

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)
CRYSTAL RIVER UNIT 3DOCKET NUMBER (2)
05000302PAGE 13
1 OF 15TITLE (4)
REACTOR TRIP DUE TO FAILED REACTOR COOLANT PUMP POWER MONITOR RELAY

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)
07	10	87	87	011	00	08	10	87	N/A		05000302
									N/A		05000302

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) 0.64		20.402(a)		20.408(a)	X	80.73(a)(2)(iv)		73.71(a)			
		20.408(a)(1)(i)		80.36(a)(1)		80.73(a)(2)(v)		73.71(a)			
		20.408(a)(1)(ii)		80.36(a)(2)		80.73(a)(2)(vi)					
		20.408(a)(1)(iii)		80.73(a)(2)(i)		80.73(a)(2)(vii)(A)					
		20.408(a)(1)(iv)		80.73(a)(2)(ii)		80.73(a)(2)(vii)(B)					
		20.408(a)(1)(v)		80.73(a)(2)(iii)		80.73(a)(2)(ix)					

LICENSEE CONTACT FOR THIS LER (12)
NAME
L. W. MOFFATT, NUCLEAR SAFETY SUPERVISORTELEPHONE NUMBER
AREA CODE
904 795-6486

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)										
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC
X	JC	RLY	A348	Y		B	JI	ZI	B045	Y
X	EC	RLY	Q080	Y						

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

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

On July 10, 1987, Crystal River Unit 3 was operating at 64% power and 523 MWe. The "C" reactor coolant pump had previously been secured, so the plant was operating with only 3 of 4 reactor coolant pumps in service. At 0537 a reactor trip occurred due to the reactor coolant pump power monitors. All 4 RPS channels indicated a loss of more than one RCP, even though the 3 RPC's remained in operation. Upon receiving the reactor trip, control room operators realized that the main turbine did not automatically trip, and they manually tripped the turbine.

The cause was due to a failed relay for the "B" RCP power monitor circuit. The failed relay caused a power fuse to open, which led to all 4 RPS channels sensing more than 1 RCP off. The cause of the turbine not tripping was the failure of the reactor trip lockout relay.

The plant was maintained in a stable condition following the trip. The failed RCP power monitor relay and open fuse were replaced. The failed reactor trip lockout relay was replaced. Both circuits were subsequently tested satisfactorily.

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LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES 8/31/85

FACILITY NAME (1) CRYSTAL RIVER UNIT #3	DOCKET NUMBER (2) 0500030287	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		01	1	00	02	OF	05

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

EVENT DESCRIPTION

On July 10, 1987, Crystal River Unit 3 (CR-3) was operating at 64% of rated thermal power and was generating 523 MWe. The "C" reactor coolant pump (RCP) [AB,P] had previously been secured due to problems with the thrust bearing and third stage seal. The pressurizer spray valve, [AB,FCV] was in manual and was partially open. An additional bank of pressurizer heaters [AB,EHTR] was on in order to maintain Reactor Coolant System (RCS) [AB] pressure constant at 2150 PSIG.

At 0537, alarms were received associated with a "B" channel Reactor Protection System (RPS) [JC] trip and RCP power monitor trip. The control board operators immediately scanned primary and secondary systems indications and found all to be normal. Within 20 seconds of the first alarms, several more alarms were received, most notably the "A", "C", and "D" RPS channels trip and RCP power monitor trip. The reactor tripped due to all four RPS channels sensing 2 RCP's not running. It should be noted that during this entire event, all 3 of the RCP's remained in operation.

In addition to receiving the alarms indicative of a reactor trip, a half-trip of the Emergency Feedwater Initiation and Control (EFIC) [BA] System was received for EFW actuation. This was due to the "B" RPS channel sensing a loss of all 4 RCP's, which causes "B" EFIC channel to issue an EFW initiation signal. Since "B" EFIC channel was the only one of the four to have issued an initiate signal, the result was only a half-trip of the actuation trains (at least 2 channels are required for a full actuation). No components were actuated. Upon receiving the reactor trip, the operators noticed that the main turbine [TA,TRB] did not automatically trip, and it was manually tripped. This quick action by the operators prevented a possible overcooling of the primary system. It was later discovered that the failure of the turbine to automatically trip was due to the failure of the reactor trip lockout relay [EC,RLY]. As a result of the turbine remaining on line approximately 9 seconds after the reactor trip, RCS pressure and pressurizer level decreased more rapidly than they normally would following a trip. The operators opened a high pressure injection valve [BQ,INV] for 5 1/2 minutes and started an additional high pressure injection pump [BQ,P] for 2 1/2 minutes to aid in maintaining pressurizer level.

Following the main turbine manual trip, the EFW block valves [BA,ISV], for "A" steam generator received an overfill protection signal to close. This was apparently due to turbine stop valve [SB,V] closure causing an oscillatory pressure wave, resulting in a spurious high steam generator level indication.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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APPROVED OMB NO. 3150-0104

EXPIRES 8/31/85

FACILITY NAME (1) CRYSTAL RIVER UNIT #3	DOCKET NUMBER (2) 0 5 0 0 0 3 0 2 8 7	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
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TEXT (If more space is required, use additional NRC Form 365A's) (17)

At 0538, both main condensate pumps [SD,P] tripped on high deaerator tank [SJ,DEA] level. The main condensate pumps were restarted and feedwater continued to be supplied via the Main Feedwater (MFW) [SJ] System. A few main steam safety valves [SB,RV] did not reseal properly, yet they reseated when main steam header pressure was manually lowered. This had no significant effect on RCS temperature.

At 0551, steam pressure on "A" steam generator suddenly became erratic, fluctuating from its normal post-trip value of 1010 PSIG to approximately 950 PSIG. These cyclic pressure oscillations had a small effect on RCS temperature, resulting in 2-3 degree changes. The problem was traced to one of the turbine bypass valves [JI,V] on the "A" main steam line. The valve was isolated and steam generator pressure control was returned to normal.

CAUSE

The root cause of the reactor trip was the failure of a relay [JC,RLY] in the RC pump power monitor circuit. A resistor within this relay failed. The relay failure deenergized the status signal for "B" RCP to the "B" RPS channel. The actuation of only "B" RPS channel does not result in a reactor trip. However, the failed relay eventually also caused the power fuse [JC,FU] to open. This fuse powered the relays for "B" RCP status signals to all 4 RPS channels. With "C" RCP previously secured, all 4 RPS channels indicated a loss of more than one RCP, causing the reactor trip. The fuse also powered optical isolators [JC,OB] for the status signal of all 4 RCP's to the "B" RPS channel, which explains why the "B" RPS channel indicated a loss of all 4 RC pumps.

The failure of the main turbine to automatically trip was due to failure of the reactor trip lockout relay. This relay is located in the back of the main control board, and its failure was discovered when the control room operators noticed a burning smell. The lockout relay did not actuate as required on a reactor trip signal. Its coil [EC,CL] was found open and charred. As-found testing performed on the relay indicated approximately 6 pounds force required to trip the relay. This value should have been approximately 3 pounds force. Apparently, when the coil was energized, it could not develop sufficient force to actuate the relay, and it overheated and failed.

The failed turbine bypass valve was found to have a broken valve position feedback linkage [JI,ZI]. This linkage was replaced and the valve was tested satisfactorily. The cause of the failure of the MSSV's to fully reseal until steam pressure was manually lowered could not be determined.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1) CRYSTAL RIVER UNIT #3	DOCKET NUMBER (2) 0 5 0 0 0 3 10 2 8 7 -	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		0	1	1	0	0	4 OF 0 5

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

SAFETY CONSIDERATIONS

The Reactor Protection System responded as designed to the signal inputs it received, even though these were erroneous signals. The Emergency Feedwater Initiation and Control (EFIC) System responded as designed and did not initiate EFW. The spurious high level signal, which closed the "A" steam generator EFW block valves for overfill protection was not a problem, since there was no need for the EFW System. If EFW had been required, an EFW actuation signal would have opened the valves as designed.

The problems encountered with the main turbine and the turbine bypass valve involved non-safety-related components. Prompt operator action prevented the failure of the main turbine to trip from causing a possible overcooling event. Failure of the turbine bypass valve caused no significant problems with RCS pressure and temperature control. The MSSV's are safety-related, but the failure of a few of these valves to reseal appeared to have little effect on RCS pressure and temperature. Based on all of the above, this event had no adverse safety consequences.

It should be noted that the failure of the RCP power monitor relay occurred in the plant configuration which is most vulnerable to RCP power monitor failures (i.e., 3 RCP operation.) If all 4 RCP's had been operating, the relay failure and fuse failure would have resulted in only "B" RPS channel sensing that all 4 RCP's were off. The remaining 3 RPS channels would have sensed that only 1 RCP was off. This condition would not have resulted in a reactor trip.

CORRECTIVE ACTIONS

The failed relay in the RCP power monitoring circuit was replaced and the newly installed relay was tested satisfactorily. Continuity checks of the wiring were made and all checks were satisfactory. The open fuse was replaced.

The failed reactor trip lockout relay was removed and tested, and was found to trip at approximately 6 pounds force. A new relay was bench tested and was found to trip at 3 pounds force. This new relay was installed, and a weight test was satisfactorily performed in place. The relay was tested satisfactorily for all of its functions, including the signal to the turbine trip circuit.

The valve position feedback linkage for the turbine bypass valve was replaced. The valve was stroke tested and verified to respond properly to a control signal, and was placed back into service.

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EXPIRES 8/31/85

FACILITY NAME (1) CRYSTAL RIVER UNIT #3	DOCKET NUMBER (2) 0 5 0 0 0 3 D 2 8 7 - 0 1 1 1 - 0 1 0 0 5 OF 0 5	LER NUMBER (6)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		

TEXT (If more space is required, use additional NRC Form 386A's) (17)

The MSSV's, which did not reseal properly, or which required steam pressure reduction to fully reseal were checked for proper lift and reseal pressure setpoints.

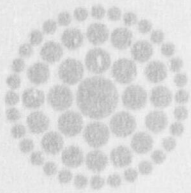
PREVIOUS SIMILAR EVENTS

The Reactor Protection System was actuated due to the Reactor Coolant Pump power monitors on eight previous occasions. The two most recent events were described in LER 85-028 and LER 85-030, valid RCP power monitor actuations. The remaining incidents involved spurious RCP power monitor actuations.

In the past, there have been other RCP power monitor relay failures, none of which resulted in a reactor trip, and one of which resulted in an opened fuse.

Failed Component Identification:

- (1) RCPPM Relay: Mfr - Amerace Corporation (AGA STAT)
Part No. STARX022XSAAXA
- (2) Rx. Trip Lockout Relay: Mfr. - General Electric
Part No. 12HEA61C240X2
- (3) Turbine Bypass Valve Linkage: Mfr. - Bailey Controls



**Florida
Power**
CORPORATION

August 10, 1987
3F0887-10

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

Subject: Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72
Licensee Event Report 87-011-00

Dear Sir:

Enclosed is Licensee Event Report (LER) No. 87-011-00
which is being submitted in accordance with 10 CFR 50.73.

Should there be any questions, please contact this office.

Sincerely,

E. C. Simpson
Director, Nuclear
Operations Site Support

WLR:mag

Enclosure

xc: Dr. J. Nelson Grace
Regional Administrator, Region II

Mr. T. F. Stetka
Senior Resident Inspector

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11