

L I C E N S E E E V E N T R E P O R T (L E R)

FACILITY NAME (1) Arkansas Nuclear One, Unit Two DOCKET NUMBER (2) PAGE (3)
01510101 31 61 8110F104

TITLE (4) Reactor Trip due to Closure of a Main Steam Isolation Valve

EVENT DATE (5)			LER NUMBER (6)		REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
Month	Day	Year	Sequential Number	Revision Number	Month	Day	Year	Facility Names	Docket Number(s)
01	21	1986	01	01	01	03	1986		01510101

OPERATING MODE (9) 1 THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check one or more of the following) (11)

POWER LEVEL (10)	11010	20.402(b)	20.405(a)(1)(i)	20.405(a)(1)(ii)	20.405(a)(1)(iii)	20.405(a)(1)(iv)	20.405(a)(1)(v)	20.405(c)	50.36(c)(1)	50.36(c)(2)	50.73(a)(2)(i)	50.73(a)(2)(ii)	50.73(a)(2)(iii)	X	50.73(a)(2)(iv)	50.73(a)(2)(v)	50.73(a)(2)(vii)	50.73(a)(2)(viii)(A)	50.73(a)(2)(viii)(B)	50.73(a)(2)(x)	73.71(b)	73.71(c)	Other (Specify in Abstract below and in Text, NRC Form 366A)
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L I C E N S E E C O N T A C T F O R T H I S L E R (1 2)

Name	Telephone Number
Dwight J. Johnson, Plant Licensing Engineer	Area Code 5101191614-1311010

C O M P L E T E O N E L I N E F O R E A C H C O M P O N E N T F A I L U R E D E S C R I B E D I N T H I S R E P O R T (1 3)

Cause	System	Component	Manufacturer	Reportable to NPRDS	Cause	System	Component	Manufacturer	Reportable to NPRDS
X	EI	J	914	PJ21917	Y				

S U P P L E M E N T R E P O R T E X P E C T E D (1 4)

Expected Submission Date (15)	Month	Day	Year
<input type="checkbox"/> Yes (If yes, complete Expected Submission Date) <input checked="" type="checkbox"/> No			

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

On 2/11/86 at 1310 hours with the unit operating at 100% power, the 'A' Main Steam Isolation Valve (MSIV) 2CV-1010 spuriously closed. In response to the MSIV closure, the Core Protection Calculators (CPCs) generated a Low Departure from Nucleate Boiling Ratio (DNBR) trip on 3 of 4 channels in the Reactor Protective System (RPS) resulting in a reactor trip and insertion of control element assemblies. The CPC response to the MSIV closure is a design feature of the CPCs which accounts for asymmetric steam generator transients by application of a penalty factor to the DNBR calculation based on cold leg temperature difference, and ultimately causing a DNBR trip. Plant trip response was normal with emergency feedwater system actuation due to normal post trip steam generator level response. The only post trip abnormality was the use of the 'A' main steam line safety valves after the trip for 'A' steam generator heat removal due to the closure of the MSIV. Normal heat removal via the condenser was restored when the MSIV was reopened two minutes after the trip. The unit was placed in stable mode 3 operations within 1 hour of the trip. The cause of the MSIV closure is suspected to be a malfunction of a motor driven relay (MDR) that operates the air pilot solenoid valve of the MSIV. A total of 5 MDRs were removed, replaced and tested within both MSIV actuation circuits. As a result, all major suspect components have been replaced. The testing of the removed components and wire checks of the actuation circuits show no cause for failure. Testing and maintenance activities were completed 2/13/86 and the unit was returned to power operation. Plant response to this transient was normal. The event posed no degradation to the health and safety of the public. There have been no similar occurrences reported and no supplemental report is planned.

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LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		Year	Sequential Number	Revision Number	
Arkansas Nuclear One, Unit Two	05000368	86	01	01	02014

TEXT (If more space is required, use additional NRC Form 366A's) (17)

I. Description of Event

A. Unit Status

The unit was operating at 100% power with reactor coolant system average temperature of 580°F and pressurizer pressure of 2250 psia.

B. Component Identification

125/28 volt DC Motor Driven Relay (MDR); EIIS Identifier = 2EJ/JE-94.

The relays involved are manufactured by Potter and Brumfield. Upon receipt of a Main Steam Isolation System (MSIS) actuation signal, these relays de-energize a set of pilot solenoid valves on each Main Steam Line Isolation Valve (MSIV) which allows air to bleed off the MSIV. This action closes the MSIV.

C. Sequence of Events

On 2/11/86 at 1310 hours the unit tripped from 100% power on a Reactor Protective System Core Protection Calculator (CPC) generated low DNBR trip signal. Plant response to the trip was normal in that the reactor trip circuit breakers opened and all control element assemblies were inserted in the core and all emergency procedure safety functions were verified satisfactory. Post trip plant response included actuation of both trains of emergency feedwater (due to post trip steam generator volume "shrink" and subsequent level response). Heat rejection was via the main condenser and atmosphere through the use of the Steam Dump and Bypass Control System (SDBCS) condenser dump valves and the main steam safety valves. 'B' steam generator (SG) post trip pressure response was normal and the 'B' main steam line safety valves were not actuated. However, the 'A' SG pressure reached 1145 psia which caused several of the 'A' SG main steam safety valves to lift. Operator response to the trip identified that 2CV-1010, the 'A' SG MSIV, had closed. At approximately 1312 hours, the control room operators opened 2CV-1010 and pressure control for the 'A' SG was established via the condenser dump valves utilizing the SDBCS. The unit was stabilized in mode 3 (hot standby) within 1 hour of the trip. The unit response to the trip and post trip plant conditions were within expected conditions and there was no degradation of the health and safety of the general public. An investigation into the cause of the MSIV closure was initiated. Upon completion of maintenance troubleshooting, maintenance corrective actions and successful operational testing of 2CV-1010, the unit was returned to power operation on 2/13/86.

II. Event Cause

A. Event Analysis

A design function of the CPCs is to protect the plant from asymmetric steam generator transients. The CPCs do this by applying a penalty factor to the DNBR calculation in response to a calculated difference in Reactor Coolant System (RCS) steam generator loop 'A' and loop 'B' "cold leg" temperatures (delta Tc). At a projected delta Tc of >14°F a penalty factor will be applied to the CPC DNBR calculation which will result in a trip. At the time of the trip, three channels of the CPCs indicated a projected delta Tc of >14°F. Actual delta Tc's at this time were 'A' channel 1.69°F; 'B' channel 1.69°F; 'C' channel 1.5°F; 'D' channel 0.37°F. From the safety parameters display system a maximum delta Tc of 16.67°F occurred approximately 19 seconds after the trip.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1) Arkansas Nuclear One, Unit Two	DOCKET NUMBER (2) 0151010131618	LER NUMBER (6)			PAGE (3) 0131014
		Year 816--	Sequential Number 0101--	Revision Number 01	

TEXT (If more space is required, use additional NRC Form 366A's) (17)

The MSIVs at Arkansas Nuclear One, Unit 2 (ANO-2) are air actuated (air to open; spring closed) "Y" type globe valves. Two 125 volt DC pilot solenoid valves are supplied for each MSIV and serve as actuators for the MSIVs. Closure of an MSIV is accomplished by actuating the pilot solenoid to "bleed off" the air holding the valve open. This actuation is accomplished by the use of a series of Motor Driven Relays (MDR). Each MSIV pilot solenoid valve receives an Engineered Safety Features Actuation (ESFAS) actuation from one train of the ESFAS. At the time of the closure of the MSIV, there were no maintenance or operations activities in progress which would have caused a single MSIV closure.

Since there are several components in the MSIV actuation scheme, the malfunction of which would have caused a single MSIV closure, and because subsequent mechanical inspection and operation of 2CV-1010 could find no mechanical fault in the opening and closing components on 2CV-1010, a thorough evaluation of the actuation circuit was performed. This evaluation included replacement and testing of the MDRs in the actuation circuit, a wire by wire verification of actuation circuit terminations, and a check of relay contact voltages including the manual handswitch contacts for continuity.

B. Root Cause

Based on the results of the event analysis the cause of the MSIV closure appears to be a malfunction in an MDR actuation relay. The evaluation of all the wire terminations for the actuation circuit for the MSIV found no abnormalities. A check of the manual actuation handswitch indicated no malfunction. The analysis for root cause determination centered on the MDRs in the actuation circuit. During the MDR testing and replacement, an ESFAS MDR (2K-404B) was found to have excessive contact resistance as indicated by a 1.5 volt DC drop across the contact compared to a nominal 1 millivolt DC drop. This voltage drop was evident even after this MDR had been cycled (an action which "wipes" clean the relay contacts, eliminating surface resistance). Further conclusive evidence of MDR failure due to high contact resistance or other causes may have been compromised due to reopening of the MSIV immediately after the reactor trip and subsequent cycling of 2CV-1010 to try and reproduce the failure. This subsequent actuation of 2CV-1010 could not have been avoided due to operational considerations in stabilizing the unit post-trip. MDR 2K-404B was removed and replaced. Subsequent testing and disassembly of this relay showed no abnormalities in either actuation or internal configuration and the relay contacts appeared normal. No other potential root causes were identified and absolute root cause is uncertain.

C. Basis for Reportability

This event is being reported under the provisions of 10 CFR 50.73(a)(2)(iv). The closure of 2CV-1010 resulted in an unanticipated automatic actuation of the ESF/RPS.

III. Corrective Actions

A. Immediate

Immediate corrective actions consisted of verifying all the Reactor Trip Safety Functions of the emergency operating procedure. This resulted in placing the plant in a safe shutdown (Mode 3) condition. Included in this was restoration of the condenser as a heat sink for the 'A' Steam Generator by reopening 2CV-1010. This was accomplished approximately 2 minutes after the trip and prevented excessive challenges of the 'A' main steam line safety valves. Plant conditions were stable within 1 hour of the trip and normal mode 3 conditions were maintained.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
Arkansas Nuclear One, Unit Two			Sequential	Revision	
		Year	Number	Number	
TEXT (If more space is required, use additional NRC Form 366A's) (17)		0 5 0 0 0 3 6 8	8 6 --	0 0 1 --	0 0 4 0 4

B. Subsequent

Upon establishing that there were no mechanical malfunctions of the MSIV itself involved, the electrical maintenance group at ANO commenced work to replace and test the MDRs for both MSIVs. This consisted of removing and replacing 4 125 Volt DC MDRs in the ESFAS control console in the Unit 2 control room. Testing of these 4 relays showed no abnormalities. As an extension of this maintenance activity, the investigation moved to the ESFAS actuation relay cabinets. The testing of these relays indicated that 2K-404B relay (2CV-1010, B train ESFAS Actuation relay) had excessive contact resistance. This relay was also removed and replaced. The testing of 2K-404B could find no cause for the excessive contact resistance. In addition to the relay testing and replacement, all the wiring terminations in the MSIV actuation circuit were verified through a wire by wire inspection of the circuits. Also, the manual actuation handswitch was tested and found to be normal.

C. Future

No future actions are planned. The subsequent actions taken replaced all active components in the circuit between the ESFAS relaying and the pilot solenoid except the wiring and the manual handswitches in the MSIV actuation circuit. These components were verified by inspection and testing to be acceptable.

IV. Additional Information

A. Similar Events

There have been no similar events of inadvertent MSIV closure at ANO-2 reported. No supplemental report is planned.



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March 13, 1986

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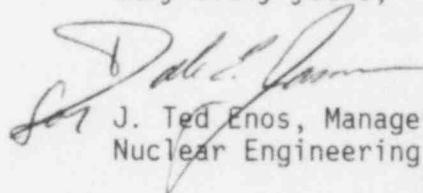
U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

SUBJECT: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Licensee Event Report
No. 86-001-00

Gentlemen:

In accordance with 10CFR50.73(a)(2)(iv), enclosed is the subject report concerning a reactor trip due to closure of a main steam isolation valve (MSIV) 2CV-1010.

Very truly yours,



J. Ted Enos, Manager
Nuclear Engineering and Licensing

JTE/RJS/sg

Enclosure

cc: Mr. James M. Taylor, Director
Office of Inspection and Enforcement
U. S. Nuclear Regulatory Commission
Washington, DC 20555

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11