



Omaha Public Power District

444 South 16<sup>th</sup> Street Mall

Omaha, NE 68102-2247

LIC-11-0106

October 27, 2011

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, DC 20555-0001

Reference: Docket No. 50-285

**Subject: Licensee Event Report 2011-008, Revision 1, for the Fort Calhoun Station**

Please find attached Licensee Event Report 2011-008, Revision 1, dated October 25, 2011. This report is being submitted pursuant to 10 CFR 50.73(a)(2)(x), 10 CFR 50.73(a)(2)(ii)(B) and 10 CFR 50.73(a)(2)(v). Changes are noted by revision bars.

If you should have any questions, please contact me.

Sincerely,

D. J. Bannister  
Vice President - Nuclear

DJB/rmc

Attachment

c: E. E. Collins, Jr., NRC Regional Administrator, Region IV  
L. E. Wilkins, NRC Project Manager  
J. C. Kirkland, NRC Senior Resident Inspector  
INPO Records Center

**LICENSEE EVENT REPORT (LER)**(See reverse for required number of  
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to [infocollects.resource@nrc.gov](mailto:infocollects.resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

**1. FACILITY NAME**

Fort Calhoun Station

**2. DOCKET NUMBER**

05000285

**3. PAGE**

1 OF 5

**4. TITLE**

Fire in Safety Related 480 Volt Electrical Bus

| 5. EVENT DATE     |     |      | 6. LER NUMBER                                                                                 |                                             |         | 7. REPORT DATE                                         |     |                                                       | 8. OTHER FACILITIES INVOLVED |                        |
|-------------------|-----|------|-----------------------------------------------------------------------------------------------|---------------------------------------------|---------|--------------------------------------------------------|-----|-------------------------------------------------------|------------------------------|------------------------|
| MONTH             | DAY | YEAR | YEAR                                                                                          | SEQUENTIAL NUMBER                           | REV NO. | MONTH                                                  | DAY | YEAR                                                  | FACILITY NAME                | DOCKET NUMBER          |
| 6                 | 7   | 2011 | 2011                                                                                          | - 008 -                                     | 1       | 10                                                     | 27  | 2011                                                  | FACILITY NAME                | DOCKET NUMBER<br>05000 |
| 9. OPERATING MODE |     |      | 11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) |                                             |         |                                                        |     |                                                       |                              |                        |
| 5                 |     |      | <input type="checkbox"/> 20.2201(b)                                                           | <input type="checkbox"/> 20.2203(a)(3)(i)   |         | <input type="checkbox"/> 50.73(a)(2)(i)(C)             |     | <input type="checkbox"/> 50.73(a)(2)(vii)             |                              |                        |
|                   |     |      | <input type="checkbox"/> 20.2201(d)                                                           | <input type="checkbox"/> 20.2203(a)(3)(ii)  |         | <input type="checkbox"/> 50.73(a)(2)(ii)(A)            |     | <input type="checkbox"/> 50.73(a)(2)(viii)(B)         |                              |                        |
| 10. POWER LEVEL   |     |      | <input type="checkbox"/> 20.2203(a)(1)                                                        | <input type="checkbox"/> 20.2203(a)(4)      |         | <input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B) |     | <input type="checkbox"/> 50.73(a)(2)(ix)(A)           |                              |                        |
|                   |     |      | <input type="checkbox"/> 20.2203(a)(2)(i)                                                     | <input type="checkbox"/> 50.36(c)(1)(i)(A)  |         | <input type="checkbox"/> 50.73(a)(2)(iii)              |     | <input type="checkbox"/> 50.73(a)(2)(x)               |                              |                        |
|                   |     |      | <input type="checkbox"/> 20.2203(a)(2)(ii)                                                    | <input type="checkbox"/> 50.36(c)(1)(ii)(A) |         | <input type="checkbox"/> 50.73(a)(2)(iv)(A)            |     | <input checked="" type="checkbox"/> 50.73(a)(2)(v)(A) |                              |                        |
|                   |     |      | <input type="checkbox"/> 20.2203(a)(2)(iii)                                                   | <input type="checkbox"/> 50.36(c)(2)        |         | <input checked="" type="checkbox"/> 50.73(a)(2)(v)(B)  |     | <input type="checkbox"/> 73.71(a)(4)                  |                              |                        |
|                   |     |      | <input type="checkbox"/> 20.2203(a)(2)(iv)                                                    | <input type="checkbox"/> 50.46(a)(3)(ii)    |         | <input checked="" type="checkbox"/> 50.73(a)(2)(v)(C)  |     | <input type="checkbox"/> 73.71(a)(5)                  |                              |                        |
|                   |     |      | <input type="checkbox"/> 20.2203(a)(2)(v)                                                     | <input type="checkbox"/> 50.73(a)(2)(i)(A)  |         | <input checked="" type="checkbox"/> 50.73(a)(2)(v)(D)  |     | <input type="checkbox"/> OTHER                        |                              |                        |
| 0                 |     |      | <input type="checkbox"/> 20.2203(a)(2)(vi)                                                    | <input type="checkbox"/> 50.73(a)(2)(i)(B)  |         |                                                        |     |                                                       |                              |                        |

**12. LICENSEE CONTACT FOR THIS LER**

FACILITY NAME

Erick Matzke

TELEPHONE NUMBER (Include Area Code)

402-533-6855

**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

| CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX | CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX |
|-------|--------|-----------|---------------|--------------------|-------|--------|-----------|---------------|--------------------|
| B     | EC     | 52        | NLI           | Y                  |       |        |           |               |                    |

**14. SUPPLEMENTAL REPORT EXPECTED**☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE)☒ NO**15. EXPECTED SUBMISSION DATE**

| MONTH | DAY | YEAR |
|-------|-----|------|
|       |     |      |

**ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)**

On June 7, 2011, at approximately 0930 CDT, a failure of a safety related 480 volt AC (V) load center supply breaker in the switchgear room occurred (Bus 1B4A). Fire alarms were received in the control room and the Halon system that protects the switchgear rooms discharged. The fire brigade responded and found the room filled with smoke, but no active fire. At 0940 CDT an Alert was declared for a fire affecting the operability of plant safety systems required to establish or maintain safe shutdown. At 1313 CDT on June 7, 2011, Fort Calhoun Station (FCS) exited the Alert after confirming that the fire was extinguished and the area was ventilated to restore access. Shutdown cooling remained in-service during the event.

FCS was also in an emergency classification of a Notification of Unusual Event (NOUE) due to high Missouri river level.

The root cause of the event was the FCS design process failed to identify the silver plating of bus bar material as a critical interface when specifying replacements for the original circuit breakers. The design process failure extended to other safety-related 480 V load center circuit breakers as well.

Corrective actions included replacing 480 V bus 1B4A and performing bus maintenance. Affected circuit breaker cradles will be realigned to ensure proper fit in the bus cubicles. Maintenance procedures are being revised to enhance maintenance practices.

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CONTINUATION SHEET**

| 1. FACILITY NAME     | 2. DOCKET | 6. LER NUMBER |                      |            | 3. PAGE |
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| Fort Calhoun Station | 05000285  | YEAR          | SEQUENTIAL<br>NUMBER | REV<br>NO. | 2 OF 5  |
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**NARRATIVE**

**BACKGROUND**

Fort Calhoun Station (FCS) is a two-loop reactor coolant system of Combustion Engineering (CE) design. The plant has six safety-related 480 VAC (V) buses and three 480 V safety related "island" cross-tie buses. The island buses are fed from one side or the other of the main 480 V buses.

**EVENT DESCRIPTION**

On June 7, 2011, at approximately 0930 CDT, a failure of a safety related 480 V load center supply breaker occurred (Bus 1B4A). FCS was operating in Mode 5 at about 82 degrees Fahrenheit with the plant fully depressurized. FCS was in an emergency classification of a Notification of Unusual Event (NOUE) due to high Missouri river level (NOUE declared June 6, 2011).

At 0930 CDT, the control room received multiple alarms that were indicative of a fire in the west electrical switchgear room. The Halon system that protects the switchgear rooms discharged. The fire brigade responded and found a room filled with smoke, but no active fire. The fire brigade confirmed that there was no active fire in the switchgear room. Additionally, during the event both trains of class 1E Direct Current (DC) grounded due to extensive damage inside cubicle 1B4A. Accompanying the DC grounds were numerous control room alarms that are fed from the DC circuits. At about 0930 CDT, while de-energizing electrical buses to aid in damage mitigation and assessment, both trains of spent fuel pool cooling were de-energized. At 0940 CDT, an Alert was declared for a fire affecting the operability of plant safety systems required to establish or maintain safe shutdown. During the course of the event a local offsite fire department responded to assist. At 1147 CDT, on June 7, 2011, power was restored to one train of spent fuel pool cooling. Spent fuel pool temperature increased 3 degrees Fahrenheit while spent fuel pool cooling was out-of-service. The operating 4160 Volt (V) train that was powering the shutdown cooling system was not affected by the fire.

Per the control room logs, FCS exited the Alert at 1313 CDT on June 7, 2011. Plant shutdown cooling remained in-service during the event.

The circuit breaker that was damaged was the supply breaker to Bus 1B4A.

At 1021 CDT, the NRC Headquarters Operations Office (HOO) was notified per 10 CFR 50.72(a)(1)(i). This revised LER report is being made per 10 CFR 50.73(a)(2)(ii)(B), 10 CFR 50.73(a)(2)(x), 10 CFR 50.73(a)(2)(v)(A), 10 CFR 50.73(a)(2)(v)(B), 10 CFR 50.73(a)(2)(v)(C) and 10 CFR 50.73(a)(2)(v)(D).

**CONCLUSION**

The original General Electric (GE) AK-50 circuit breakers had been in-service for more than 40 years and due to aging issues and the lack of available spare parts for the original circuit breakers, twelve of these circuit breakers were replaced during the 2009 Refueling Outage (RFO) on ten 480 V buses. The GE original equipment was replaced with Square D circuit breakers supplied through Nuclear Logistics Incorporated (NLI).

The Square D circuit breakers were not an exact replacement for the GE equipment; therefore, a cradle assembly was utilized to ensure that the Square D equipment would match-up to the GE switchgear. The cradle assembly consists of finger clusters that engage the bus bars at the back of the GE

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switchgear, and has stabs on the circuit breaker side of the cradle assembly that accept the circuit breaker finger clusters.

An analysis determined that the root cause of the fire in 480 V Bus 1B4A was that the FCS design process failed to identify the silver plating of bus bar material as a critical interface when specifying replacements for the original General Electric (GE) AK-50 circuit breakers. Silver plating provides a non-reactive/corrosive material to most environments for the breaker stabs to remain in contact for long periods of time without incident. The circuit breaker cradle fingers, where they engage the bus bars, were longer than the original AK-50 circuit breakers and did not properly contact the silver plating of the stabs. The cradle fingers engaged the bus bar in a contact area of hardened grease and copper oxide build-up, which caused a high resistance connection at the stab to finger interface. The high resistance connection overheated the finger cluster resulting in bus grounding and phase-to-phase shorting.

Other contributing causes include:

- An acrid odor that existed for three days preceding the bus fire was not adequately communicated to engineering, maintenance, or management.
- FCS engineering had limited knowledge of GE AKD-5 switchgear resulting in overreliance on vendor knowledge and skill.
- An FCS modification procedure lacks requirements to identify and compare critical design characteristics of equipment being modified. Additionally, this procedure has weak requirements for the use of operating experience criteria.
- Maintenance procedures that govern 480 V bus cleaning are inadequate. Also, access to the bus side of the GE AKD-5 switchgear is difficult limiting the selection of inspection/testing methods.
- As-left resistance readings from the line to load side of the switchgear following circuit breaker replacement were not confirmed.

During the 2009 RFO an additional ten Square D circuit breakers supplied by NLI, with the same finger cluster configuration as the 1B4A circuit breakers were installed in 1B3A and seven other safety-related 480 V buses. The major safety-related 480 V equipment that could have been affected by the installation of the 12 circuit breakers include:

**Bus 1B4A**

- AC-3B Component Cooling Water Pump
- VA-46B Control Room Ventilation

**Bus 1B4B**

- SI-3B Containment Spray Pump

**Bus 1B4C**

- SI-2B High Pressure Safety Injection Pump
- CH-1B Charging Pump
- AC-5B Spent Fuel Pool Cooling Pump
- VA-3B Containment Cooler

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**Island Bus 1B-3A-4A**

- SI-2C High Pressure Safety Injection Pump

**Island Bus 1B3B-4B**

- SI-3C Containment Spray Pump
- CH-1C Charging Pump

**Island Bus 1B3C-4C**

- AC-3C Component Cooling Water Pump

**Bus 1B-3A**

- SI-2A High Pressure Safety Injection Pump
- CH-1A Charging Pump
- AC-5A Spent Fuel Pool Cooling Pump
- VA-3A Containment Cooler

**Bus 1B-3B**

- AC-3A Component Cooling Water Pump
- VA-46A Control Room Air Conditioning

**Bus 1B-3C**

- SI-3A Containment Spray Pump

**CORRECTIVE ACTIONS**

The affected bus was de-energized and the Halon system extinguished the fire. The Halon system was recharged and restored to service.

The station conducted inspections and testing of the unaffected 480 V buses, the supply breakers to the 480 V buses, and the 480 V bus tie breakers. The tested 480 V supply breakers and bus tie breakers passed their inspections and testing.

The station is replacing the affected bus (1B4A), which contains two 480 V supply circuit breakers, 1B4A and BT-1B4A (supply breaker to the associated "island" bus).

As part of an extent of condition review ten other unaffected 480 V load center bus stabs for supply and bus tie circuit breakers are being inspected, and re-plated with silver at the vendor shop.

The silver plating on affected 480 V bus stabs is being extended so the Square D circuit breaker cradle fingers properly contact the silver plated surface of the bus stabs.

Affected circuit breaker cradles will be realigned to ensure proper fit in the 480 V bus cubicles.

Procedures are being developed or revised that address 480 V bus inspection and maintenance practices.

Other corrective actions to address the fire and extent of condition are documented in the FCS Corrective Action Program.

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**SAFETY SIGNIFICANCE**

As a direct result of the fire in bus 1B4A and the tripping of bus 1B3A, spent fuel pool cooling was lost for approximately 90 minutes. Shutdown cooling was powered from the unaffected 4160 V bus. The loss of both safety-related 480 V bus trains is a potentially unanalyzed condition in circuit breaker coordination and impacted nuclear safety.

The twelve 480 V Square D circuit breakers were installed during the 2009 RFO and were in-service for an 18 month operating cycle. As noted in the conclusion section above, an extent of condition existed in the remaining ten safety-related 480 V buses which could have impacted nuclear safety if a fire occurred while the plant was above 300 degrees F.

**SAFETY SIGNIFICANT FUNCTIONAL FAILURE**

This event does result in a safety system functional failure in accordance with NEI-99-02.

**PREVIOUS EVENTS**

None