Ameren MISSOURI

Callaway Plant

September 07, 2016

ULNRC-06324

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

10 CFR 50.73(a)(2)(iv)

Ladies and Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
RENEWED FACILITY OPERATING LICENSE NPF-30
LICENSEE EVENT REPORT 2015-002-01
MANUAL AUXILIARY FEEDWATER ACTUATION

On September 17, 2015, Callaway Plant submitted Licensee Event Report (LER) 2015-002-00 in accordance with 10CFR50.73(a)(2)(iv)(A) to report a manual actuation of the auxiliary feedwater system.

The enclosed supplemental LER, 2015-002-01, is submitted to update the cause and corrective actions for the same event.

This letter does not contain new commitments.

Sincerely,

Barry L. Cox
Senior Director, Nuclear Operations

Enclosure

cc: Mr. Kriss M. Kennedy
Regional Administrator
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Index and send hardcopy to QA File A160.0761

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APPROVED BY OMB: NO. 3150-0104 EXPIRES: 01/31/2017

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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 4

4. TITLE

Manual Auxiliary Feedwater System Actuation

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
07	23	2015	2015	- 002 -	01	09	07	2016	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
B	SJ	DCC	Siemens	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)*

During plant cooldown in response to conditions reported to the NRC on July 23, 2015 in Event Notification 51253, Callaway was in Mode 3 (Hot Standby) and on the way to Mode 5 (Cold Shutdown). In accordance with cooldown procedures, Callaway was operating with one Main Feedwater Pump (MFP) when the pump speed unexpectedly lowered to 0 RPM. The pump was manually tripped in response to the condition. This led to a decrease in water level in the steam generators. Operators manually activated the Auxiliary Feedwater System to maintain water level in the steam generators. This system actuation is reportable per 10CFR50.73(a)(2)(iv)(A).

Fault tree analysis and subsequent testing identified the most probable cause for the loss of the 'B' MFP is a software defect introduced during the software development process for the digital feedwater control system installed in 2013. Plant operating procedures have been revised to allow for a rapid start of the startup MFP during a plant shut down. Additionally, procedures were revised to allow for the startup MFP to be placed in a ready state when only one MFP is required based on power level. These procedure revisions will provide defense in-depth against unnecessary Auxiliary Feedwater System actuations in the future.

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

The main feedwater system [EIIS System SJ] supplies feedwater to the secondary side of the steam generators [EIIS Component SG] in order to remove heat from the reactor coolant system (RCS) [EIIS System AB] during normal operations. The system consists of two main feedwater pumps (MFPs) [EIIS System SJ Component P] and one startup feedwater pump, which is only used for very low-power conditions.

The MFPs are controlled by a digital control system, which is operated via touch screen controls in the main control room.

The safety-related auxiliary feedwater (AFW) system [EIIS System BA] supplies feedwater to the steam generators to remove decay heat from the reactor coolant system upon the loss of the normal feedwater supply via either manual actuation or automatic response to an Auxiliary Feedwater Actuation Signal (AFAS). The auxiliary feedwater system may also be used following a reactor shutdown to cool the reactor coolant system to below approximately 350 degrees Fahrenheit and 400 psi gauge.

2. INITIAL PLANT CONDITIONS:

On July 23, 2015 at 0115, Callaway Plant operators initiated a shutdown required by Technical Specification (TS) 3.4.13, "RCS Operational Leakage," as reported to the NRC in Event Notification 51253. At 1357 Callaway was in Mode 3 (Hot Standby) and on the way to Mode 5 (Cold Shutdown). The plant was being operated per procedure with one MFP supplying feedwater flow to the steam generators. The startup feedwater pump was unavailable due to a fire protection requirement to have its breaker [EIIS Component BKR] in the racked out position.

3. EVENT DESCRIPTION:

On July 23, 2015, during a plant shutdown, main feedwater flow was lost to all four steam generators. A manual actuation of the auxiliary feedwater system was performed to prevent a reactor trip signal and AFAS. As described in Section 2 above, the plant was in Mode 3 at the time of the manual actuation.

Prior to the AFW manual actuation, the balance of plant operator was lowering the 'B' Main Feedwater Pump (MFP) speed manually per procedure via the pump's digital control board to regulate pump differential pressure (dP). After performing the manual speed decrease, the operator turned his attention to other main control board indications. A 'B' MFP vibration annunciator returned the operator's attention to the digital feedwater control indications at 1333. He noticed that the discharge valve position and pump speed demand went to 0 percent and 0 RPM respectively and the pump was coasting down. No pump trip alarms were received.

An equipment operator was dispatched to investigate the 'B' MFP and reported a metallic banging sound. This was later confirmed to be the main feedwater pump turbine 'B' low pressure steam line check valve. While the equipment operator was investigating the pump locally, the control room operator was able to control pump speed manually using both increase and decrease pushbutton commands. When the equipment operator reported to the control room that he heard an unusual noise at the pump, the decision was made to trip the pump at 1342.

The 'A' MFP had been tripped earlier during the plant down-power, per procedure. The startup feed pump is not maintained in a standby condition, so was unavailable. Therefore, following the 'B' MFP trip all main feedwater sources were unavailable. With none of the normal sources of main feedwater readily available and 'D' steam generator level approaching 23%, the decision was made to put the AFW system in service to establish makeup to the steam generators.

Following the procedure for a manual AFW actuation, the operators manually closed all four AFW Discharge Control Valves (ALHV0005, ALHV0007, ALHV0009, and ALHV0011) to prevent unnecessary water hammer and thermal shock in the steam generators. When the operators attempted to reopen ALHV0011, the valve did not respond. After no response was received, the operator reduced the valve demand to 0% on the main control board. An equipment operator was dispatched to the valve to manually open the valve. The operator locally opened ALHV0011. After this local action, control was restored from the main control board.

4. ASSESSMENT OF SAFETY CONSEQUENCES:

The actual and potential safety consequences of the loss of the Main Feedwater system are not significant, as Main Feedwater is not a safety-related system. By design, the safety-related Auxiliary Feedwater system performs the credited function of supplying feedwater to the steam generators in the event of a postulated accident. In addition, the deterministic Accident Analysis includes evaluation of an assumed or postulated complete loss of feedwater supply from the Main Feedwater system to the steam generators. Thus, the loss of Main Feedwater delivery leading to the manual AFW actuation was consistent with the results contained in the Accident Analysis of record.

When called upon for this event, the Auxiliary Feedwater system was able to perform its specified safety function despite the anomalous behavior of the ALHV0011 valve. (The ALHV0011 issue, which itself is not reportable, was subsequently corrected). Postulating reasonable and credible alternative conditions, including normal plant operating conditions (Mode 1) and accident conditions, would have no impact on the significance of loss of Main Feedwater as these conditions are accounted for in the Accident Analysis of record.

5. REPORTING REQUIREMENTS:

This LER is submitted pursuant to 10 CFR 50.73(a)(2)(iv)(A) to report an Auxiliary Feedwater system actuation.

Specifically, 10 CFR 50.73(a)(2)(iv) states in part, "The licensee shall report:

(A) Any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B) of this section…

(B) The systems to which the requirements of paragraph (a)(2)(iv)(A) of this section apply are:

(6) PWR auxiliary or emergency feedwater system."

The auxiliary feedwater system was manually actuated in response to a decrease in water level in the steam generators following the MFP trip. This fulfills the reporting requirement of 10 CFR 50.73(a)(2)(iv)(A) due to actuation of the system specified in 10 CFR 50.73(a)(2)(iv)(B)(6).

6. CAUSE OF THE EVENT:

The manual actuation of the auxiliary feedwater system was necessitated by the manual trip of the 'B' MFP. Following the event, the main feedwater digital control touchscreen from the main control room was replaced. The touchscreen removed from the plant was tested and the failure could not be replicated. It is not likely that the touchscreen was the cause of this event. The most likely cause is a software malfunction. The software malfunction has only occurred once and was not able to be re-created after numerous tests to the on-site test system.

7. ACTIONS TAKEN:

In order to prevent a MFP digital control software defect from resulting in an AFW actuation in the future, operating procedures were revised to allow for a rapid start of the startup feedwater pump during a plant shutdown. Procedures were also revised to allow the startup feedwater pump to be kept in a ready state and/or the opposite MFP to be kept reset, as contingencies, when plant conditions require only one MFP to be in operation. These procedure revisions add defense in-depth against unnecessary AFW actuations during plant shutdown in the future by providing additional pumps to feed the steam generators in the event that the preferred pump experiences an automatic or manual trip. Additionally, a communication was issued to all operators to notify all crews of this condition.

8. PREVIOUS SIMILAR EVENTS:

An Operating Experience (OE) review for Callaway since the main feedwater digital control system was installed in 2013 revealed no other manual actuations of the auxiliary feedwater system due to failure of MFPs or their associated digital control system.