

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

March 21, 1991  
LIC-91-0010L

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

Reference: Docket No. 50-285

Gentlemen:

Subject: Licensee Event Report 91-04 for the Fort Calhoun Station

Please find attached Licensee Event Report 91-04 dated March 21, 1991. This report is being submitted pursuant to 10 CFR 50.73(a)(2)(ii)(B). A 7 day extension request for submittal of this report was approved by NRC Region IV personnel on March 14, 1991.

If you should have any questions, please contact me.

Sincerely,

*W. G. Gates*

W. G. Gates  
Division Manager  
Nuclear Operations

WGG/djm

Attachment

c: R. D. Martin, NRC Regional Administrator  
W. C. Walker, NRC Project Manager  
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 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)

PAGE (3)

Fort Calhoun Station Unit No. 1

0 5 0 0 0 2 8 5 1 OF 0 5

TITLE (4)

Offsite Power Low Signal Outside Design Basis

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)

N

0 5 0 0 0

0 2 1 2 9 1 9 1 0 0 4 0 0 0 3 2 1 9 1

5 5 0 0 0

OPERATING MODE (9)

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5 (Check one or more of the following) (11)

POWER LEVEL (10)

1715

20.402(a)

20.406(a)

50.73(a)(2)(iv)

73.71(a)

20.406(a)(1)(i)

50.38(a)(1)

50.73(a)(2)(v)

73.71(a)

20.406(a)(1)(ii)

50.38(a)(2)

50.73(a)(2)(vi)

OTHER (Specify in Abstract below and in Text, NRC Form 366.2)

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)(x)

LICENSEE CONTACT FOR THIS LER (12)

NAME

D. S. Molzer, Shift Technical Advisor

TELEPHONE NUMBER

AREA CODE

41012 513131-16181914

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 |
|-------|--------|-----------|--------------|-------------------|-------|--------|-----------|--------------|-------------------|
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SUPPLEMENTAL REPORT EXPECTED (14)

EXPECTED SUBMISSION DATE (15)

MONTH DAY YEAR

YES (If yes, complete EXPECTED SUBMISSION DATE)

NO

ABSTRACT (Limit to 1400 words, i.e., approx. fifteen single-space typewritten lines)

(16)

The Offsite Power Low Signal (OPLS) provides degraded voltage protection to safeguards equipment; when a degraded voltage condition exists concurrent with a Safety Injection Actuation Signal, the OPLS signal isolates safeguards buses 1A3 and 1A4 from their offsite power supply (161 kV) and initiates automatic actions to load the safeguards equipment onto the emergency diesel generators. Engineering analysis revealed that, during a postulated accident, the voltage supplied to some 480 V safeguards loads could degrade to as low as 87.5% of rated voltage without OPLS being actuated. Since the possibility existed for voltage to be lower than the recommended 90% of rated voltage for certain 480 V safeguards loads without an OPLS actuation, management determined on February 12, 1991 that the plant was outside of its design basis.

Corrective actions include administrative controls of equipment configurations and bus loadings, as well as resetting of the OPLS setpoints. A long term corrective action plan is being developed.

LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-630), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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YEAR SEQUENTIAL REVISION

NUMBER NUMBER NUMBER

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TEXT (If more space is required, use additional NRC Form 365A's) (17)

At Fort Calhoun Station the electrical distribution system is designed with four separate 4160 V buses, two of which (1A3 and 1A4) are designated as safeguards buses. These 4160 V safeguards buses are normally fed from the 161 KV system which constitutes the offsite power supply. The two safeguards buses and their associated 480 V buses supply power to Engineered Safety Feature (ESF) components that are required for safe reactor shutdown and removal of decay heat. To ensure that adequate voltage exists from the offsite power system to these buses during an accident, the electrical distribution system has been equipped with a degraded voltage protection system. The degraded voltage protection system is referred to as the Offsite Power Low Signal (OPLS). The OPLS provides protection to safeguards equipment when an undervoltage condition is sensed on buses 1A3 or 1A4, in the presence of a Safety Injection Actuation Signal (SIAS). When a degraded voltage condition exists concurrent with a SIAS, the OPLS signal isolates buses 1A3 and 1A4 from their offsite power supply (161 KV) and initiates automatic actions to load the safeguards equipment onto the emergency diesel generators. The OPLS setpoints were originally designed to ensure the voltage being supplied to the 4160 V and 480 V loads does not drop below 90% of nameplate voltage during an accident. The motor manufacturer recommends that terminal voltage be maintained at a minimum of 90% of motor nameplate rating to assure long-term motor protection from excessive current.

Omaha Public Power District (OPPD) has been involved in a Design Basis Reconstitution Project to verify or reconstruct the design basis calculations and analyses of Fort Calhoun Station systems including the electrical distribution system. In 1989, the first revision of the Design Basis Document for the electrical distribution system was issued. An open item in this document identified the lack of supporting documentation to verify that certain loads could be assured of operating above their minimum voltage rating. In an effort to resolve this open item a computer software program, "Electrical Load Monitoring System" (ELMS), was utilized to model the plant electrical distribution system for purposes of reconstituting the original Degraded Voltage Analysis. The ELMS revealed that during an accident in which safeguard equipment would be required to operate, the voltage supplied to some 480 V safeguards loads could degrade to as low as 87.5% of rated voltage without OPLS being actuated. Since the possibility existed for voltage to be lower than the recommended 90% of rated voltage for certain 480 V safeguards loads without an OPLS actuation, the Plant Review Committee (PRC) determined on February 12, 1991 that the plant was outside of its design basis. The PRC concluded that OPLS was operable based upon engineering judgement that the safeguards loads would continue to perform their intended functions at the degraded voltage. The plant was at 75% power and mode 1 at the time of the determination.



LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

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

A one hour report was subsequently made to the NRC at 1615 hours on February 12, 1991 in accordance with 10 CFR 50.72(b)(1)(ii)(B). This written report is submitted pursuant to 10 CFR 50.72(a)(2)(ii)(B) for the plant being outside its design basis. A 7 day extension request for submittal of this report was approved by NRC Region IV personnel on March 14, 1991.

As a result of OPPD's effort to reconstitute the original Degraded Voltage Analysis, several modifications were identified that have contributed to degrading the plant undervoltage protection capabilities. Initially, the OPLS degraded voltage protection system was installed in 1973 under modification MR-FC-77-064 in response to a NRC generic letter on degraded voltage, dated June 2, 1977. During a recent review of design basis documents, it was discovered that the original analysis performed in support of the modification did not assume the worst case loading that would occur during a Loss of Coolant Accident (LOCA) scenario. The load model used in the original analysis was not representative of these worst case operating conditions and thus did not conservatively assume the loads that would be present. This potentially could allow a condition in which voltage on the 480 V buses could decrease below 90% of rated voltage without having reached the original OPLS actuation setpoints.

Another concern identified was modification MR-FC-84-105, completed in 1985, which replaced the 4160/480 V transformers with those of a higher impedance. The higher impedance transformers were selected in order to limit ground fault currents available to the 480 V switchgear. This also resulted in lower 480 V system voltages due to the higher impedances. Although the analysis concluded that voltage levels were acceptable based on operator action to trip various large loads during an accident, these assumptions were invalid since they took credit for manual action to reduce system loads during post-LOCA operation. Recent review of the original licensing basis degraded voltage (OPLS) submittal to the NRC on August 30, 1978, indicates that these assumptions do not meet design criteria for "automatic" protection of ESF loads for undervoltage conditions in a post-LOCA condition.

In 1986, an engineering consultant was contracted to update the electrical distribution system's design basis documents for future modifications and verify the OPLS operating setpoints. On November 3, 1988, plant management was notified of the results of the report. It was identified that the possibility existed for the 4160 V buses to trip from their offsite power supply (161KV) during accident conditions. It appeared that during an accident condition assuming safeguards bus 1A4 at its heaviest normal loading, 161 KV grid at its lowest normal expected voltage, and ESF equipment sequenced onto the buses following a Safety Injection Actuation Signal, OPLS actuation would occur while offsite power was in a normal voltage range. LER 88-33 was submitted to the NRC documenting the condition and corrective action.

LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

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TEXT (If more space is required, use additional NRC Form 306A's) (17)

To correct the problem, Modification MR-FC-88-110 was installed in 1988 to increase various safeguards equipment sequencer starting times until system starting loads had decreased. The analysis performed in support of the modification took credit for operator action to reduce certain 4160 V loads in order to increase system voltage. Although it wasn't realized at the time, credit could not be taken for reducing system loads by means of non-automatic protection of ESF equipment. As previously stated, this type of load reduction does not meet design criteria for "automatic" protection of ESF loads for undervoltage conditions in a post-LOCA condition.

Because the OPLS was determined to be outside its design basis on February 12, 1991, an engineering evaluation was performed to determine the effects of degraded voltage on the safeguards equipment, specifically the 480 V motors. By considering the time overcurrent protection curves for safeguards loads, it was concluded that sufficient margin exists such that the safeguard equipment would be able to operate without tripping during a Design Basis Accident with an undervoltage condition on the 161 KV system. The estimated motor overload currents would not be expected to generate sufficient heating of the motor internals over the required operating times that would preclude acceptable equipment performance. This justification is based on engineering judgement.

The primary cause of this event can be attributed to an inadequate modification design at the time the original Degraded Voltage Analysis was performed. The assumption made in the original analysis was nonconservative and has propagated throughout subsequent revisions to the analysis. A contributing cause was lack of procedural guidance for the performance and documentation of assumptions used in the calculations. Another contributing cause was lack of comprehensive Design Basis Documentation prior to July, 1988. This resulted in inadequate documentation of the original OPLS design criteria which led to credit being taken in subsequent modifications for non-automatic protection of safeguards loads. These primary and contributing causes have already been corrected through the development of upgraded procedures for the control of calculations and documentation requirements. Additionally, the development and issuance of plant Design Basis Documents have provided the corrective action necessary for resolution of incomplete design basis documentation.

# LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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

The following compensatory measures were taken to ensure the operability of the degraded voltage system (OPLS) and thus assure the satisfactory performance of the safeguards motors:

- (1) Engineering analysis EA-FC-91-017 was performed to derive new OPLS setpoints for current bus loading configurations. The new setpoints are more conservative than the setpoints currently listed in the Technical Specifications. The OPLS actuation relays have been recalibrated with the new setpoints designated in EA-FC-91-017. The new OPLS setpoints in conjunction with the loading configuration specified in the analysis will ensure safeguards motors are capable of satisfying their design function during accident conditions.
- (2) Administrative restrictions were placed on equipment rotation and bus loading configurations through Operations Memorandum FC-91-02. The loading restrictions are necessary to ensure bus alignment is consistent with that assumed in the analysis for the new setpoints. Administrative bus loading restrictions will remain in effect until long term corrective action has been completed. If an electrical configuration arises due to plant operating requirements which are outside the permitted restrictions, plant staff will contact Engineering, evaluate the situation, and determine operability and reportability.
- (3) As an interim measure until the new OPLS setpoints were installed, a dedicated operator was stationed in the control room to monitor voltage levels on 4160 V buses 1A3 and 1A4 and manually actuate OPLS if voltages dropped below the new OPLS alarm setpoints installed on the plant computer.

A plan for long-term corrective action is being developed to remove administrative operating restrictions. Highlights of this plan will be provided in a supplement to this LER by June 21, 1991.

Other Licensee Event Reports which have been submitted addressing design deficiencies are LERs 90-03, 90-05, 90-07, 90-09, 90-16, 90-20, 90-23, 90-25, 89-09, 89-14, 89-15, 89-24, 88-09, 88-19, 88-20, 88-32, and 88-33.