



**Carolina Power & Light Company**

Brunswick Nuclear Project  
P. O. Box 10429  
Southport, NC 28461-0429  
August 27, 1991

FILE: B09-13520

10CFR21

Mr. S. D. Ebnetter, Regional Administrator  
U.S. Nuclear Regulatory Commission  
101 Marietta St. NW  
Suite 2900, Atlanta GA 30323

BRUNSWICK STEAM ELECTRIC PLANT UNITS 1 AND 2  
DOCKET NO. 50-325 AND 50-324  
LICENSE NO. DPR-71 AND DPR-62  
NOTIFICATION OF A 10CFR21 REPORTABLE OCCURRENCE

Dear Mr. Ebnetter:

This confirms the telephone conversation at 1342 hours on August 26, 1991 between Mr. H. Christenson (of your staff) and Mr. G. Theerling (of my staff) which satisfied the requirements of 10CFR21 reporting criteria.

On July 30, 1991, Carolina Power and Light Company submitted LER 2-91-005 titled, ESF Actuation Caused By Voltage Regulator Transient With Failure Of Primary Containment Isolation Solenoid Operated Valves. At that time an evaluation was in progress to determine if this failure was reportable under the requirements of 10CFR21. This evaluation identified the failure of the normally energized ASCO model L206-832 solenoid valves due to gelling of the lubricant (Dow Corning 550) as reportable per 10CFR21. This evaluation was presented to the Plant Nuclear Safety Committee on August 22, 1991. The Plant General Manager, and the Vice President Brunswick Nuclear Project were notified on August 23, 1991. The 10CFR21 Evaluation/Notification review completed August 22, 1991, found the original LER 2-91-005, as submitted, supplied the information required for 10CFR21 reporting.

Very truly yours,

J. W. Spencer, General Manager  
Brunswick Nuclear Project

Enclosure

cc: Mr. N. B. Le  
Mr. H. C. Christenson  
Mr. R. L. Prevatte

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Carolina Power & Light Company

Brunswick Nuclear Project  
P. O. Box 10429  
Southport, N.C. 28461-0429

July 30, 1991

FILE: B09-13510C

10CFR50.73

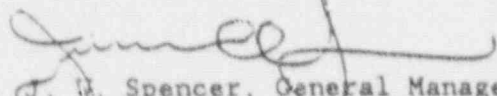
U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D. C. 20555

BRUNSWICK STEAM ELECTRIC PLANT UNIT 2  
DOCKET NO. 50-324  
LICENSE NO. DRP-62  
LICENSEE EVENT REPORT 2-91-005

Gentlemen:

In accordance with Title 10 of 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 submitted in accordance with the format set forth in NUREG-1022, September 1983.

Very truly yours,

  
J. M. Spencer, General Manager  
Brunswick Nuclear Project

RSK/

Enclosure

cc: Mr. S. D. Ebnetter  
Mr. N. B. Le  
BSEP NRC Resident Office

*Handwritten:* AUGUST 16 1991  
bpp

EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION  
COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING  
BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH  
(P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555,  
AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF  
MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

## LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Brunswick Steam Electric Plant Unit 2								DOCKET NUMBER (2) 05000324			PAGE (3) 1			
TITLE (4) ESF ACTUATIONS CAUSED BY VOLTAGE REGULATOR TRANSIENT WITH FAILURE OF PRIMARY CONTAINMENT ISOLATION SOLENOID OPERATED VALVES														
EVENT DATE (5)			LER NUMBER (6)					REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)			
MONTH	DAY	YEAR	YEAR	SEQ. NO.	REV. NO.	MONTH	DAY	YEAR	FACILITY NAME		DOCKET NUMBER			
6	30	91	91	005	0	7	30	91						
OPERATING MODE (9) 1 POWER LEVEL (10) 95 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)(vi) OTHER (Specify in Abstract and Text) 20.405(a)(1)(iii) 50.73(a)(2)(i) 50.73(a)(2)(vii)(A) 20.405(a)(1)(iv) X 50.73(a)(2)(ii) 50.73(a)(2)(vii)(B) 20.405(a)(1)(v) 50.73(a)(2)(iii) 50.73(a)(2)(viii)														
LICENSEE CONTACT FOR THIS LER (12)														
NAME Rhonda S. Knight, Regulatory Compliance Specialist									TELEPHONE NUMBER (919) 457-2174					
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)														
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRCDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRCDS					
B	JM	SOL	A610	Y										
SUPPLEMENTAL REPORT EXPECTED (14)									EXPECTED SUBMISSION		MONTH	DAY	YEAR	
X	YES (If yes, complete EXPECTED SUBMISSION DATE)							NO		DATE (15)		11	15	91

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

A surveillance to check the operation of the Manual and Auto Main Generator Voltage Regulators was in progress. Following a step of the procedure which required the voltage regulator Mode Selector switch to be placed in the Manual position, the Transfer voltmeter deflected significantly. Emergency Bus E4 was lost and the Reactor Protection System Motor-generator set 2B tripped. Emergency Diesel Generator #4 auto-started and a half SCRAM signal was received along with Primary Containment System Isolation signals; Group 3 (Reactor Water Cleanup), Group 6 (Containment Atmospheric Control), half Group 1 (Main Steam Line), Group 2-Division II (Transverse Incore Probe and Drywell Floor/Equipment Drains). Main Generator output voltage was raised using the Manual voltage regulator and the voltage regulator was transferred to the Automatic mode. ESF actuations occurred except for the outboard Drywell Floor Drain Isolation valve which failed to close on the Group 2-Division II signal. The Inboard Floor Drain Isolation valve was closed after four attempts and the line was isolated. The cause of this event is still under investigation. Due to the plant being at full power, the decision was made to allow the voltage regulator to remain in the Automatic mode until troubleshooting takes place during the September, 1991 scheduled shutdown for a refueling outage. Initial investigations indicate that the valve failures were due to a lubricant which gelled inside the ASCO solenoids causing the core to adhere to the top casing in its energized position. Scratches on the outboard valve solenoid internals may have contributed to the failure. As corrective action the solenoids on the two valves that failed were replaced. Valves with similar solenoids were tested and surveillance frequency increased. A task force has been established to investigate the ASCO solenoid issue. Under reasonable and credible alternative conditions this event would not have been more severe. Other similar ASCO events were LER 2-88-001 and Plant Incident Report 90-036; Voltage Regulator events LER 2-81-01, 1-86-024, 2-90-015.



# LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (8)				PAGE (3)
Brunswick Steam Electric Plant Unit 2	05000324	YEAR	SEQ NO.	REV NO.	2	
		91	005	0		

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

## INITIAL CONDITIONS

On June 30, 1991 at approximately 05:15 (EDT), the unit was operating at approximately 95% power after a power reduction to perform Main Turbine valve testing. ECCS systems and Emergency Diesel Generators (EDG) were operable and in standby.

## EVENT NARRATIVE

A Control Operator was performing a weekly surveillance using an operating procedure to check the operation of the Manual (DC) and Auto (AC) Main Generator Voltage Regulator. After completing a step of the procedure which places the Voltage Regulator Mode Selector switch in the Manual position, the Control Operator observed a significant deflection of the Transfer voltmeter (TVM). The TVM monitors the output of the Manual (DC) and Auto (AC) voltage regulators and is used to match the outputs of the two regulators so that generator voltage does not change when the regulator is transferred. The observed deflection of the TVM indicated that generator excitation had decreased upon transferring from Auto to the Manual mode. The Control Operator asked the Senior Control Operator (SCO) if he had seen the TVM deflection and the SCO replied that he had. The Control Operator looked again at the TVM and also observed that the generator megavars had decreased from 80 to 10. An alarm came in for a 250 volt battery B ground followed by an alarm for a 250 volt battery A ground. The Control Operator began to receive alarms indicating a loss of Reactor Protection System Bus B and Emergency Bus 4 (E4 bus). At approximately 05:19, the Bus 2C to Emergency Bus E4 master and slave breakers tripped due to actuation of the E4 Bus undervoltage relays. This initiated an auto-start of the #4 Emergency Diesel Generator. One undervoltage relay associated with the auto-start logic for the #3 EDG actuated.

Results of the loss of the E4 Bus included;

1. Auto-start of the associated Emergency Diesel Generator which re-energized the E4 Bus.
2. Trip of the 2B Reactor Protection System (RPS) Motor-Generator (MG) set resulted in the following;

### 1/2 SCRAM-Division II

Primary Containment Isolation System;

GROUP 2 ISOLATION-Division II (Transverse Incore Probe and Drywell Floor and Equipment Drain Valves) (2-G16-F004 failed to close)

GROUP 3 ISOLATION (Reactor Water Cleanup)

GROUP 6 ISOLATION (Containment Atmospheric Control)

At approximately 05:29, the Control Operator manually raised the main generator output voltage using the Manual voltage regulator. The voltage regulator was transferred to the Automatic mode at approximately 05:33. Expected actuations resulting from a loss of the E4 Bus occurred as required except for the Drywell Floor Drain Outboard Isolation valve (2-G16-F004) which failed to close on a GROUP 2 isolation signal. After verification of actuations, the 2B MG SET was restarted. The 230 KV Voltage Recorder trace indicated a reduction from approximately 234 KV to approximately 227 KV over an approximately 1-2 minute period. The 230 KV bus voltage remained at this degraded level approximately 6-7 minutes.

Due to the failure of 2-G16-F004, an eight hour active Limiting Condition for Operation (LCO) in accordance with Technical Specifications (T.S.) was initiated. This Technical Specification requires that with only one operable valve, the affected penetration line be isolated within eight hours by use of at least one deactivated automatic valve secured in the isolated position. This required the closure of the Drywell Floor Drain Inboard Isolation

**LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION**

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS  
INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS  
REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS  
MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY  
COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK  
REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND  
BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (5)				PAGE (3)
		YEAR	SEQ NO.		REV NO.	
Brunswick Steam Electric Plant Unit 2	05000324	91	005		0	3

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

Valve (2-G16-F003). At approximately 12:45, the Control Operator attempted to close 2-G16-F003 valve using the control switch.

At 12:55, after four attempts, the valve closed. Although the penetration line was already isolated, the problems encountered in closing the valve required declaring the valve inoperable resulting in two primary containment isolation valves in series being inoperable.

With the two primary containment isolation valves in series being inoperable, the unit was unable to perform an Operational Leakage surveillance required per Technical Specifications. After solenoid replacement on 2-G16-F004 and 2-G16-F003 the valves were declared operable and returned to service at approximately 22:10 and 23:00 respectively.

At approximately 23:20, the Operational Leakage surveillance was performed satisfactorily.

**CAUSE OF EVENT****VOLTAGE REGULATOR**

The cause of this event is still under investigation. After the event a General Electric (GE) Technical Representative was brought to the plant site to assist in investigating the voltage regulator transient. Due to the plant being at full power, the decision was made to allow the voltage regulator to remain in Automatic mode. No causal determination was made during this initial investigation with GE.

**2-G16-F003 AND 2-G16-F004 FAILURES**

The cause of this event is still under investigation. The failed valves are Model L206832RVF ASCO solenoid valves which vent air pressure upon loss of power. The Instrument Air pressure at these valves is 90 psig. The normal power supply is 115 VAC from the Emergency buses. The valves are both located outside of primary containment, in the same area and are supplied by the same Instrument Air header. The valves have separate air pressure regulators and filters. Based upon these facts, Carolina Power and Light requested a root cause investigation of the two solenoid valves to be performed by Failure Prevention, Inc.

The report titled, ROOT CAUSE OF THE FAILURE OF TWO SOLENOID VALVES AT BRUNSWICK UNIT 2, dated July 6, 1991, revealed that lubricant had completely coated the top of the solenoid core in 2-G16-F003. A few light scratches were found on the valve's upper and lower stems. A patch of copper bearing material was found adhering to the upper stem in a 1' on that passes through a brass bushing.

Disassembly of the solenoid for 2-G16-F004 was performed by CP&L personnel who found the lower stem slightly bent.

Failure Prevention, Inc.'s examination of the 2-G16-F004 solenoid found that lubricant coated about 50% of the top of the core as well as many scratches on the lower stem area. A long thread machining burr was found between the upper seat bushing and the main body and was still attached to the threaded region of the valve's 'pressure' port.

These preliminary investigations indicate that the cause of this event was due to the lubricant (Dow Corning 550) used by the vendor. Failure Preventions, Inc.'s report stated that the root cause of the sticking of the 2-G16-F003 was an abundance of lubricant that had gelled causing the solenoid core to adhere to the top casing in its energized position.

The report also stated that the cause for 2-G16-F004 solenoid valve failure was likely a combination of the lubricant gelling and foreign matter. The report stated that either one could be the cause, but a combination was the most likely reason.

# **LICENSEE EVENT REPORT (LER)** **TEXT CONTINUATION**

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FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)				PAGE (3)
Brunswick Steam Electric Plant Unit 2	05000324	YEAR	SEQ NO.	REV NO.	4	
		91	005	0		

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

## **CORRECTIVE ACTIONS**

The weekly surveillance that was being performed on the Voltage Regulator during the initiation of this event has been deferred on both units until further investigation can be conducted.

The solenoids for 2-G16-F003 and 2-G16-F004 were replaced.

The frequency of stroking similar valves with this type ASCO solenoid has been increased to weekly.

A Site Incident Investigation Team (SIIT) was established to investigate the following:

1. The cause of the voltage regulator malfunction.
2. The cause of the ASCO solenoid valve failures.
3. Verification of the operation of the relays associated with the Emergency Diesel Generator auto-starting logic.

The voltage regulator is to remain in the Automatic mode until troubleshooting takes place during the September, 1991 scheduled shutdown for a refueling outage.

Failure Prevention, Inc. recommended increasing the exercising frequency to weekly for Unit 1 and Unit 2 ACSO normally energized solenoids to prevent any gelled lubricant from having time to cause adherence.

An air quality study was done with no indications that this was a problem.

As a result of these valve failures, 10 valves with normally energized Automatic Switch Company (ASCO) solenoids on Units 1 and 2 were tested following the event. One valve on Unit 1 was declared inoperable upon the subsequent testing due to a slow stroke time. Upon stroking the valve four times, the stroke time improved and the valve was declared operable.

The SIIT team has been disbanded. A task force is continuing investigation and troubleshooting of the ASCO solenoids.

Undervoltage relays associated with the auto-start logic for the Emergency Diesel Generators were verified to have functioned as designed.

## **SAFETY ASSESSMENT**

Safety systems functioned as designed with the exception of the Drywell Floor Drain Primary Containment Isolation valves. Considering this, the event would not have been more severe in that neither a reasonable and credible alternative condition would have provided a source term within the Drywell. Without the source term, there is no increase in the quantity of material which would be released through the nonisolated penetrations. Furthermore, the 2-G16-F003 valve did go closed with the fourth attempt and did in fact isolate the path from the Drywell. During the operators response to safety system actuations/isolations, a response verification is performed as it was in this case. In the event that a verification revealed that the required responses were not received under actual accident conditions, the operator would attempt to effect the response to mitigate any consequences due to an unisolated primary containment penetration. This event was the result of a power failure and the appropriate Technical Specification was implemented.

# LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)				PAGE (3)
Brunswick Steam Electric Plant Unit 2	05000324	YEAR		SEQ NO.		5
		91		005	0	

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

## PREVIOUS SIMILAR EVENTS

### VOLTAGE REGULATOR

Brunswick has had at least two similar events that involved reactor SCRAMs due to Voltage Regulator transients, 2-87-01 and 1-86-024. These events involved problems with the motor operated potentiometers which establish the Voltage Regulator setpoint. Potentiometer oxide buildup was determined to be the cause for of these events. After these events, the potentiometer was changed out to a sealed type to prevent recurrence. Another SCRAM occurred in September 1990, LER 2-90-015, which involved erratic operation of the Automatic Voltage Regulator due to improper adjustment of the various Auto Regulator settings.

### DRYWELL FLOOR AND EQUIPMENT DRAIN VALVES

Brunswick has had at least two other events involving the Drywell Floor and Equipment Drain Inboard and Outboard valves (1/2-G16-F003, 1/2-G16-F004, 1/2-G16-F019, 1/2-G16-F020) which all have normally energized ASCO solenoids. One occurred in January of 1988, LER 2-88-001 on Unit 2 and one in May of 1990, Plant Incident Report 90-036 for Units 1 and 2.

## EIIS COMPONENT IDENTIFICATION

### System/Component

RWCU  
RPS MG SET  
EDG  
GENERATOR VOLTAGE REGULATOR  
TRANSVERSE INCORE PROBE ISOLATION VALVE  
DRYWELL FLOOR DRAIN ISOLATION VALVE  
DRYWELL EQUIPMENT DRAIN ISOLATION VALVE  
TVM

### EIIS Code

CE  
JC/MG  
EK  
TB/RG  
JM/IG/ISV  
JM/ISV  
JM/ISV  
EI