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Callaway Plant

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March 1, 2002

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop P1-137
Washington, DC 20555-0001

ULNRC-04616

Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
FACILITY OPERATING LICENSE NPF-30
LICENSEE EVENT REPORT 2002-001-01
Manual Auxiliary Feedwater Actuation and subsequent gas binding of the "A" Motor Driven Auxiliary Feedwater pump

The enclosed Licensee Event Report (LER) is a supplement to Callaway Plant LER 2002-001-00, which was submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A) to report an event that resulted in the manual actuation of the Motor Driven Auxiliary Feedwater pumps and the subsequent failure of the "A" Motor Driven Auxiliary Feedwater pump. This supplement provides additional details not available at the time of the original submittal.

Warren A. Witt
Manager,
Callaway Plant

WAW/ewh

Enclosure

IE22

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NRC FORM 366 (1-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 6-30-2001

Estimated burden per response to comply with this mandatory information 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 Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@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 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)

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TITLE (4)

Manual Auxiliary Feedwater Actuation and subsequent gas binding of the "A" Motor Driven Auxiliary Feedwater pump

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER 05000
12	3	2001	2002	– 001	– 01	3	1	2002	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	1
POWER LEVEL (10)	12

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

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

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
M. A. Reidmeyer, Supervisor, Regional Regulatory Affairs	(573)676-4306

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
X	BA	P	I075	Y					

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

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On 12/3/01, a normal plant shutdown was being conducted to facilitate repairs to the Main Generator. After electrically unloading the Main Generator, high vibration occurred on the main turbine requiring breaking condenser vacuum to expedite stopping the main turbine. Both Motor Driven Auxiliary Feedwater (MDAFW) pumps were started prior to breaking vacuum. "B" MDAFW pump operated normally, but "A" MDAFW pump failed to develop sufficient pressure and flow. The Turbine Driven Auxiliary Feedwater (TDAFW) pump was placed in service to supply all Steam Generators. "A" and "B" MDAFW pumps were secured, and an investigation was begun to determine the problem with "A" MDAFW pump. The gas binding of "A" MDAFW pump was caused by a piece of foam from a floating cover inside the Condensate Storage Tank (CST), momentarily blocking the pump suction and creating a partial gas binding situation. On 1/31/02, Callaway Plant shutdown to facilitate removal of the CST floating cover. After the floating cover was removed, the CST was cleaned, inspected, and returned to service. All three AFW pumps, plus suction and discharge piping, were inspected. The high turbine vibration was due to a rapid cooldown of the main turbine, which affected internal component clearances. Procedures have been revised to provide additional guidance to maintain acceptable cooldown rates for the Main Turbine.

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

I. DESCRIPTION OF THE REPORTABLE EVENT

A. REPORTABLE EVENT CLASSIFICATION

This LER is being submitted per 10CFR50.73(a)(2)(iv). It is characterized by a manual actuation of the Auxiliary Feedwater System while conducting a normal plant shutdown.

B. PLANT OPERATING CONDITIONS PRIOR TO THE EVENT

Callaway Plant was in Mode 1 at 12 percent reactor power conducting a normal plant shutdown to facilitate repairs to the Main Generator.

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

The initial review of plant Structures, Systems, or Components (SSC) did not indicate any SSCs inoperable at the start of the event that contributed to the event.

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

On 12/3/01, Callaway Plant was in Mode 1 at 12 percent reactor power conducting a normal plant shutdown to facilitate repairs to the Main Generator. Upon electrically securing the Main Generator at 2248, a high vibration condition was experienced during turbine coastdown. This high vibration condition required breaking condenser vacuum. Realizing that main feedwater to the Steam Generators (S/G) would be lost once condenser vacuum was broken, the On-Shift Operation staff took the action of manually actuating the Auxiliary Feedwater system instead of relying upon plant parameters to cause an automatic actuation. Both "A" and "B" MDAFW pumps were started prior to breaking condenser vacuum. "B" MDAFW pump operated properly. "A" MDAFW pump operated properly for approximately 14 seconds and then failed to sustain sufficient pressure and flow. The Turbine Driven Auxiliary Feedwater (TDAFW) pump was started to compensate for the lack of flow normally provided by the "A" MDAFW pump and "A" MDAFW pump was secured. With the TDAFW pump in service, the "B" MDAFW pump was not necessary and it was secured. Once the Main Turbine was stopped, condenser vacuum was restored. While the condenser was unavailable, S/G atmospheric Power Operated Relief Valves (PORV) were used to control the plant cooldown. Upon restoration of condenser vacuum, the normal condenser steam dumps were used to control plant cooldown.

The manual shutdown of the reactor plant was completed without incident. Initial investigations revealed that the "A" MDAFW pump had become gas bound. As a remedial action, shiftly venting of the Auxiliary Feedwater system was instituted while root cause investigations continued.

A methodical investigation was conducted to determine the root cause of the gas binding of the "A" MDAFW pump. Initial efforts were focused on determining potential sources of air/gas that would have the potential to cause the gas binding experienced. Flowserve Corporation, whom manufactured the pump, and Dominion Engineering were contracted to provide assistance in the investigation. Several issues were considered and dismissed including:

- Nitrogen coming out of solution
- Net Positive Suction Head issues
- Combinations of low CST levels and high CST temperatures
- Air intrusion through packing leaks
- Adequacy of filling and venting methods

After thoroughly investigating the possibility of gas binding from external sources, it was determined that foreign material had blocked the pump suction and caused a gas binding condition. This was supported by a small piece of polyurethane foam that was found in the seal water line on the pump casing.
On 1/26/02, The Condensate Storage Tank (CST), which supplies water to the AFW pumps, was inspected for foreign material. Internal to the CST is a floating cover that provides a separation boundary between water and any gas contained within the tank. This floating cover has a foam ring attached to the edge of the cover, and this ring is composed of a polyurethane foam core enclosed within a Teflon coated fiberglass cloth. During the inspection, a five-foot section of the foam ring was found damaged. Twenty-five inches of foam was still attached at the damaged section but trapped under the floating cover. Two smaller pieces of foam were located within a sump internal to the CST. A section of foam 20.5 inches long remained unaccounted for and was determined to have been responsible for causing the pump suction restriction which caused the gas binding to occur.
On 1/31/02, the Callaway Plant shutdown to facilitate removal of the CST internal floating cover and to perform inspections of all three AFW pumps plus associated suction piping and discharge piping up to the AFW flow control valves supplying the Steam Generators. During this outage the floating cover was removed and the CST cleaned and inspected. Testing of the "A" MDAFW pump subsequent to the ingestion of the foreign material revealed a slight degradation of the pump hydraulic performance. The rotating element was replaced during the outage and subsequent testing has determined that the "A" MDAFW pump is Operable.

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

The main turbine vibration became evident as the turbine was being taken off-line. Several vibration alarms were experienced during the evolution, which alerted the operators of the problem.

The failure of "A" MDAFW pump was discovered while monitoring discharge pressure and flow after starting the pump.

II. EVENT DRIVEN INFORMATION

A. SAFETY SYSTEMS THAT RESPONDED

The Motor Driven Auxiliary Feedwater pumps were manually started prior to an automatic Auxiliary Feedwater Actuation Signal (AFAS). The S/G blowdown system was isolated when the automatic AFAS was generated.

B. DURATION OF SAFETY SYSTEM INOPERABILITY

The "A" MDAFW pump was declared Inoperable at 2307, 12/3/01 and was declared Operable at 2110, 12/5/01 for a total Inoperability time of 46 hours 3 minutes.

C. SAFETY CONSEQUENCES AND IMPLICATIONS OF THE EVENT.

A Conditional Core Damage Probability (CCDP) for this event was determined to be 7.0 E-6. This CCDP was based upon the Inoperability of the "A" MDAFW pump on 12/3/01. A past operability evaluation of the CST has been conducted along with inspections of the CST, AFW piping, and AFW pumps. As a result of the inspections and operability evaluations, the overall delta core damage frequency for this event has been determined to be 8.35 E-6.

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

III. CAUSE OF THE EVENT

The initiating precursor was a main turbine high vibration condition. Analysis of available plant data indicated that an excessive cooldown rate of the main turbine occurred. This in turn negatively affected component tolerances with a resulting high vibration condition. Plant shutdown procedures did not provide adequate warnings or precautions against this cooldown rate.

The failure of the "A" MDAFW pump was due to ingestion of foreign material momentarily blocking the pump suction and causing a gas binding condition. This foreign material was determined to be from a foam ring attached to a floating cover contained within the CST. The foam ring had deteriorated causing a piece of the foam to tear loose and be drawn into the suction piping of the "A" MDAFW pump.

The failure of the foam ring attached to the floating cover has been attributed to normal wear accelerated by Nitrogen gas agitation occurring along the CST wall in the same location as the ring contact point.

IV. CORRECTIVE ACTIONS

To prevent similar turbine vibration issues in the future, several procedures have been revised. Additional operator training is being conducted on these procedure changes.

To prevent ingestion of foreign material into the AFW pumps, the CST internal floating cover was removed and the CST cleaned and inspected. All three AFW pump internals were inspected along with their suction and discharge piping and verified free of foreign material.

The rotating element was replaced on the "A" MDAFW pump.

V. PREVIOUS SIMILAR EVENTS

A review of safety related Callaway Action Request System (CARS) and Callaway LERs revealed one similar incident involving foreign material entering the suction of an Essential Service Water pump. This is documented in LER 2001-002-00.

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VI. ADDITIONAL INFORMATION

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

System: BA

Component: P