AmerenUE
Callaway Plant

PO Box 620
Fulton, MO 65251

February 4, 2010

ULNRC-05675

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

10 CFR 50.73(a)(2)(i)(A)

Ladies and Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
FACILITY OPERATING LICENSE NPF-30
LICENSEE EVENT REPORT 2009-001-01
TECHNICAL SPECIFICATION REQUIRED
SHUTDOWN DUE TO LOSS OF POWER SUPPLY

On April 17, 2009, Callaway plant submitted licensee event report, LER 2009-001-00, in accordance with 10CFR50.73(a)(2)(i)(A) to report a reactor shutdown required by Technical Specifications due to the loss of a power supply in the Balance of Plant Engineered Safety Features Actuation System channel 1 logic cabinet.

The enclosed supplemental licensee event report, LER 2009-001-01, is submitted to revise the causes and corrective actions for the same condition.

This letter does not contain new commitments.

Sincerely,

David W. Neterer
Plant Director

EMF

Enclosure

cc: Mr. Elmo E. Collins, Jr.
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U.S. Nuclear Regulatory Commission
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Index and send hardcopy to QA File A160.0761

Hardcopy:

Certrec Corporation
4200 South Hulen, Suite 422
Fort Worth, TX 76109
(Certrec receives ALL attachments as long as they are non-safeguards and may be publicly disclosed.)

LEREvents@inpo.org (must send the **WORD** version of the LER to this address)

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NRC FORM 366 (9-2007)	U.S. NUCLEAR REGULATORY COMMISSION	APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2010
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: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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	2. DOCKET NUMBER	3. PAGE
Callaway Plant Unit 1	05000483	1 OF 6

4. TITLE
Technical Specification Required Shutdown due to Loss of Power Supply

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
02	19	2009	2009	- 001 -	01	02	04	2010	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE
1

10. POWER LEVEL
100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☒ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
T.B. Elwood, Supervising Engineer, Regulatory Affairs and Licensing	314-225-1905

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
E	JE	RJX	S257	Y					

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

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

At 0228 on 2/19/2009, while operating at 100-percent reactor power, multiple control room annunciators actuated in response to a power supply failure in the Balance of Plant Engineered Safety Features Actuation System (ESFAS) channel 1 logic cabinet. Due to the number of isolation and actuation instrumentation functions affected, numerous Technical Specification (TS) Conditions and Required Actions were entered. TS 3.3.2.Q required the plant to be in MODE 3 in 6 hours and MODE 4 in 12 hours. Although the power supply was replaced in a timely manner, it was not able to be replaced before plant shutdown was required per TS 3.3.2.Q. Hence, load reduction began at 0530, with MODE 3 being reached at 0817. The power supply was replaced and the system was restored to Operable at 1009.

Root Causes for this event include inadequate trending of condition monitoring data, no preventive maintenance strategy for critical power supplies, and failure to identify generic power supply failure issues and implement corrective actions. The Corrective Action to Prevent Recurrence for this event is to generate new preventive maintenance tasks in order to implement a time-based replacement and refurbishment program for critical power supplies.

All times are approximate and Central Standard Time unless otherwise stated.

I. DESCRIPTION OF THE REPORTABLE EVENT

A. REPORTABLE EVENT CLASSIFICATION

10CFR50.73(a)(2)(i)(A) requires reporting of the completion of any nuclear plant shutdown required by the plant's Technical Specifications. This Licensee Event Report (LER) is submitted accordingly.

B. PLANT OPERATING CONDITIONS PRIOR TO THE EVENT

The plant was in MODE 1 (Power Operation) at 100-percent reactor power at the time the event occurred.

C. STATUS OF STRUCTURES, SYSTEMS OR COMPONENTS THAT WERE INOPERABLE AT THE START OF THE EVENT AND THAT CONTRIBUTED TO THE EVENT

No structures, systems, or components were inoperable at the start of the event which contributed to the event.

D. NARRATIVE SUMMARY OF THE EVENT, INCLUDING DATES AND APPROXIMATE TIMES

At 0228 on 2/19/2009, multiple annunciators actuated in the control room in response to receipt of a containment purge isolation [EIIS system: JE] signal (CPIS), control room ventilation isolation [EIIS system: JE] signal (CRVIS), fuel building isolation [EIIS system: JE] signal (FBIS), steam generator blowdown and sample isolation [EIIS system: WI] signal (SGBSIS), as well as signals indicative of an auxiliary feedwater pump [EIIS system: BA, component: P] suction transfer to the essential service water (ESW) [EIIS system: BI] and a motor-driven auxiliary feedwater pump start. Proper actuations were verified for the CRVIS, CPIS, and FBIS per plant operating procedure OTO-SA-00001, Engineered Safety Feature Actuation Verification and Restoration, which was entered at 0231. Both trains of CRVIS, CPIS, and FBIS actuated per design.

Investigation revealed that the lights on power supplies PS-1, PS-3, and PS-4 [EIIS system: JE, component: RJX] were extinguished on cabinet SA036D [EIIS system: JE, component: CAB], Balance of Plant (BOP) Engineered Safety Features Actuation System (ESFAS) channel 1 logic cabinet (located in the back of the control room). Although the annunciator actuations were indicative of these three power supply failures, PS-1 directly feeds the other two downstream power supplies, PS-3 and PS-4, such that there was actually only one power supply failure, i.e., PS-1.

The BOP ESFAS system functions to provide certain ESFAS actuation signals including a CPIS, CRVIS, FBIS, SGBSIS, and Auxiliary Feedwater Actuation Signal (AFAS). In this instance, both trains of CPIS, CRVIS, and FBIS logic actuated (such that the affected dampers [EIIS system: JM, component: DMP] repositioned, etc.).

The system isolation/actuations were invalid because they were not initiated in response to actual plant conditions, nor were they initiated due to parameters satisfying the requirements for initiation of the

safety functions of the systems.

Although the isolation/actuations were invalid, the system isolation and actuations that occurred did occur per design in response to the initiating condition (i.e., the noted power supply failure). However, the inadvertent isolation/actuations only affected containment isolation dampers in one system, Containment Purge, and therefore these inadvertent isolation/actuations are NOT reportable per 10CFR50.73(a)(2)(iv)(A) & (B).

While there was annunciation that the MDAFP had started and that AFW suction had switched to ESW, these alarms were caused by the power supply failure; the actuations normally indicated by these alarms did not actually occur, as previously noted.

In response to the failure of PS-1, and based on the identified actuation/isolation functions affected, the following Technical Specification (TS) Conditions were entered:

AFAS:	3.3.2.J, 3.3.2.O, 3.3.2.P, 3.3.2.Q, 3.3.2.R and 3.7.5.C
CPIS:	3.3.6.B and Final Safety Analysis Report (FSAR) Specification 16.11.2.4
CRVIS:	3.3.7.A
FBIS:	3.3.8.A

Shortly thereafter, the Operations crew realized that they failed to take Action per Condition 3.3.2.O, which requires tripping an inoperable LSP channel within 1 hour. Entry into TS Limiting Condition for Operation (LCO) 3.0.3 was thus made and logged. However, it was subsequently confirmed that the loss of power to the bistable module placed it in a tripped condition, and therefore, entry into LCO 3.0.3 was not required.

In addition, the Operations crew should have entered TS 3.3.6 Condition A for CPIS; however, after the expiration of its 4-hour Completion Time, default Condition B is required to be entered to assure the specified safety function is satisfied. TS 3.3.6 Condition B was entered immediately as discussed above.

The Required Actions of Condition 3.3.2.Q require the plant to be in MODE 3 (Hot Standby) in 6 hours and MODE 4 (Hot Shutdown) in 12 hours. Load reduction began at 0530 on 2/19/2009, with MODE 3 being reached at 0817. The PS-1 power supply was replaced and the system was restored to Operable status at 1009 on 2/19/2009. TS Condition 3.3.2.Q was thus exited at that time.

The failed PS-1 power supply was shipped offsite to a vendor for failure analysis. The failure mechanism was determined to be an end-of-life failure of the power supply due to failed and degraded capacitors [EIIS system: JE, component: CAP].

Due to non-related, equipment issues experienced during the plant shutdown, and in order to perform additional discretionary work to enhance unit reliability, a forced outage ensued and the plant was maintained in a shutdown condition, i.e., stable in MODE 3. The plant entered MODE 2 (Startup) at 1556 on 3/1/2009, and MODE 1 at 2218. At 1312 on 3/3/2009, the main electrical generator [EIIS system: TB] was paralleled to the grid and Callaway Plant was returned to service.

E. METHOD OF DISCOVERY OF EACH COMPONENT, SYSTEM FAILURE, OR PROCEDURAL ERROR

Given the multiple annunciators at the onset of this event, the condition was self-revealing. Causal factors, as well as a root cause, were discovered through the use of a seven-step root cause analysis, with assistance from the vendor who performed the failure analysis.

II. EVENT DRIVEN INFORMATION

A. SAFETY SYSTEMS THAT RESPONDED

Not applicable for this event.

B. DURATION OF SAFETY SYSTEM INOPERABILITY

No structures, systems, or components were inoperable during the event which contributed to the event.

C. SAFETY CONSEQUENCES AND IMPLICATIONS OF THE EVENT.

This event was determined to be of very low risk significance. At no time was the plant in an unanalyzed condition. The events described in this LER involve a reactor shutdown required by TS. The shutdown was completed without incidence within the allotted time. During the shutdown, no equipment malfunctions or human performance errors were encountered that would have placed the plant in a condition outside of its safety analysis. Therefore, this event has been determined to be of low safety and risk significance.

III. CAUSE(S) OF THE EVENT AND CORRECTIVE ACTION(S)

This event was evaluated using a root cause analysis (RCA) process. An RCA team was assembled to review this event, determine the cause of the event, and develop corrective action to prevent recurrence. The RCA team identified two Causal Factors (CFs) with three Root Causes (RCs). This issue has been entered into Callaway's corrective action program. One Corrective Action to Prevent Recurrence (CATPR) and two Corrective Actions (CAs) were identified.

The first CF identified was that no actions were taken in response to the existing condition monitoring preventive maintenance (PM) results (i.e., voltage and ripple checks). According to EPRI guidelines, PM includes predictive and periodic actions to improve equipment reliability and availability. The goal of predictive maintenance activities is to collect, trend, and analyze equipment operating data and process parameters to initiate maintenance activities for degrading equipment prior to failure, thereby minimizing unplanned corrective maintenance activities. Callaway's PM strategy for these power supplies has been based solely on the predictive approach, which was consistent with industry and EPRI guidance several years ago. The predictive approach is predicated on effective trending and monitoring of the data collected. No periodic replacement strategy had been implemented. The RCA team determined that the condition monitoring data for these power supplies has not been adequately trended or monitored. Therefore, inadequate trending and monitoring of the existing PM data was determined to be a RC for this power supply failure. The CA for this RC is to incorporate System Engineer trending and monitoring of BOP ESFAS and LSELS power supply data into System Trending and Monitoring Plans (STAMPs) to include monitoring frequency and action levels.

The second CF identified was that the power supply was not replaced prior to exceeding its expected service life. The power supply service time exceeded approximately 25 years, which is beyond any reasonable service life expectation. The RC was that Callaway did not have a time-based PM strategy in place to replace these critical power supplies prior to failure. The power supply was allowed to run to failure without any time-based replacement planned. The CATPR for this RC is to generate new PM tasks in order to

implement a time-based replacement and refurbishment program for critical power supplies based upon EPRI guidelines and Callaway's Power Supply Life Cycle Management (LCM) study. A CA is to reverse engineer and replace all power supplies currently installed in the BOP ESFAS and Load Shedding and Emergency Load Sequencing (LSELS) system [EIIS system: JE] cabinets. A second RC for this CF was a failure to recognize the generic issues with power supply failures and implement corrective actions. Callaway has had previous opportunities to prevent this power supply failure, but adequate corrective actions were not implemented.

The extent of condition review determined the scope to include a population of fourteen power supplies in the BOP ESFAS and LSELS cabinets. These power supplies are all of similar design, used in similar Consolidated Controls cabinets, and have similar TS implications. Based upon a review of the failure history of the applicable power supplies, the most common failure mechanism appears to be failed or degraded capacitors. The capacitors have failed by opening, shorting, or leaking causing the output voltage to have increased ripple, lower voltage output, or no output.

Until the power supplies identified by the extent-of-condition review can be replaced/refurbished in accordance with the above-noted replacement and refurbishment program, and in light of the limited number of available spares for the current power supplies, contingency actions have been established for the current operating cycle. Work Management has developed on-demand PM work documents to replace any failed BOP ESFAS and LSELS power supply. In addition to these work documents, I&C has staged one spare of each type of power supply such that the spare is maintained energized in the shop. These contingency actions will facilitate prompt replacement if the need arises (i.e., within the most limiting TS 3.3.2 action time of 6 hours).

IV. PREVIOUS SIMILAR EVENTS

A search of the Callaway corrective action request system (CARS) identified five occurrences of power supply failures similar to the event on 2/19/2009.

- LER 1992-011: In October 1992, all four field contact power supply output fuses blew causing all main control board annunciators [EIIS system: IB] to become inoperable during restoration from replacement of a failed power supply. The cause of the initial failure of the power supply was a short in the power transformer internal to the field power supply. An extent-of-condition review was performed for annunciator power supply internal components. Corrective action called for establishing a replacement program for those power supplies.
- In October 2002, a power supply in the ESFAS channel 4 logic cabinet was found failed. It was suspected that an electrolytic capacitor on the regulating board was degraded and caused the failure. An extent-of-condition review was performed for the power supply components in the BOP ESFAS and LSELS cabinets. As corrective actions, the need for developing a replacement program was identified. Since this program was implemented only a month before the event described in this LER, this program could not have prevented this failure.
- In October 2002, an LSELS power supply failed. The cause of the failure was indeterminate. The power supply age was 20 to 25 years. The corrective actions were to continue voltage and ripple check PMs on these power supplies in order to detect some of the incipient failures. An extent-of-condition review was performed for the power supply components in the BOP ESFAS and LSELS cabinets, and the need for a replacement program was identified. Again, since this program was implemented only a month before the event described in this LER, this program could not have prevented this failure.

NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

- In February 2005, a maintenance preventable functional failure for the plant computer system due to inadequate PMs for installed power supplies was identified. Corrective actions included creating a power supply PM document under the Equipment Reliability Improvement Project (ERIP) based on identifying the actions that should be taken to monitor and replace supplies to reduce service failures. These corrective actions were not implemented. The extent of condition and cause were not identified.
- In October 2008, a power supply in the ESFAS channel 4 logic cabinet failed, which led to CPIS, CRVIS, and FBIS inadvertent actuations. The cause of this power supply failure was age-related. Enhancements included revising the PM basis document for BOP ESFAS and LSELS power supply monitoring, incorporating EPRI recommendations based on replacement frequency and the results of the LCM plan. This enhancement has not yet been implemented. The extent-of-condition review included the power supplies in the BOP ESFAS and LSELS cabinets within the identified scope.

V. ADDITIONAL INFORMATION

The power supply that failed is a Sorenson (EPIX code S257) model STM 48-14M20. This is a DC/DC power supply with the following ratings:

Input 105-145 Vdc / 6.7 A
Output Nominal 48 Vdc / 10 A

The system and component codes listed below are from the IEEE Standard 805-1984 and IEEE Standard 803A-1984 respectively.

System: BA, Auxiliary/Emergency Feedwater System (PWR)
Component: P, Pump

System: BI, Essential Service Water System

System: IB, Annunciator System

System: JE, Engineered Safety Features Actuation System
Component: CAB, Cabinet
CAP, Capacitor
RJX, Power Supply, Electric, Regulated

System: JM, Containment Isolation Control System
Component: DMP, Damper

System: TB, Main Generator System
System: WI, Steam Generator Blowdown System