



*Entergy*

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October 28, 2003

U. S. Nuclear Regulatory Commission  
Document Control Desk  
Mail Station OP1-17  
Washington, DC 20555

Subject: Arkansas Nuclear One - Unit 1  
Docket No. 50-313  
License No. DPR-51  
Licensee Event Report 50-313/2003-001-00

Dear Sir or Madam:

In accordance with 10CFR50.73(a)(2)(iv)(A), enclosed is the subject report concerning an automatic actuation of the Reactor Protection and Emergency Feedwater Systems. The enclosure contains no commitments.

Sincerely,

Glenn R. Ashley  
Manager, Licensing

GRA/dh

enclosure

IE22

cc: Dr. Bruce S. Mallett  
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U. S. Nuclear Regulatory Commission  
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Arlington, TX 76011-8064

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## LICENSEE EVENT REPORT (LER)

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503.

## FACILITY NAME (1)

Arkansas Nuclear One - Unit 1

## DOCKET NUMBER (2)

05000313

## PAGE (3)

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TITLE(4) Reactor Trip due to Automatic Actuation of the Reactor Protection System on High Reactor Coolant System Pressure and Actuation of the Emergency Feedwater System Resulting From a Lightning-Induced Closure of the Main Turbine Governor Valves

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
08	29	2003	2003	001	00	10	28	2003	FACILITY NAME	DOCKET NUMBER

OPERATING  
MODE (9)

1

POWER  
LEVEL (10)

100

## THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (Check one or more) (11)

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

## LICENSEE CONTACT FOR THIS LER (12)

## NAME

Dee Hawkins, Nuclear Safety and Licensing Specialist

## TELEPHONE NUMBER (Include Area Code)

479-858-5589

## 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
B	TB	94	G080	N		C	SJ	FCV	L200	Y

## SUPPLEMENTAL REPORT EXPECTED (14)

YES	NO	EXPECTED SUBMISSION DATE (15)	MO	DAY	YEAR
(If yes, complete EXPECTED SUBMISSION DATE)	X				

## ABSTRACT (16)

At 1428 CDT on August 29, 2003, ANO-1 experienced an automatic actuation of the Reactor Protection System due to high Reactor Coolant System (RCS) pressure. The RCS high pressure condition was caused by the inadvertent closure of the main turbine governor valves due to a lightning-induced Electro Hydraulic Control (EHC) System malfunction. Following the trip, the main generator output breakers failed to open automatically due to the failure of both the primary and secondary reverse power relays to trip. The output breakers were manually opened approximately 1.5 minutes after the reactor trip. Main Feedwater Block Valve CV-2675 to the "B" Once-Through Steam Generator failed to fully close resulting in erratic control of feedwater flow to the steam generator. The Emergency Feedwater Initiation and Control System actuated as expected and initiated emergency feedwater flow to the affected steam generator. Failure of CV-2675 to close was due to a failed rectifier that supplies DC voltage to the valve's clutches. The damaged and failed components were replaced and the main feedwater block valve and main generator output breakers were tested to verify operability. The EHC System and its power supplies were tested and found to be satisfactory. Improvements to the EHC System to provide isolation for the interlock circuit for the main generator output breakers are being developed.

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## NARRATIVE (17)

## A. Plant Status

At the time this event occurred, Arkansas Nuclear One, Unit 1 (ANO-1) was operating in Mode 1 at approximately 100 percent power. The ANO-1 area was experiencing inclement weather in the form of thunderstorm activity.

## B. Event Description

At 1428 CDT on August 29, 2003, ANO-1 experienced an automatic actuation of the Reactor Protection System (RPS) [JC] due to high Reactor Coolant System (RCS) [AB] pressure. The RCS high pressure condition was caused by the closure of the main turbine governor valves. The closure of these valves was likely due to a lightning-induced Electro Hydraulic Control (EHC) [TG] System malfunction. All control rods fully inserted and the unit was in stable Hot Standby conditions (Mode 3) shortly after the reactor trip.

Following the reactor trip, the main generator output breakers failed to open automatically due to failure of both the primary and secondary reverse power relays to trip. The output breakers were manually opened approximately 1.5 minutes after the reactor trip in accordance with post-trip procedures. The main turbine tripped as a result of the reactor trip.

Main Feedwater Block Valve CV-2675 to the "B" Once-Through Steam Generator (OTSG) [AB] failed to fully close resulting in erratic control of feedwater flow to the steam generator. The "B" Main Feedwater (MFW) [SJ] Pump was placed in manual in an attempt to control steam generator level. When steam generator level reached the automatic actuation setpoint, the Emergency Feedwater Initiation and Control (EFIC) [JB] System actuated as expected and initiated Emergency Feedwater (EFW) [BA] flow to the affected steam generator. EFW flow quickly restored the steam generator level to setpoint. Both MFW pumps remained operable throughout the transient and MFW flow was never lost. The EFW System recirculated for approximately two hours. Valve CV-2675 was manually closed at 1713. The Auxiliary Feedwater [SJ] Pump was placed in service and the EFW and MFW pumps were secured.

Fifteen main steam safety valves (MSSVs) [SB] lifted. All valves performed satisfactorily. MSSV PSV-2697 did not appear to lift. The highest pressure indicated for the PSV-2697 steam header was less than the +3 percent setpoint margin for this valve; therefore, the performance of PSV-2697 was determined to be acceptable.

The Reactor Protection and Emergency Feedwater Systems performed as designed. No technical specification limits were exceeded.

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## C. Root Cause

The reactor trip was initiated by an electrical perturbation that caused a malfunction of the Main Turbine EHC System. The lightning-induced electrical perturbation simulated an "output breaker open" permissive causing the EHC System to change control states briefly. The change in the control signal resulted in closure of the main turbine governor valves.

The main generator output breakers failed to open automatically due to failure of both the primary and secondary reverse power relays to trip. The primary reverse power relay is set to actuate three seconds after sensing a reverse power of greater than 2MWe. If the primary relay fails to operate, the backup reverse power relay should actuate in 30 seconds. The primary relay failed due to binding. The secondary relay was found to be nonfunctional due to a flaw in the control logic that deenergized the relay before it could actuate.

In addition, Main Feedwater Block Valve CV-2675 did not fully close due to the failure of its valve operator. CV-2675 is an 18-inch gate valve with a two-speed motor operator powered by 480 volt AC. The speed change in the operator, accomplished by the use of high-speed and slow-speed clutches, gives the motor operator the ability to close the valve at high speed, but protects the valve from seating damage by slowing during the last 5 percent of travel. The high-speed and slow-speed clutches are DC powered. To obtain the required DC supply from the 480 volt source, the motor operator has an integral full-wave bridge rectifier, followed by fly-back capacitors. Troubleshooting revealed that two of the four diodes of the full-wave rectifier were damaged. This condition degraded the DC supply to the clutches and prevented clutch operation. The damage to the rectifier diodes was likely caused by a bad connection on one of the fly-back capacitors. This allowed the collapsing magnetic field from the high-speed clutch to be impressed across the diode bridge.

## D. Corrective Actions

Following replacement of the damaged components, testing was performed to verify operability of Main Feedwater Block Valve CV-2675.

The primary reverse power relay for the main generator output breaker was replaced with a new unit, eliminating the binding condition that was found on the failed relay. The main generator output breaker was tested to verify operability of the system. The trip logic of the backup reverse power relay will be corrected during the next refueling outage scheduled for the

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spring of 2004. Operations personnel have been provided with contingency actions during the interim period of plant operation.

A functional test of the EHC System was conducted and no problems were identified. The system's power supplies were tested and found satisfactory.

Improvements to the EHC System are being developed to provide circuit isolation for the main generator output breaker contact to prevent false breaker indication due to lightning.

## E. Safety Significance

The RPS initiated a reactor trip upon reaching the high RCS pressure setpoint as designed. The plant response to the transient was complicated by the failure of a main feedwater block valve to fully close. The EFIC System actuated as a result of low steam generator level and initiated EFW flow to the affected steam generator.

Although this event was complicated by equipment malfunctions, the unit was returned to normal post-trip parameters shortly after the trip. Therefore, this event is considered to be of low safety significance.

## F. Basis for Reportability

Automatic actuations of the Reactor Protection System and Emergency Feedwater System are being reported in accordance with 10CFR50.73(a)(2)(iv)(A). An initial report of this event was made to the NRC Operations Center at 1559 CDT on August 29, 2003, in accordance with 10CFR50.72(b)(2)(iv)(B) and 10CFR50.72(b)(3)(iv)(A). Supplemental notifications were made to the NRC Operations Center at 0044 CDT and 1815 CDT on August 30, 2003.

## G. Additional Information

Although there have been previous lightning-induced plant transients, the only previous similar event was reported in LER 50-313/86-004-00 (letter 1CAN058604 dated May 8, 1986).

The valve operator for Main Feedwater Block Valve CV-2675, model SMB-4, was manufactured by Limitorque Corporation (MFR Code L200). The main generator output breaker primary reverse power relay, model 12GGP53C1A, was manufactured by General Electric Company (MFR Code G080).

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].