Ameren MISSOURI

Callaway Plant

March 1, 2018

ULNRC-06418

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.
RENEWED FACILITY OPERATING LICENSE NPF-30
LICENSEE EVENT REPORT 2017-001-01
VIOLATION OF TECHNICAL SPECIFICATION 3.7.9
DUE TO ULTIMATE HEAT SINK (UHS) COOLING TOWER TRAIN INOPERABILITY

On August 15, 2017, Ameren Missouri submitted Licensee Event Report (LER) 2017-001-00 in accordance with 10 CFR 50.73(a)(2)(i)(B) to report a violation of Technical Specification 3.7.9, "Ultimate Heat Sink," due to the inoperability of the 'A' UHS Cooling Tower Train for a duration of 96 hours and 23 minutes with the plant operating in Mode 1. At the time that LER 2017-001-00 was submitted, offsite vendor analysis of the failed component had not been completed. The enclosed LER supplement, LER 2017-001-01, is submitted to incorporate the results of the vendor analysis.

This letter does not contain new commitments.

If you have any questions concerning this LER supplement, please contact Tom Elwood, Supervising Engineer, Regulatory Affairs and Licensing at (314) 225-1905.

Sincerely,

Barry L. Cox
Senior Director, Nuclear Operations

Enclosure: LER 2017-001-01

cc: Mr. Kriss M. Kennedy
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NRC FORM 366 (04-2017) U.S. NUCLEAR REGULATORY COMMISSION

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LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

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4. TITLE

Violation of Technical Specification 3.7.9 Due to Ultimate Heat Sink (UHS) Cooling Tower Train Inoperability

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
									N/A	N/A
06	16	2017	2017	- 001	- 01	03	01	2018	FACILITY NAME	DOCKET NUMBER
									N/A	N/A

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
Mode 1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
100%	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	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
B	BS	RLY	Cutler - Hammer	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 16, 2017, with the plant in Mode 1 and 100% reactor power, the 'A' Ultimate Heat Sink (UHS) Cooling Tower Fan was operating in fast-speed to cool the UHS retention pond. The fan spuriously tripped after 44 minutes of operation. The most probable cause of the spurious trip was a defective fast-speed thermal overload relay that had been installed as a replacement during recent preventative maintenance activities.

In Mode 1, Technical Specifications require each of two redundant UHS cooling tower trains to be capable of dissipating the heat contained in the Essential Service Water (ESW) system. An inoperable UHS cooling tower fan renders its UHS cooling tower train inoperable. Review determined that the fan was inoperable from the start of the preventative maintenance task, and existed for a duration of 96 hours and 23 minutes while the plant was in Mode 1. Consequently, it was concluded that the 'A' UHS Cooling Tower Train had been inoperable for a period of time longer than allowed by the plant's Technical Specifications.

For corrective action, maintenance procedures have been revised to include additional pre-installation testing of similar thermal overload relays to ensure that defects similar to the one that caused the reported failure are detected prior to installation in the plant.

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NARRATIVE

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

Ultimate Heat Sink (UHS) System Description:

The UHS [EIIS system: BS] consists of a seismic Category I mechanical draft cooling tower and a seismic Category I source of makeup water (retention pond) for the tower. The UHS cooling tower provides heat dissipation from the Essential Service Water (ESW) system [EIIS system: BI] for safe shutdown of the plant following an accident. The UHS cooling tower is divided into two trains each with two cells having one fan assembly (fan, gear reducer, and motor) per cell. A single train with two cells is required for safe shutdown. Supply headers and spray pipes for each train are separated by interior walls.

Per Technical Specification 3.7.9, "Ultimate Heat Sink," two UHS cooling tower trains are required to dissipate the heat contained in the ESW system during Modes 1, 2, 3, and 4. An inoperable UHS cooling tower fan renders its UHS cooling tower train inoperable. If one cooling tower train is inoperable, action must be taken to restore the inoperable cooling tower train to Operable status within 72 hours. If the cooling tower train cannot be restored to Operable status within the associated Completion Time, the plant must be placed in Mode 3 within 6 hours and in Mode 5 within 36 hours.

Thermal Overload Relay:

Thermal overload relays function to protect motors, motor control apparatus and motor-branch circuit conductors against excessive heating due to motor overloads and failure to start.

2. INITIAL PLANT CONDITIONS:

The plant was in Mode 1, Power Operation, at 100% reactor power at the time of this event. Besides the noted defective fast-speed thermal overload relay, there were no structures, systems, or components inoperable that contributed to the event.

3. EVENT DESCRIPTION:

On June 13, 2017, at approximately 0730, the 'A' Train of the UHS Cooling Tower was rendered inoperable when a maintenance activity to clean and inspect starter NG07SAF1 was authorized to start. During this maintenance activity, the fast-speed thermal overload relay was replaced. The 'A' train of the UHS Cooling Tower was declared operable upon completion of the maintenance activity and the associated post-maintenance testing on June 14, 2017 at 1340.

On June 16, 2017 at 0732, an unexpected ESW Engineered Safety Feature Actuation Signal (ESFAS) alarm was received in the Control Room. At the time, the 'A' Train of the UHS Cooling Tower (Fans 'A' and 'C') was operating in fast speed to cool the UHS retention pond. Upon investigation, it was determined that the 'A' fan was not running and that the fast-speed thermal overload relay (on starter NG07SAF1) was tripped. The 'A' Train of the UHS Cooling Tower was declared inoperable as a result of the failure to run the 'A' UHS Cooling Tower Fan, CEF01A. Operability was restored when post maintenance testing was satisfactorily completed on June 17, 2017 at 0753.

The duration of the 'A' UHS Cooling Tower Fan (CEF01A) inoperability was 96 hours and 23 minutes, beginning with the maintenance activity (and associated thermal overload relay replacement). The inoperability existed while the plant was in Mode 1.

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4. ASSESSMENT OF SAFETY CONSEQUENCES:

The UHS provides a source of water for use by the ESW system. The UHS retention pond and cooling tower are designed to work together to meet temperature and inventory requirements for up to a 30-day (post-accident) mission time. The inoperable condition associated with the 'A' UHS Cooling Tower Fan (CEF01A) would have prevented the 'A' UHS Cooling Tower Train from performing its specified safety functions. The protected 'B' UHS Cooling Tower Train remained Operable during this event. Due to established procedural guidance to secure the inoperable train, a loss of UHS safety function would not have occurred. The 'B' Train of the UHS Cooling Tower would have been able to maintain UHS retention pond temperature limits and adequate UHS retention pond inventory for the required 30-day UHS mission time.

Partial train failures of the UHS cooling tower are specifically analyzed in the licensing basis analyses of record for Callaway. Sensitivities using the GOTHIC model developed for the licensing basis UHS thermal hydraulic analysis of record show that an unmitigated failure of the 'A' UHS Cooling Tower Fan, CEF01A, would have resulted in no adverse impact on water inventory in the UHS retention pond, but would have resulted in post-Design Basis Accident (DBA) UHS retention pond temperatures in excess of the analyzed limit discussed in the Callaway FSAR. However, specific procedural guidance exists for the Operators to diagnose and mitigate failure of a UHS Cooling Tower fan during post-accident conditions. This guidance is incorporated into the Callaway Emergency Operating Procedure (EOP) network. Licensed operators receive training on EOPs.

The specific operator actions required to diagnose and mitigate a partial train failure in the UHS cooling tower are included in Callaway's Significant Operator Response Timing program. This provides assurance of the ongoing validity of the operator response times credited in the Callaway analysis of record. Crediting manual operator actions to diagnose and mitigate partial train failures or failure of an entire train of the UHS Cooling Tower was submitted for and received NRC approval as a part of License Amendment 208. Based on the Operability of the 'B' UHS Cooling Tower Train, and the ability of Callaway operators to diagnose and mitigate a partial failure of the 'A' UHS Cooling Tower Train, it can be concluded that the event described in this LER did not prevent the fulfillment of any safety function or significantly degrade plant safety.

5. REPORTING REQUIREMENTS:

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

Technical Specification 3.7.9 requires the UHS to be Operable in Modes 1, 2, 3, and 4. With one UHS Cooling Tower train inoperable, Condition A applies such that Required Action A.1 must be entered. Required Action A.1 requires the inoperable train to be restored within a specified Completion Time of 72 hours. With Required Action A.1 and its associated Completion Time not met, Condition B applies such that Required Action B.1 and B.2 must be entered. These actions direct the plant to be in Mode 3 in 6 hours and in Mode 5 within 36 hours, respectively.

The 'A' Train of the UHS Cooling Tower was inoperable for a duration of approximately 96 hours and 23 minutes, with the plant operating in Mode 1. This was a violation of TS 3.7.9, and consequently, this event is required to be reported as a condition or operation prohibited by the plant's Technical Specifications, pursuant to 10 CFR 50.73(a)(2)(i)(B).

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6. CAUSE OF THE EVENT:

The most probable root cause was determined to be a defective fast-speed thermal overload relay (Cutler-Hammer Freedom Series C306) based on additional bench testing of the relay. The failure of the relay resulted in a trip of the 'A' UHS Cooling Tower Fan. Pre-installation testing and setup of the relay was performed in accordance with Callaway procedures and work instructions. The pre-installation testing and setup confirmed that the relay would provide fan motor protection by tripping under overload conditions. However, the testing did not confirm that the relay would not spuriously trip during extended operation in elevated ambient temperatures representative of the installed location.

Subsequent to the submission of Revision 0 of this LER, failure analysis of the defective thermal overload relay was performed by an offsite vendor. The vendor report did not present any new or additional information/findings that would modify the root cause or corrective actions. The vendor report validates conclusions from the original root cause evaluation. The main conclusion points to subtle differences in the ambient compensator associated with the relay as compared to an additional relay specimen sent to the vendor laboratory for the purpose of aiding in the failure analysis. Neither Callaway's internal root cause analysis nor the vendor laboratory analysis established a conclusive cause for the subtle difference in ambient compensation for the overload relay.

7. CORRECTIVE ACTIONS:

Maintenance procedures have been revised to include an elevated temperature hold-in test prior to installation of Cutler-Hammer Freedom Series C306 thermal overload relays in the plant. This will prevent installation of relays that are defective in the manner that caused this event. Subjecting the overload relays to temperatures that are likely to occur in the plant rather than just room temperature will indicate which relays are defective in regards to ambient temperature compensation.

As noted above, a failure analysis of the defective thermal overload relay was performed by an offsite vendor subsequent to the submission of Revision 0 of this LER. The vendor report did not present any new or additional information/findings that would modify the corrective actions. The vendor report validates conclusions from the original root cause evaluation. The main conclusion points to subtle differences in the ambient compensator associated with the relay as compared to an additional relay specimen sent to the vendor laboratory for the purpose of aiding in the failure analysis. Neither Callaway's internal root cause analysis nor the vendor laboratory analysis established a conclusive cause for the subtle difference in ambient compensation for the overload relay. The existing corrective actions, as they are currently established, will address identifying ambient compensation deficiencies with any new Freedom Series thermal overload relays prior to installation in the plant.

8. PREVIOUS SIMILAR EVENTS:

A review of Callaway LERs for the past three years did not identify any other examples of defective thermal overload relays that caused a component to fail to run in a manner that resulted in a condition or operation prohibited by Technical Specifications. Two corrective action documents were identified in which thermal overloads were involved with UHS Cooling Tower Fan start failures. Those two documents, i.e. CAR 200704421 and CAR 201703163 (written in 2007 and 2017, respectively) are included as internal Operating Experience in the Root Cause Analysis for the current event. These two events document start failures, not failures of the fan to run subsequent to a successful start.