Fadi M. Diya
Vice President
Nuclear Operations
Ameren Missouri
Callaway Plant
T 573.676.6411
F 573.676.4056

December 21, 2010

ULNRC-05752

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

10 CFR 50.73(a)(2)(i)(B)
10 CFR 50.73(a)(2)(v)(A)
10 CFR 50.73(a)(2)(v)(B)
10 CFR 50.73(a)(2)(v)(D)

Ladies and Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
FACILITY OPERATING LICENSE NPF-30
LICENSEE EVENT REPORT 2010-005-01
EMERGENCY DIESEL GENERATOR "A" SHUTDOWN
DURING 24-HOUR SURVEILLANCE

On May 28, 2010 Callaway Plant submitted Licensee Event Report (LER) 2010-005-00 in accordance with 10 CFR 50.73(a)(2)(i)(B), 10 CFR 50.73(a)(2)(v)(A), 10 CFR 50.73(a)(2)(v)(B), and 10 CFR 50.73(a)(2)(v)(D) to report an event in which the "A" emergency diesel generator at Callaway failed and automatically shut down during a 24-hour surveillance run.

The enclosed supplemental Licensee Event Report, LER 2010-005-01, is submitted to revise the causes and corrective actions for the same condition.

This letter does not contain new commitments.

Sincerely,

Fadi M Diya
Vice President, Nuclear Operations

Enclosure

cc: Mr. Elmo E. Collins, Jr.
Regional Administrator
U.S. Nuclear Regulatory Commission
Region IV
612 E. Lamar Blvd., Suite 400
Arlington, TX 76011-4125

Senior Resident Inspector
Callaway Resident Office
U.S. Nuclear Regulatory Commission
8201 NRC Road
Steedman, MO 65077

Mr. Mohan C. Thadani (2 copies)
Senior Project Manager, Callaway Plant
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Mail Stop O-8G14
Washington, DC 20555-2738

Mr. James Polickoski
Project Manager, Callaway Plant
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Mail Stop O-8B1A
Washington, DC 20555-2738

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)

Electronic distribution for the following can be made via LER ULNRC Distribution:

A. C. Heflin
F. M. Diya
C. O. Reasoner III
D. W. Neterer
L. S. Sandbothe
S. A. Maglio
S. L. Gallagher
T. L. Woodward (NSRB)
T. B. Elwood
D. E. Dumbacher (NRC)
B. D. Brooks (WCNOC)
Ms. Diane M. Hooper (WCNOC)
Mr. Tim Hope (Luminant Power)
Mr. Ron Barnes (APS)
Mr. Tom Baldwin (PG&E)
Mr. Wayne Harrison (STPNOC)
Ms. Linda Conklin (SCE)
Mr. John O'Neill (Pillsbury Winthrop Shaw Pittman LLP)
Missouri Public Service Commission
Records Center (INPO)

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

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 FOIA/Privacy Section (T-5 F53), 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.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Callaway Plant Unit 1	05000483	1 OF 7

4. TITLE

Emergency Diesel Generator A Shutdown during 24 Hour Surveillance

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
03	30	2010	2010	- 005 -	01	12	21	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)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☒ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☐ 50.73(a)(2)(iv)(A)
- ☒ 50.73(a)(2)(v)(A)
- ☒ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☒ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

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
A	EK	ENG	F010	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)*

The A Emergency Diesel Generator (EDG) failed on March 30, 2010, during a 24-hour Technical Specification (TS) run. Post-trip indications showed that the A EDG tripped on reverse power. The B EDG was operable and in its normal standby lineup. Offsite power was available at the time of the event.

After the cause of the failure and means to restore the EDG were identified, it was determined that the EDG would not be restored to operable status within the TS allowed timeframe. Enforcement discretion (ED) was requested and granted. The ED is documented in NRC's approval letter for NOED 10-4-001. The A EDG was declared operable on April 4, 2010.

The cause of the A EDG shutdown was due to a failure of the governor to maintain the fuel rack open during operation. The root cause for this event was inattention to detail by craft during fabrication and installation of the EDG governor gear drive assembly gasket which resulted in the failure of the governor drive due to blockage of the lubrication supply port. The fabrication and installation of the gasket occurred eleven years prior to the EDG failure.

Corrective action includes revising work instructions for the governor drive assembly for the emergency diesel engines to verify the governor drive assembly gasket has an oil supply port and that it is appropriately aligned to the oil port in the governor drive case during installation.

1. DESCRIPTION OF STRUCTURE(S), SYSTEM(S) AND COMPONENT(S):

The Class IE AC system at Callaway is divided into two redundant load groups. Either one of the load groups is capable of providing power to the systems/components needed to safely reach cold shutdown. Each AC load group consists of a 4.16-kV bus, 480-V load centers, 480-V motor control centers, and lower voltage AC supplies. Each 4.16-kV load group is supplied by two preferred power supply feeders (offsite power circuit connections) and one diesel generator (standby) supply feeder. One (either) load group is adequate to satisfy minimum engineered safety features demand caused by a LOCA and loss of preferred power supply.

The standby power supply for each safety-related load group consists of one diesel generator [EIIS system EK, EIIS component DG] complete with its accessories and fuel storage and transfer systems. It is capable of supplying essential loads necessary to reliably and safely shut down and isolate the reactor. Each diesel generator is rated at 6,201 kW for continuous operation. One diesel generator is connected exclusively to a single 4.16-kV safety feature bus of a load group. The diesel generators are electrically isolated from each other.

The diesels [EIIS component ENG] are manufactured by the Fairbanks Morse division of Colt Pielstick Industries. Each engine is a four stroke, V-14, 8600 hp, 514 rpm, water cooled engine. The engine control system consists of the governor, auxiliary start and shutdown control servo, overspeed trip, fuel shutdown servo, and linkages to position the fuel injector pump racks. Each diesel uses a Woodward governor [EIIS component 65] Model EGB-50P to regulate engine speed under varying load conditions.

The governor provides the motive force to position the fuel rack of the EDG. The EDG governor operates as a hydraulic actuator and is coupled to the EDG by a splined input shaft. A splined coupling in the governor drive case engages the splined governor input shaft. The splined coupling is supported by an oil lubricated bushing within the governor drive case. The EDG governor regulates the amount of fuel supplied to the engine by manipulating fuel rack position in response to signals from the electronic governor or backup mechanical governor. To maintain constant engine speed, the governor, through linkages to the fuel injection pumps, increases or decreases the fuel supplied to the engine as applied load increases or decreases. The motive force for controlling the fuel rack is provided by a pump within the governor. This shaft-driven pump connects to the governor drive unit at the spline coupling.

2. INITIAL PLANT CONDITIONS:

On March 30, 2010, Callaway plant was in Mode 1 at 100 percent power. Plant personnel were performing a 24-hour loaded run of the train A emergency diesel generator (EDG) per Technical Specification (TS) Surveillance Requirement (SR) 3.8.1.14. The B EDG was operable and in its normal standby lineup as required by TSs. The A EDG was paralled to the

grid via the A train 4160-VAC safety-related bus NB01 such that offsite power was available to the train A 4160-VAC safety-related bus. Offsite power was being supplied to the B train 4160-VAC bus NB02 via the normal supply breaker for that bus.

3. EVENT DESCRIPTION:

The event addressed by this LER is a failure of the A EDG to continue to run during performance of a surveillance (24-hour run) on March 30, 2010.

The 24-hour run was begun with a slow start of the A EDG at approximately 0125 on March 30, 2010. Nothing unusual was observed at that time. The EDG load was subsequently ramped up to six megawatts such that full load was achieved at approximately 0145. There were no alarms or indication present while the EDG continued to run.

Shortly after 1800, the Reactor Operator (RO) observed both megawatts and voltage lowering, so some slight adjustments to power and voltage were made. Load and voltage parameters were maintained within the required range.

At 1808, alarms unexpectedly came on for an automatic diesel shutdown. The following annunciators came in:

Main Control Board Annunciator:
20D - DG NE01 TROUBLE
20B – alarmed and cleared on under voltage/under frequency

Local annunciators:
6D - ENGINE TROUBLE SHUTDOWN
7A - GENERATOR UNDERFREQUENCY
7D - GENERATOR PROTECTIVE RELAY

Flags dropped locally for Protective Relays:
NE107 132 DG REVERSE POWER
NE107 130 DG UNIT S/D TARGET RELAY
NE107 124 1DG VOLT HZ
NE107 186 1DG LOCK OUT RELAY

The Field Supervisor inspected the A EDG. He saw no apparent cause for the trip. A System Engineer came on site at approximately 1915 and conducted a walk down of the XNB01 transformer, the NB03 capacitor bank, the diesel generator output breaker, and the diesel room. There were no flags dropped on NB0111, the diesel generator output breaker. There were no other lockouts on the NB01 bus and no indications of any faulted equipment with lockouts.

Post-trip indications showed that the A EDG tripped on reverse power. A reverse power scenario occurs if the diesel engine is no longer supplying sufficient power (torque) to the generator. If insufficient power is generated by the diesel engine, the generator will act as a motor and drive the diesel engine.

A one-hour run of the B EDG was completed to meet the common-cause determination requirement of TS Required Action B.3.2.

4. ASSESSMENT OF SAFETY CONSEQUENCES:

This event resulted in the loss of the safety function of the A EDG to provide emergency 4160-VAC power to the NB01 bus in the event of a loss of offsite power (LOOP). This event was evaluated with the Callaway PRA model. The evaluation determined the conditional core damage probability (CCDP) of this event was less than 1E-6; therefore, this event was of very low risk significance. Use of the PRA model to evaluate the event provides for a comprehensive, quantitative assessment of the potential safety consequences and implications of the event, including consideration of alternative conditions beyond those analyzed in the FSAR.

It was determined that the A EDG was inoperable between May 11, 2007 and April 4, 2010. (See section 5 below.) Review of plant documents indicates that the B EDG was taken out-of-service during the timeframes listed below (while it was unknown that the A EDG was inoperable). During these timeframes both EDGs were inoperable.

Start	Finish	Duration (HH:mm)
3/17/2010 12:01	3/19/2010 5:46	41:45
10/27/2009 4:10	10/30/2009 1:21	69:11
6/3/2009 4:26	6/4/2009 0:53	20:27
3/30/2009 23:00	4/9/2009 0:00	217:00
12/24/2008 16:24	12/25/2008 20:46	28:22
10/25/2008 0:02	10/30/2008 9:43	129:41
9/30/2008 4:03	10/1/2008 16:03	36:00
6/10/2008 4:30	6/11/2008 1:41	21:11
5/6/2008 4:18	5/7/2008 19:55	39:37
3/18/2008 10:35	3/18/2008 23:16	12:41
2/29/2008 5:00	3/1/2008 2:52	21:52
12/17/2007 8:49	12/17/2007 23:47	14:58
10/2/2007 4:02	10/4/2007 13:25	57:23
8/11/2007 5:56	8/12/2007 21:49	39:53

5. REPORTING REQUIREMENTS:

This LER is submitted pursuant to 10CFR50.73(a)(2)(i)(B) to report a condition prohibited by the Technical Specifications and 10CFR50.73(a)(2)(v) as an event or condition that could have prevented fulfillment of a safety function.

10CFR50.73(a)(2)(i)(B): The A EDG failed at approximately 16.7 hours into its 24-hour TS surveillance run. TS SR 3.8.1.14 requires verifying that "each DG operates at a power factor less than or equal to 0.9 and greater than or equal 0.8 and operates for greater than or equal to 24 hours ..." Since this was not met, the condition constituted a failure to meet the TS Limiting Condition for Operation (LCO).

TS 3.8.1 requires both EDGs to be operable during plant operation (i.e., Modes 1, 2, 3, and 4). With one EDG inoperable during plant operation, Condition B in the ACTIONS section of TS 3.8.1 applies, and per associated Required Action B.4, the inoperable EDG must be restored to operable status within 72 hours. If the Completion Time of 72 hours cannot be met, Condition G must be entered, wherein Required Action G.1 requires commencement of a controlled plant shutdown such that the plant is required to be in Mode 3 within 6 hours AND in Mode 5 within 36 hours.

After the test failure, and once the cause of the failure and the means to restore the EDG were identified, Callaway Plant determined that the EDG would not be restored to operable status within the timeframe allowed by the TS. Callaway Plant requested and NRC granted enforcement discretion. This is documented in AmerenUE ULNRC-05693 and in the NRC's approval letter for Notice of Enforcement Discretion (NOED) 10-4-001. The A EDG was declared operable on April 4, 2010 at 1220. The plant was not required to be shut down because the EDG was repaired and declared operable within the timeframe allowed by the NOED.

Results from the cause investigation indicate that the EDG was not able to meet its 24-hour surveillance time prior to the failure on March 30, 2010. Based on evaluation of the failure mechanism that caused the A EDG to become inoperable, it is estimated that the last time the EDG would have been able to meet the 24-hour surveillance test was on February 3, 2010. That timeframe exceeds the 72-hour allowed out-of-service time permitted by TS 3.8.1 per Required Action B.4.

Beyond the above, an evaluation was performed to determine when the A EDG became incapable of meeting its 7-day mission time (which is also considered to be an operability requirement). Based on the failure mechanism identified for the EDG (as described in section 6), and as determined by extrapolation of the wear rate associated with the failure mechanism (as related to the number of operating hours accumulated by the EDG), it was determined that the EDG became incapable of meeting its 7-day mission in May 2007. (Specifically, it was during the performance of a 24-hour run on May 11, 2007 that the accumulated hours of operation exceeded the threshold established as the point when the EDG became incapable of

meeting its 7-day mission time). On this basis the EDG was determined to be inoperable from May 11, 2007 to April 4, 2010 (when it was restored to operable status following the March 30, 2010 test failure).

10CFR50.73(a)(2)(v): As discussed above, the A EDG was determined to be inoperable between May 11, 2007 and April 4, 2010. Review of plant documents indicates that the B EDG was taken out-of-service during the timeframes listed above in the Assessment of Safety Consequences section (as it was not known that the A EDG was inoperable during those times). During these timeframes both EDGs were inoperable such that the EDG safety function(s) could not be fulfilled.

During a design basis accident, the EDGs are designed and intended to supply power to the ECCS systems and residual heat removal (RHR) pumps and valves, as well as the component cooling water systems and essential service water systems. As such, the EDGs support safety functions A, B, and D of 10CFR50.73(a)(2)(v). Those safety functions are:

(A) Shut down the reactor and maintain it in a safe shutdown condition,
(B) Remove residual heat,
(D) Mitigate the consequences of an accident.

6. CAUSE OF THE EVENT:

The cause of the A EDG shutdown was due to a failure of the governor to maintain the fuel rack open during operation. The governor operates as a hydraulic actuator. Hydraulic pressure within the governor was lost when the splined coupling on the drive shaft failed. Troubleshooting, disassembly and inspection of the governor drive assembly revealed an improperly cut gasket which blocked the oil port to the gear case. Operation without forced oil lubrication to the governor drive gear case resulted in increased wear of the vertical shaft bearing. The bearing wear resulted in the radial movement of the vertical gear shaft in the gear case which caused wear on the teeth on the spline sleeve and mating male spline on the governor drive shaft. The worn teeth on the spline resulted in the governor failing to rotate with engine speed and subsequent diesel shutdown on March 30, 2010. The damaged parts were replaced and a post-maintenance test was conducted to restore the EDG to an operable condition.

The root cause for this event was determined to be inattention to detail by craft during fabrication and installation of the EDG governor gear drive assembly gasket which resulted in the failure of the governor drive due to blockage of the lubrication supply port. This fabrication and installation of the gasket occurred eleven years prior to the EDG failure event. In addition, a contributing cause was determined to be the failure to implement industry recommended preventive maintenance practices which if implemented may have identified the lack of forced oil flow in the governor drive or the degrading governor spline and degraded

governor drive components prior to the failure event.

As an extent of condition review, oil flow to the B EDG governor drive assembly was verified on April 6, 2010. Additionally, the B EDG governor was removed and inspected on April 23, 2010. The spline on the shaft was found to be in like new condition with no evidence of wear.

7. CORRECTIVE ACTIONS:

The Corrective Action to Prevent Recurrence is to revise the standard work instructions for the governor drive assembly for the emergency diesel engines to verify the governor drive assembly gasket has an oil supply port and that it is appropriately aligned to the oil port in the governor drive case during installation. In addition, an independent verification for this configuration was added to the standard work instructions. The revision of the standard work instructions has been implemented.

Corrective actions to ensure proper material stocking levels and to more effectively implement vendor maintenance recommendations for the EDGs and other risk-significant equipment were implemented.

8. PREVIOUS SIMILAR EVENTS:

The EDG failure event causal factor was: Governor Drive Assembly Gasket did not have the oil supply port. None of the internal operating experience reviewed had events originating in this Causal Factor.