AmerenUE
Callaway Plant

PO Box 620
Fulton, MO 65251

February 12, 2003

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

ULNRC-04805

Ladies and Gentlemen:

DOCKET NUMBER 50-483
Callaway PLANT UNIT 1
UNION ELECTRIC CO.
FACILITY OPERATING LICENSE NPF-30
LICENSEE EVENT REPORT 2002-014-00
Reactor Trip while removing "C" Condenstate Pump from service.

The enclosed licensee event report is submitted in accordance with 10CFR50.73(a)(2)(iv)(A) to report a reactor trip while reducing power in preparation for stopping "C" condensate pump and an overspeed trip of the turbine driven auxiliary feedwater pump when responding to a restart signal.

Very truly yours,

Warren A. Witt

Warren A. Witt
Manager, Callaway Plant

WAW/ewh

Enclosure

IE22

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NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

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)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
CALLAWAY PLANT UNIT 1	05000 483	1 OF 5

4. TITLE
Reactor Trip while removing "C" Condensate Pump from service.

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
12	14	2002	2002	- 014 -	00	2	12	2003	FACILITY NAME	DOCKET NUMBER
										05000

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)		20.2203(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
	20.2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)		Specify in Abstract below or in NRC Form 366A
	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)		

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Mark A. Reidmeyer	(573) 676-4306

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	BA	SCV	*See III (b)	Y					

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

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

At 0421, 12/14/2002, Callaway plant experienced an automatic reactor trip on Overtemperature delta T (OTDT). The trip occurred while reducing power from 100 percent power to approximately 80 percent at 1 percent per minute to secure "C" Condensate pump due to an oil leak. While reducing power, OTDT penalty points accumulated due to:

a) control rod insertion which caused Axial Flux Deviation to go further negative,
b) an existing Axial Offset Deviation, and
c) a pre-existing conservative gain adjustment in the electronic circuitry for the OTDT trip function.

Control rods were placed in automatic at the beginning of the down power evolution in accordance with plant procedures. The accumulation of penalty points culminated in a rod stop and turbine runback. Subsequently at approximately 83 percent power, the reactor tripped on OTDT. Initial plant response, including Auxiliary Feedwater actuation, was per design. The Turbine Driven Auxiliary Feedwater Pump (TDAFP) was secured but later received a start signal when two steam generator (S/G) levels decreased below the actuation setpoint, and experienced an overspeed condition. S/G levels were restored to normal using the motor driven auxiliary feed pumps. The plant was stabilized in Mode 3 at normal operating temperature and pressure. Emergency Notification System notifications were completed at 0811.

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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 event was classified as reportable per 10CFR50.73(a)(2)(iv)(A), system actuation.

B. PLANT OPERATING CONDITIONS PRIOR TO THE EVENT

Initial plant conditions were Mode 1, 100 percent power. Prior to the event, Callaway Plant experienced an oil leak on "C" Condensate Pump and while reducing power to allow securing the condensate pump, a reactor trip occurred. Power had been reduced to 83 percent as indicated on plant computer point REN0051A before the reactor trip occurred.
Additionally, Callaway recently completed refueling and the new core is exhibiting symptoms of Axial Offset Deviation (AOD). AOD is an axial power distribution more negative than predicted at the beginning of the cycle. Per core design, initial Delta I is targeted for approximately negative 7 percent and AOD contributes another negative 5 percent. Thus at the start of this event, actual Delta I was already approximately negative 12 percent.

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

There were no components that were initially inoperable at the start of the event, which contributed to the event.

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

On 12/14/2002, at 0421, Callaway Plant experienced an automatic reactor trip on Overtemperature Delta T (OTDT). The trip occurred while reducing power from 100 percent to approximately 80 percent at 1 percent per minute to secure "C" Condensate pump due to an oil leak. While reducing power, OTDT penalty points accumulated due to:
a) control rod insertion which caused Axial Flux Difference (AFD) to go further negative,
b) an existing Axial Offset Deviation (AOD), and
c) a pre-existing conservative gain adjustment in the electronic circuitry for the OTDT trip function.
Control rods were placed in automatic at the beginning of the down power evolution in accordance with plant procedures. The accumulation of penalty points culminated in a rod stop and turbine runback. Subsequently at approximately 83 percent power, the reactor tripped automatically on OTDT. Initial plant response, including Auxiliary Feedwater actuation, was per design. The on-shift Operations crew responded appropriately, using emergency and off-normal procedures as directed.

Following the reactor trip, Control Room Operators restored Steam Generator (S/G) water levels using the Auxiliary Feedwater system. The Turbine Driven Auxiliary Feedwater Pump (TDAFP) was secured at 0451 with operators using the Motor Driven Auxiliary Feedwater Pumps (MDAFP) to control S/G water levels. At 0501 a valid TDAFP start signal was generated when two steam generator water levels drifted down below the Auxiliary Feedwater Actuation Signal (AFAS) setpoint. Upon receipt of the second actuation signal, the TDAFP tripped on electric overspeed during startup. Steam generator water levels were restored to normal using the Motor Driven Auxiliary Feedwater pumps and the plant was stabilized in Mode 3 at normal operating temperature and pressure.

Due to the extensive troubleshooting and repair effort required to return the TDAFP to an Operable status, a Notification Of Enforcement Discretion (NOED) was requested. NOED 02-4-004 was approved and issued by the NRC. Repairs to the TDAFP, which had continued in parallel with the NOED request, were completed within the Technical Specification completion time limit and ultimately the NOED was unnecessary.

Subsequent investigations determined the cause of both the reactor trip and the overspeed of the TDAFP.

REACTOR TRIP

The reactor trip was attributed to a gain setting on a summing amp card that amplified the magnitude of the negative AFD. The gain setting was more conservative than required for this point in core life. This caused the AFD to appear to be more negative than it actually was to the F(Delta I) function generator. This in turn, caused the F(Delta I) function generator to generate more of an OTDT setpoint penalty than was necessary.

In 1998, it was determined that when control rods are inserted into the reactor core, the accuracy of the excore AFD indication is adversely impacted. This inaccuracy is more severe later in core life and requires an increase in the summing amp gain setting to compensate for the inaccuracy. To compensate for this shadowing of the neutron flux profile from the excore NI, the electronic circuitry gain was increased from 2 to a new setting of 3.

When the 12/14/02 downpower and subsequent runback occurred, control rods were inserted and axial flux difference was driven further negative. OTDT penalty points began accumulating when actual AFD was approximately negative 13 percent as opposed to the negative 21 percent required. Thus the increased electronic gain of three, when combined with an initial large negative axial offset value of negative 5 percent due to AOD, an intended beginning-of-core life negative axial offset value of negative 7 percent, and the rapid power transient, resulted in the OTDT reactor trip experienced on 12/14/02.

TDAFP OVERSPEED

The overspeed trip of TDAFP was the result of a misalignment problem between the governor valve bonnet, valve stem, and servo linkages, which was exacerbated by an oversized valve stem. The misalignment problem placed a side loading on the governor valve stem that introduced drag forces during valve stroking. By design the required valve stem diameter is 0.4988 inch, however the installed valve stem, which had been manufactured on-site, measured 0.5000 inch. Thermal expansion of the oversized governor valve stem caused by 30 minutes of normal operation, added additional stem drag forces. These increases in drag forces resulted in a sluggish governor valve response during the second start and an electric overspeed trip of the TDAFP.

It should be stressed that upon receiving the initial AFAS due to the reactor trip, the TDAFP operated satisfactorily during the initial 30 minute operation. Post event investigations determined that this overspeed trip was unique to the circumstances experienced during this event, i.e. a restart of the TDAFP after having been secured for a very short period of time. In a standby condition, the governor valve is full open and during a normal TDAFP startup, the governor valve initially strokes shut to prevent an overspeed from occurring during the startup. During RF12, the existing governor valve stem was replaced with the oversized stem involved with this event. With the TDAFP components having elevated temperatures from prior operation and not have cooled substantially in the short time span since being secured, the misalignment problem was compounded by the thermal expansion of the oversized valve stem and resulted in the TDAFP overspeed event.

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

1) During post trip evaluations, it was determined that the summing amp gain setting of 3 was overly conservative for this point in core life and resulted in an unnecessary reactor trip.

2) The overspeed trip of the TDAFP was self revealing at the time of the event and subsequent investigations determined the cause of the TDAFP overspeed to be due to the stem misalignment condition which was further exaggerated by an oversized valve stem manufactured by site personnel.

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

II. EVENT DRIVEN INFORMATION

A. SAFETY SYSTEMS THAT RESPONDED

During the initial event, the Reactor Protection System (RPS) actuated based on exceeding the OTDT setpoint. Additionally, the auxiliary feedwater system actuated along with steam generator blowdown isolation in response to the reactor trip. The subsequent low steam generator water levels experienced after the plant had been stabilized from the reactor trip resulted in another auxiliary feedwater actuation and the overspeed of the TDAFP.

B. DURATION OF SAFETY SYSTEM INOPERABILITY

The faulted TDAFP rendered one out of three trains of Auxiliary Feedwater inoperable, but the safety function was still capable of being satisfied.

C. SAFETY CONSEQUENCES AND IMPLICATIONS OF THE EVENT.

A probabilistic risk assessment was conducted to evaluate the reactor trip and resulting plant response to the transient. The risk assessment took into account the plant conditions immediately following the event, including an assumption that the TDAFP failed to start, and is considered to be a conservative estimate of the conditional probability of core damage (or conditional core damage probability, CCDP). The risk assessment determined that this event, a reactor trip with main feedwater potentially available, resulted in a CCDP of 5.0E-07. This indicates that the event was not significant with respect to the health and safety of the public.

Additional analysis is being conducted to verify that the TDAFP would have operated satisfactorily for the duration of the required mission time. If adverse results are discovered, an LER revision will be submitted.

III. CAUSE OF THE EVENT

During post event investigations, the following causal factors were identified:

(a) OTDT Reactor trip: post-trip investigations determined that the trip was caused by an overly conservative gain setting in the electronic circuitry which generated the OTDT rod stop, turbine runback, and reactor trip setpoints. This increased gain caused penalty points to be accumulated at an accelerated rate, culminating in exceeding an overly conservative OTDT reactor trip setpoint. The operational impact of AOD was evaluated for steady state and routine power maneuvers, however, plant behavior under rapid load changes was not considered.

(b) TDAFP overspeed trip: post-failure investigations determined that the failure was attributable to a misalignment problem between the governor valve bonnet and servo linkages, which was exacerbated by an oversized valve stem that had been manufactured by plant personnel.

IV. CORRECTIVE ACTIONS

The OTDT gain setting was reduced to a value of 2 and verified acceptable via subsequent testing. The data from the transient on 12/14 was retrieved and the OTDT setpoints and F(Delta I) penalty calculated. These values were then re-calculated assuming a gain of 2 instead of 3 and it was found that for this transient, the point will not be reached where a penalty from delta I is incurred. The accuracy of the new gain setting will be verified during monthly flux maps to ensure that this gain value remains conservative.
Training on this event was conducted for all on-shift licensed personnel. Programming for the plant simulator will be upgraded to reflect changes in plant response associated with changing the summing amp gain.

The overspeed trip of the TDAFP was corrected by:

a) proper realignment of the governor valve bonnet, stem and servo linkage, and

b) replacement of the oversized valve stem with a properly sized stem

The following list of corrective actions, along with other recommendations, are being evaluated in an effort to prevent reoccurrence:

a) revise applicable plant procedures to require alignment verifications,
b) improve training on measurement techniques and tools,
c) obtain and evaluate a representative sample of site-fabricated components as an extent of condition review.

V. PREVIOUS SIMILAR EVENTS

A review of data covering a three year period was conducted. No LERs were identified involving problems associated with OTDT actuations or failure of safety related equipment due to misalignments/part manufacturing issues.

A review of the Callaway Plant's Corrective Action Request (CAR) system identified the following CAR involving OTDT:

1) 200208043 – partial OTDT reactor trip at approximately 90 percent power due to a reduction in the OTDT setpoint attributed to the accumulation of OTDT penalty points.

A review of the CAR system identified five CARs involving problems with the TDAFP overspeed trip mechanisms. Only CAR 200208110 documents a problem that occurred after the maintenance involving the misalignment and oversized valve stem installation.

1) 200201014 – a bent emergency connecting rod prevented smooth disengagement of the trip device.
2) 200201025 – tappet nut on the trip linkage incorrectly set.
3) 200207075 – tripper cams installed incorrectly.
4) 200207935 – mechanical trip linkage tripped approximately 50 percent of the time when FCHV0312 was closed.
5) 200208110 – mechanical overspeed trip occurred while securing the TDAFP.

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: SCV

NOTE: Only one component is identified as a failure, this being the TDAFP governor valve. The problem experienced with the OTDT trip was not due to a component failure; instead it was due to inadequate evaluations concerning the effects of AOD upon plant operations.