

Omaha Public Power District  
444 South 16th Street Mall  
Omaha, Nebraska 68102-2247  
402/636-2000

May 20, 1992  
LIC-92-137L

U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Mail Station P1-137  
Washington, DC 20555

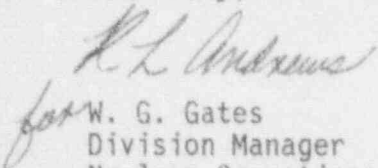
Reference: Docket No. 92-200

Gentlemen:

Subject: Licensee Event Report 92-017 for the Fort Calhoun Station

Please find attached Licensee Event Report 92-017 dated May 20, 1992. This report is being submitted pursuant to 10 CFR 50.73(a)(2)(v)(D). If you should have any questions, please contact me.

Sincerely,

  
for W. G. Gates  
Division Manager  
Nuclear Operations

WGG/lah

Attachment

c: R. D. Martin, NRC Regional Administrator, Region IV  
D. L. Wigginton, NRC Senior Project Manager  
S. D. Bloom, NRC Project Engineer  
R. P. Mullikin, NRC Senior Resident Inspector  
INPO Records Center

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LICENSEE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REGULATION: 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) Fort Calhoun Station Unit No. 1		DOCKET NUMBER (2) 0   5   0   0   0   2   8   5	PAGE (3) 1 OF 0   4
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TITLE (4)  
Cracking of Cam Followers on General Electric Type SBM Control Switches

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)										
0	4	2	0	9	2	9	2	0	1	7	0	0	0	5	2	8	5	1	OF	0	4

OPERATING MODE (9) 5

POWER LEVEL (10) 0 | 0 | 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 50. (Check one or more of the following) (11)

<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.405(c)	<input type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 72.71(b)
<input type="checkbox"/> 20.405(a)(1)(i)	<input type="checkbox"/> 50.36(c)(1)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> 73.71(c)
<input type="checkbox"/> 20.405(a)(1)(ii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(vi)	OTHER (Specify in Abstract and in Text, NRC Form 388A)
<input type="checkbox"/> 20.405(a)(1)(iii)	<input type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(vii)(A)	
<input type="checkbox"/> 20.405(a)(1)(iv)	<input type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(vii)(B)	
<input type="checkbox"/> 20.405(a)(1)(v)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(viii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME James R. Geschwender, Station Licensing Engineer	TELEPHONE NUMBER AREA CODE 4   0   2   5   3   3   -   6   8   5   7
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC
B	E	A	5   2	G   0   8   0	Y				

SUPPLEMENTAL REPORT EXPECTED (14)

YES (if yes, complete EXPECTED SUBMISSION DATE)  NO

EXPECTED SUBMISSION DATE (15)

MONTH	DAY	YEAR

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

On March 14, 1992, with the Fort Calhoun Station in Mode 5 (Refueling Shutdown), a General Electric Type SBM Switch associated with a 4160V breaker was found to have a broken contact. An inspection of the switch revealed that a Lexan cam follower for the broken contact had cracked and rendered the contact unable to close. Inspection of additional SBM switches associated with 4160V switchgear revealed indications of cracks on additional Lexan cam followers. Some of these were missing pieces of cam follower material. On April 20, 1992 at 1524, with the plant in Mode 5, it was determined that a potential common mode failure mechanism existed.

Based upon the ability to manually operate breakers, potential switch failure due to cracked cam followers was determined to have no immediate safety implications with the plant in refueling shutdown.

The root cause of the event is considered to be mechanical stress cracking of the cam followers caused by inadequacies in the initial assembly of the switches at the manufacturer, with a contributing cause of mechanical stresses induced through switch operation over the life of the plant.

SBM switches associated with 4160V switchgear and critical Control Board and Auxiliary Instrument Panel mounted switches were inspected. Switches which were inspected and determined to require replacement prior to resuming power operation, have been replaced.

LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 90.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-539), 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)  Fort Calhoun Station Unit No. 1	DOCKET NUMBER (2)  0   5   0   0   0   2   8   5	LER NUMBER (3)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
		9   2	—   0   1   7	—   0   0	0   2	OF 0   4

TEXT (If more space is required, use additional NRC Form 385A's)(17)

General Electric (GE) Type SBM Control Switches are used in 4160V and 480V switchgear, and Control Board and Auxiliary Instrument Panels at the Fort Calhoun Station (FCS). Cam followers in these switches may be composed of Lexan (a transparent polycarbonate) or Delrin (a milky-white acetal resin). Previous industry experience regarding SBM switches manufactured prior to 1976 (including NRC Information Notice 80-13) has indicated a problem involving cracking of polycarbonate cam followers exposed to hydrocarbons during fabrication or maintenance. The Omaha Public Power District review of this issue resulted in a 1984 recommendation to replace safety related SBM switches. Replacement was not pursued for SBM switches located on the 4160V switchgear based on a finding that a sample of eight SBM switches on the 4160V switchgear all had Delrin cam followers. Thirty SBM switches in the Control Room were replaced during the 1985 Refueling Outage. Replacement of additional SBM switches was not recommended at that time based upon results of inspection of the replaced switches which revealed only minor cracking due to stress, not hydrocarbon exposure.

On March 14, 1992, while FCS was in a Refueling Outage (in Mode 5, Refueling Shutdown), it was discovered that a contact was broken in an auxiliary switch (General Electric SBM type) associated with the 4160V breaker for Raw Water Pump AC-10A. The broken contact (contact did not close when switch was operated) was discovered during post-modification testing. The contact was a permissive for auto-closure of the output breaker for Emergency Diesel Generator No. 1 (DG-1). The contact operates one of two redundant circuits which can initiate auto-closure of the DG-1 output breaker. The operability of DG-1 was not in question, since the failure represented a degradation of redundancy of the actuation circuits. The contact function necessary to allow DG-1 to auto-close onto the bus would have been fulfilled by the redundant circuit. A Station Incident Report was initiated to evaluate the failure, and the switch was replaced on April 1, 1992.

An inspection of the switch was conducted on April 17, 1992, in response to the Station Incident Report. This inspection revealed that a plastic cam follower for the broken contact had cracked and allowed the roll pin to fall out of the switch, rendering the contact unable to close. Based on previous industry experience, the cracking of the contact associated with Raw Water Pump AC-10A was initially believed to have resulted from exposure to hydrocarbons. A sample of SBM switches associated with 4160V switchgear was inspected on April 18, 1992. This sample indicated that approximately 20 percent of the switches had Lexan cam followers with varying degrees of cracking, and approximately 80 percent had Delrin cam followers (Delrin does not exhibit cracking). Based on the sample results, it was decided to conduct a systematic inspection of the cam followers in the SBM switches associated with the 4160V switchgear.

Inspection of the SBM switches associated with 4160V switchgear was completed on April 19, 1992. The inspection revealed that 136 of the SBM switches associated with 4160V switchgear were composed of Delrin, and 55 had Lexan cam followers. Of the 55 SBM switches with Lexan cam followers, 40 were found to have indications of cracks on cam followers. Of the 40 SBM switches with indications of cracks, 15 had missing pieces of cam follower material and an additional six had open cracks.

LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 60.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-830), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20545, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)  Fort Calhoun Station Unit No. 1	DOCKET NUMBER (2)  05000028592	LER NUMBER (3)			PAGE (6)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
		92	017	00	03	OF 04

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

On April 20, 1992 at 1524, with the plant in Mode 5, it was determined that a reportable condition existed. Based upon evaluation of the switch failure mechanism, a potential common mode failure mechanism was identified. A four-hour notification was made on April 20, 1992 at 1632, pursuant to 10 CFR 50.72(b)(2)(iii)(D), based upon the potential for interference with the safety function of systems needed to mitigate the consequences of an accident. This report is submitted pursuant to 10 CFR 50.73(a)(2)(v)(D). Based upon the ability to manually operate breakers, potential switch failure due to cracked cam followers was determined to have no immediate safety implications with the plant in refueling shutdown.

Criteria were established for use in determining the need to replace SBM switches:

- 1) All switches with missing cam follower pieces, broken cam followers, or "open cracks" in cam followers, must be replaced.
- 2) Switches with only "tight cracks" in cam followers or a mixture of "tight cracks" and no cracks in cam followers, do not require switch replacement.

These criteria were based upon industry data regarding testing of switches with cracked cam followers. Testing conducted by GE in 1976, using "crazed" cam followers (i.e., cam followers with "worse than visible hair-line cracks"), produced no failures prior to 100,000 operations. One switch tested by GE reached more than 1,450,000 operations without a failure.

Following the inspection of the SBM switches associated with the 4160V switchgear, those which were found to be damaged were further reviewed. Of these switches, those identified as requiring replacement were replaced. Since the inspection of the switches in the 4160V switchgear revealed deterioration, inspection of SBM switches in other applications was pursued.

A sample of 10 readily accessible switches in the Control Room were initially inspected. Based on the results of this initial inspection, it was determined that additional switches should be inspected. In order to determine which switches needed to be inspected, Engineering evaluated a comprehensive list of SBM switches at FCS to identify the critical switches for safety related functions. (Switches replaced during the 1985 Refueling Outage were not considered as they have Delrin cam followers.) Inspection was recommended for additional Control Room switches which met criteria documented in Engineering Analysis EA-FC-92-032. The analysis indicated that the subset of all SBM switches selected for inspection will ensure plant safe shutdown within the FCS design basis.

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)  Fort Calhoun Station Unit No. 1	DOCKET NUMBER (2)  0   5   0   0   0   2   8   5   9   2	LER NUMBER (3)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
		9   2	—   0   1   7	—   0   0	0   4	OF 0   4

TEXT (If more space is required, use additional NRC Form 386A's)(17)

As a result of these inspections, several switches in the Control Room were identified as requiring replacement, based on the previously established replacement criteria. The inspection, replacement and acceptability of the current plant configuration is documented in Engineering Analysis EA-FC-92-032.

The event is significant in that postulated failures of cam follower contacts could prevent certain automatic safety functions, such as load shed and diesel generator breaker closure, from occurring on demand. Cracked cam followers could allow the roll pin to work free from the cam and eventually prevent the affected contact from operating (closing) during switch operation. However, based upon the ability to manually operate breakers (if automatic features had been disabled), potential switch failure due to cracked cam followers was determined to have no immediate safety implications with the plant in refueling shutdown. Subsequent replacement of selected switches and evaluation of switches which were not inspected and/or replaced has justified the ability to mitigate the consequences of an accident during power operation.

The root cause of the event is considered to be mechanical stress cracking of the cam followers caused by inadequacies in the initial assembly of the switches at the manufacturer, with a contributing cause of mechanical stresses induced through switch operation over the life of the plant.

Corrective actions which have been completed as a result of this event are:

- 1) SBM switches associated with 4160V switchgear, and critical Control Board and Auxiliary Instrument Panel mounted switches have been inspected.
- 2) SBM switches which were inspected and found to require replacement (to ensure plant safe shutdown within the FCS design basis), have been replaced.

Corrective actions which will be completed as a result of this event are:

- 1) Five additional SBM switches will be replaced by the end of the 1993 Refueling Outage (justification for the replacement schedule for these switches is provided in EA-FC-92-032).
- 2) Further review of the failure mechanism will be conducted and a determination made as to what long-term actions are required to address the balance of the switches in the plant (i.e., periodically inspect, replace on a priority schedule, or replace on an as-fail basis). This review and determination of long-term action will be completed by December 31, 1992.

This is the first event to be reported involving the failure of SBM switches at FCS.