCO solenoids. It is expected the solenoid valves will be replaced at approximately three-year intervals due to the radiation susceptibility of viton.



Carolina Power & Light Company

Brunswick Steam Electric Plant

P. O. Box 10429

Southport, NC 28461-0429

October 25, 1985

FILE: B09-13510C

SERIAL: BSEP/85-1840

NRC Document Control Desk

U.S. Nuclear Regulatory Commission

Washington, DC 20555

BRUNSWICK STEAM ELECTRIC PLANT UNIT 2

DOCKET NO. 50-324

LICENSE NO. DPR-62

LICENSEE EVENT REPORT 2-85-008

Gentlemen:

In accordance with Title 10 to the Code of Federal Regulations, the enclosed Licensee Event Report is submitted. This report fulfills the requirement for a written report within thirty (30) days of a reportable occurrence and is in accordance with the format set forth in NUREG-1022, September 1983.

Very truly yours,

C. R. Dietz, General Manager
Brunswick Steam Electric Plant

MJP/mbh

Enclosure

cc: Dr. J. N. Grace

IE22

//