NRC Form 366
(9-83)

U.S. Nuclear Regulatory Commission
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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4) Automatic Reactor Trip Due to Inadvertent Trip of a Reactor Coolant Pump Breaker

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
Month	Day	Year	Year	Sequential Number	Revision Number	Month	Day	Year	Facility Names	Docket Number(s)
									N/A	0 5 0 0 0
0 4	2 1	8 6	8 6	0 0 4	0 0	0 5	2 2	8 6	N/A	0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)					
POWER LEVEL (10)	1 0 0	20.402(b)		20.405(c)	X	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)	Other (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

Name	Telephone Number
Dwight J. Johnson, Plant Licensing Engineer	Area Code 5 0 1 9 6 4 - 3 1 0 0

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

Cause	System	Component	Manufacturer	Reportable to NPRDS	Cause	System	Component	Manufacturer	Reportable to NPRDS
B	J L	J I	G 0 8 0	Y					

SUPPLEMENT 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 fifteen single-space typewritten lines) (16)

On 4/21/86 at 0532 hours, the unit tripped from 100% power due to a core protection calculator (CPC) generated low departure from nucleate boiling ratio (DNBR) trip in 2 out of 4 channels of the reactor protective system. No post trip plant response abnormalities were noted. The emergency feedwater system actuated on normal post trip steam generator level response. The plant was stabilized in hot standby (mode 3) conditions within 1 hour of the trip. The reactor trip was due to application of a large penalty factor to the value of minimum DNBR calculated by the CPCs as a result of tripping reactor coolant pump (RCP) 2P-32D. 2P-32D tripped during change-out of an indicating lamp during which an electrically shorted light bulb was inserted in the pump status indicating circuit on the remote shutdown panel (2C-80). The shorted bulb resulted in the energization of the trip solenoid of the breaker for 2P-32D. The root cause for this event is an apparent design weakness in the RCP breaker indicating circuit on 2C-80. The circuits will be redesigned to prevent recurrence. This design modification will be installed during the next refueling outage. Similar plant circuits are being evaluated and those having a potential for similar failures will be corrected accordingly. This event was an uncomplicated reactor trip. This event posed no threat to the health and safety of the general public; no similar events have been reported.

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

I. Description of Event

A. Unit Status

Arkansas Nuclear One, Unit Two (ANO-2) was operating at 100% power with reactor coolant system (RCS) average temperature of 580 degrees Fahrenheit and pressurizer pressure of 2250 psia. ANO-2 had been operating continuously since 2/11/86 and there were no abnormal operating conditions.

B. Component Identification

Remote Shutdown Panel (2C-80) Reactor Coolant Pump D (RCP 2P-32D) breaker position indication; EIIS Identifier = JL-JI.

Panel 2C-80 has indicating lights for the status of each RCP breaker. These lights serve a dual purpose in that when illuminated, they indicate the RCP is energized and also show continuity exists through the solenoid trip for each pump breaker. The indication is powered from the 125 volt DC control power circuit. The light bulbs used in this application in 2C-80 are 656, type 155 volt, 6 watt rated and are manufactured by Sylvania and General Electric.

C. Sequence of Events

On 4/21/86 at 0532 hours, ANO-2 tripped from 100% power on 2 out of 4 channels of the core protection calculators (CPCs) indicating low departure from nucleate boiling ratio (DNBR). The computer generated sequence of events showed the following significant details:

05:32:45 - 2P-32D breaker status indicates breaker is tripped.

05:32:46:49 - Channels 1 and 4 of the reactor protective system (RPS) tripped on indicated low DNBR.

05:32:46:50 - All reactor trip breakers tripped.

05:32:46:70 - Main turbine generator tripped.

05:33:00:70 - Normal post trip steam generator level "shrink" reaches emergency feedwater (EFW) low level actuation setpoint and EFW is initiated.

Post trip response was normal, all components functioned properly. RCS heat removal was accomplished by the steam generators and main condenser utilizing the steam dump and bypass control system (SDBCS). The steam driven EFW pump was manually secured at 0548 hours after verifying steam generator levels increasing. Feedwater was then supplied to the steam generators by the 'A' main feedwater (MFW) pump and the electric motor driven EFW pump. At 0600 hours, after verifying normal steam generator levels, the 'A' MFW pump was secured. The plant was stabilized in normal mode 3 operations within the hour. An investigation into the cause of the RCP trip and subsequent reactor trip was initiated. Upon establishing the cause of the RCP trip, 2P-32D was restarted at 0908 hours the same day and the plant returned to full power operations on 4/22/86.

II. Event Cause

A. Event Analysis

Activities in progress at the time of this event included a weekly check of indicating lamp status on various panels in the plant. Any lamps identified as non-functional are replaced. At the time of the 2P-32D trip, a licensed control room operator was replacing the status indicating lamp on 2C-80 for 2P-32D. This action apparently caused the trip coil for the 2P-32D breaker to energize thus tripping the breaker.

The reactor trip that followed the pump trip was due to application of a large penalty factor to the value of minimum DNBR calculated by the CPCs. Penalization of the calculated value of DNBR is a design conservatism that assures a DNBR trip is generated whenever the RCS mass flow rate is reduced due to the reduction in the number of operating reactor coolant pumps. The CPC post trip data was analyzed and the following results were shown:

CPC 'A' DNBR Values:
Calculated minimum DNBR value - 1.468 Penalized DNBR value - .1468

CPC 'B' DNBR Values:
Calculated minimum DNBR value - 1.502 Penalized DNBR value - .1502

CPC 'C' DNBR Values:
Calculated minimum DNBR value - 1.499 Penalized DNBR value - .1499

CPC 'D' DNBR Values:
Calculated minimum DNBR value - 1.452 Penalized DNBR value - .1452

These results show that the penalized DNBR value was well below the trip setpoint of 1.25 and resulted in a reactor trip.

B. Root Cause

The cause of the reactor trip was the generation of a low DNBR trip on 2 of 4 channels of the RPS due to the tripping of 2P-32D. The trip of the RCP was due to a direct electrical short circuit in the light bulb the operator was inserting in the RCP breaker indication circuit. Upon examination of the light bulb, a drop of solder was found in the base and identified as the source of the short. The indicating circuit design is such that the status light serves a dual purpose of breaker status indication and also is wired in series with the breaker trip solenoid. This is a standard design feature that permits continuous monitoring of a breaker's trip solenoid condition while the breaker is energized. In similar circuit designs for ANO-2, the current passing through the solenoid is kept below the nominal actuation value by placing a ballast resistor and reduced voltage indicating lamp in the circuit. However, in 2C-80, this resistance was provided by utilizing a high resistance, high voltage bulb, and the ballast resistor was not used. When the bulb with a direct short was inserted in the circuit, sufficient current was passed to the trip solenoid which actuated to trip the breaker for 2P-32D. The root cause for this event was a design weakness for the RCP breaker indicating light circuits in 2C-80. The potential for an RCP trip due to a shorted indicating light bulb was not identified during initial design and construction.

C. Basis for Reportability

This event is being reported under the provisions of 10 CFR 50.73(a)(2)(iv). The inadvertent trip of 2P-32D resulted in an unanticipated actuation of the Engineered Safety Features Actuation System/Reactor Protective System. The event was an uncomplicated reactor trip and posed no threat to the health and safety of the general public.

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 condition (mode 3 operations). Included in this action was establishment of normal primary

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to secondary heat transfer utilizing the steam generators, the SDBCS, and main condenser with feedwater being supplied by the electric motor driven EFW pump. These conditions were established and maintained within 1 hour of the trip.

B. Subsequent

Subsequent actions were focused on evaluating the cause of the 2P-32D trip. Upon identifying the indicating light bulb as the source of the trip, a good bulb was inserted in the circuit and the pump was restarted. The evaluation also indicated that, unlike similar circuits at ANO-2, 2C-80 RCP status indicating light circuits lacked a ballast resistor. The plant was subsequently restarted after cause of the trip was established.

C. Future

Future corrective actions include redesign and installation of new RCP breaker indication circuits in 2C-80 to include ballast resistors in the circuit. This action will be accomplished during the upcoming refueling outage scheduled for June of 1986. Additionally, similar circuits at this facility are being evaluated by the ANO engineering staff for like design. Should any other similar circuits be identified in this evaluation, they will be corrected accordingly.

IV. Additional Information

A. Similar Events

There have been no similar automatic reactor trips initiated by reactor coolant pump trips reported for ANO-2. No supplemental report is planned.

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May 22, 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. 86-004-00

Gentlemen:

In accordance with 10CFR50.73(a)(2)(iv), attached is the subject report concerning the automatic reactor trip due to the inadvertent trip of a Reactor Coolant Pump (RCP) resulting from a design weakness in the RCP breaker indicating circuit.

Very truly yours,

Dale E. James for

J. Ted Enos, Manager
Nuclear Engineering and Licensing

JTE/RJS/sg

Attachment

cc: Mr. Robert D. Martin
Regional Administrator
U. S. Nuclear Regulatory Commission
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