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October 15, 2012

ULNRC-05917

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

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

Ladies and Gentlemen:

**DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
FACILITY OPERATING LICENSE NPF-30
LICENSEE EVENT REPORT 2012-002-00
NON-COMPLIANCE WITH TECHNICAL
SPECIFICATION 3.8.7, "INVERTERS – OPERATING"**

The enclosed licensee event report (LER) is submitted in accordance with 10 CFR 50.73(a)(2)(i)(B). LER 2012-002-00 is submitted to report a condition prohibited by Technical Specifications due to the inoperability of 120-volt vital AC instrument system power inverter NN14 for a period of time longer than that allowed by Technical Specification 3.8.7.

This letter does not contain new commitments.

Sincerely,

Fadi M. Diya
Vice President Nuclear Operations

DRB/nls

Enclosed: LER 2012-002-00

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cc: Mr. Elmo E. Collins
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Index and send hardcopy to QA File A160.0761

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LICENSEE EVENT REPORT (LER)
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4. TITLE
Failure of 120-V Vital Instrument System Power Inverter NN14

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
08	19	2012	2012	002	00	10	15	2012	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE 1	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)									
	<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)						
10. POWER LEVEL 100%	<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)(A)						
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)						
	<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)(ix)(A)						
	<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 type="checkbox"/> 50.73(a)(2)(x)						
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)						
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<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 type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER							
<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A							

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME T.B. Elwood, Supervising Engineer, Regulatory Affairs and Licensing	TELEPHONE NUMBER (Include Area Code) 314-225-1905
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13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	EF	INVT	S250	Y					

14. SUPPLEMENTAL REPORT EXPECTED <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input type="checkbox"/> NO	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR

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

At 1521 on August 19, 2012, a failure of the NN14 inverter occurred. This inverter provides power to the NN04 instrument bus which is one of the four vital 120-volt, alternating current (AC), instrument buses at Callaway Plant. The NN04 bus remained energized throughout the event.

The cause was failure of the output constant-voltage transformer (CVT) within the inverter. Specifically, internal windings in the transformer shorted to ground as a result of less robust varnish used by the manufacturer (prior to 1998) for insulation and controlling vibration.

After the cause of failure was identified and work to replace the CVT was progressing, enforcement discretion (ED) was verbally requested of the NRC to allow continued plant operation beyond the Technical Specification time limit for restoration of the inverter to operable status. The ED request was verbally approved at 1455 on August 20. Following replacement of the CVT, NN14 was declared operable at 1205 on August 21, 2012.

Corrective actions include periodic replacements of the CVTs on all four similar inverters, as well as enhanced periodic inspections and monitoring of the subject inverters, including the transformers.

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

The onsite Class 1E AC, DC, and AC vital bus electrical power distribution systems at Callaway are divided by train into two redundant and independent AC, DC, and AC vital bus electrical power distribution subsystems.

The AC electrical power subsystem for each train consists of an Engineered Safety Feature (ESF) 4.16-kV bus [EIS system EB] and 480-V buses [EIS system ED], and load centers. Each 4.16-kV ESF bus has one separate and independent offsite source of power as well as a dedicated onsite emergency diesel generator (DG) source. Each 4.16-kV ESF bus is normally connected to a preferred offsite source. After a loss of the preferred offsite power source to a 4.16-kV ESF bus, the onsite emergency DG supplies power to the bus. A transfer to the alternate offsite source is accomplished by manually repositioning breakers, if required. Control power for the 4.16-kV breakers is supplied from the Class 1E DC system.

The 120-VAC vital buses [EIS system EF] are arranged in two load groups per train and are normally powered through the inverters from the 125-VDC electrical power subsystem [EIS system EJ]. The 125-VDC electrical power distribution system is arranged into two buses per train.

Each 125-VDC bus is supported by a 125-VDC Class 1E battery bank [EIS system EJ] and associated 125-VDC Class 1E battery charger which is supported by a 480-VAC source.

The table below provides the overall scheme for the above-described distribution buses.

AC and DC Electrical Power Distribution Systems

TYPE	VOLTAGE	TRAIN A	TRAIN B
AC safety buses	4160 V 480 V	ESF Bus NB01 Load Centers NG01, NG03	ESF Bus NB02 Load Centers NG02, NG04
DC buses	125 V	Bus NK01 Bus NK03	Bus NK02 Bus NK04
AC vital buses	120 V	Bus NN01 Bus NN03	Bus NN02 Bus NN04

The four independent Class 1E 120-VAC vital buses independently provide power to the four channels of the protection systems and reactor control systems. The power supply for each 120-VAC vital bus consists of one inverter/uninterruptible power supply (UPS) and one external standby regulating transformer which can be connected to the bus through the manual transfer switch.

Each inverter/UPS [EIS component INVT] (i.e., NN11, NN12, NN13 and NN14) consists of a 7.5-KVA solid-state inverter with an integral 480-VAC to 120-VAC single-phase regulating transformer

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[EIS component XFMR] for use as a backup/alternate source, an automatic static transfer switch that will switch to the backup supply in the event of inverter failure, and a manual maintenance bypass switch that can be used to switch to the backup supply during maintenance activities or in the event of an inverter failure. The normal supply for each UPS/inverter is from the associated Class 1E DC bus. The UPS/inverter backup source (i.e., the integral regulating transformer) for each unit is supplied from 480 VAC.

2. INITIAL PLANT CONDITIONS:

On August 19, 2012, Callaway Plant was in Mode 1 at 100-percent rated thermal power. The only safety related equipment out of service at the time was the "B" train RVLIS (Reactor Vessel Level Indication System).

3. EVENT DESCRIPTION:

The event addressed by this LER is a failure of 120-volt vital AC instrument system power inverter NN14.

At 1521 on 8/19/2012 control room annunciator 28B, NN14 INV TRBL/XFR energized due to NN14 swapping to its alternate power supply. Also, computer point alarm NNU0007A, 1E INV NN14 Xfer to Alt Sply, alarmed. Procedure OTO-NN-00001, "Loss of Safety Related Instrument Power," was entered and actions under the applicable annunciator response procedure were taken. Operations personnel investigated NN14 and found all indicating lights on NN14 out. An acrid smell was noted but there was no evidence of fire. NN14 output voltage, current and frequency were normal (as provided by the regulating transformer). The inverter was declared inoperable and Condition A (Required Action A.1) of Technical Specification (TS) 3.8.7 was entered at 1521 on 8/19/2012. Per Required Action A.1 of TS 3.8.7, a "clock" was started for restoring the inoperable inverter to Operable status within 24 hours in accordance with the Completion Time specified for Required Action A.1.

Burn marks were discovered on the constant voltage transformer (CVT) internal to the NN14 inverter, indicative of an internal short. This failure was discussed with the vendor, who confirmed the likely cause of failure and the need for replacement of the CVT.

After the cause of failure was identified a work plan for replacing the CVT was promptly developed. Based on the work plan schedule, and as replacement activities were begun, it was clear that the inverter could be restored within a reasonable, planned timeframe but not within the time allowed by TS 3.8.7 (i.e., before a plant shutdown would be required). Therefore, enforcement discretion was verbally requested of the NRC via a telephone call conducted on August 20, 2012 to allow additional time for repairing/restoring the inverter. The request was verbally approved such that an additional 36 hours was allowed (beyond the 24-hour TS Completion Time) for restoring the inverter to operable status (including the CVT replacement itself and performance of post-maintenance testing and voltage monitoring) before requiring a plant shutdown. The NN14 CVT was successfully

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replaced and the inverter was subsequently declared operable at 1205 on August 21, 2012. (This was approximately 45 hours after initially declaring the inverter inoperable, and thus within the time limit allowed by the enforcement discretion).

In accordance with the guidance provided in Part 9900 of the NRC Inspection Manual, the verbal request for enforcement discretion was followed up with a written request, as submitted on August 22, 2012 via Ameren Missouri letter ULNRC-05901, "Request for NRC Enforcement Discretion Regarding Requirements of Technical Specification 3.8.7, 'Inverters-Operating.'" The NRC subsequently issued a Notice of Enforcement Discretion (NOED) via their approval letter dated August 23, 2012.

4. ASSESSMENT OF SAFETY CONSEQUENCES:

The loss of inverter NN14 did not result in a significant adverse impact on nuclear safety.

The loss of inverter NN14 did not result in a condition that could have prevented fulfillment of a safety function. The event only affected one of the four required inverters such that both inverters associated with the "A" train remained operable, and one inverter in the "B" train remained operable. Further, the NN04 120-VAC vital bus supported by NN14 was able to be maintained energized (with acceptable voltage) by the alternate source. With three inverters operable, there is (was) enough uninterruptible power support to the instruments supported by the remaining operable inverters such that all credited, automatic trip/actuation functions assumed in the accident analysis would still occur as required on demand (barring no additional failures).

The loss of inverter NN14 was evaluated with the Callaway Probabilistic Risk Assessment model. The evaluation determined the incremental conditional core damage probability (ICCDP) of this event was less than 1E-6/yr; 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.

5. REPORTING REQUIREMENTS:

This LER is submitted pursuant to 10 CFR 50.73(a)(2)(i)(B) to report a condition prohibited by the Technical Specifications.

Per the Limiting Condition of Operation (LCO) of TS 3.8.7, "Inverters-Operating," all four required inverters must be Operable during plant operation, i.e., during Modes 1, 2, 3, and 4. With one required inverter inoperable, Condition A applies and associated Required Action A.1 must be entered, which requires restoring the inoperable inverter to Operable status within the specified Completion Time of 24 hours. Otherwise, Condition B is entered, and in this Condition a controlled plant shutdown is required such that per Required Actions B.1 and B.2, the plant must be in Mode 3

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in 6 hours and in Mode 5 in 36 hours, respectively.

As stated above, after it was determined that the inverter would not be restored to operable status within the timeframe allowed by the TS, Callaway management requested and NRC granted enforcement discretion to allow continued plant operation for an additional 36 hours beyond the 24-hour TS Completion Time specified in TS 3.8.7. NN14 was subsequently declared operable at 1205 on August 21, 2012. The total period of NN14 inoperability was 44 hours and 44 minutes.

Although enforcement discretion was granted to allow the NN14 inverter to be restored within a reasonable time, and although this allowance was based on a determination of acceptably low risk (per the risk analysis performed in support of the August 20, 2012 verbal request and as documented in the above-noted correspondence), the time taken to restore the NN14 inverter to operable status exceeded the time limit specified in TS 3.8.7. That is, the NN14 inverter was inoperable and the plant remained in Mode 1 for a time that exceeded the sum of the 24-hour Completion Time specified per Required Action A.1 and the 6-hour time limit for placing the plant in Mode 3 per Required Action B.1. Consequently, a violation of TS 3.8.7 occurred, and this is required to be reported pursuant to 10 CFR 50.73(a)(2)(i)(B) as a condition or operation prohibited by the Technical Specifications.

6. CAUSE OF THE EVENT:

The cause of the event was determined to be failure of the output constant-voltage transformer (CVT) within the inverter. Specifically, the "B" windings in the secondary part of the transformer were found shorted to ground, when tested. This was evident from close inspection of the transformer and by the acrid odor that was noticed upon initial inspection just after the failure. The most probable cause of the short was determined to be degradation of the transformer windings/insulation. This failure was discussed with the vendor, who confirmed the likely cause of failure and the need for replacement of the CVT. Further review found the failure of the CVT was the result of a less robust varnish used by the manufacturer prior to 1998 for insulation and controlling vibration. The varnish eventually failed, resulting in a short circuit to ground and an automatic transfer of loads to the bypass source.

The root cause of the event was that performance monitoring of the inverters was inadequate to identify the degradation.

7. CORRECTIVE ACTIONS:

Actions developed to recognize and respond to CVT degradation include periodic replacement of the constant voltage transformers for the NN inverters, as well as including guidance for inspections and monitoring of the inverters, including the transformers, in preventive maintenance documents. Additionally, the noise levels generated from the transformers, which may be indicative of increased vibration and associated degradation, will be monitored as part of engineering walkdowns. Action levels associated with periodic thermography of the CVTs will also be developed.

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8. PREVIOUS SIMILAR EVENTS:

Previous to this event, NN14 had spuriously transferred to its alternate source on two other occasions for unconfirmed reasons, beginning approximately 23 days earlier. The first transfer occurred on 7/27/2012 and the second on 8/13/2012.

The inverter operated acceptably between these events, as evidenced by the fact that it maintained acceptable voltage on the NN04 bus in its required line-up.