

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)
CRYSTAL RIVER UNIT 3DOCKET NUMBER (2)
0 5 0 0 0 3 0 2 1 OF 0 1 3

TITLE (4)

INVERTER FAILURE AND REACTOR TRIP

| EVENT DATE (5) | | | LER NUMBER (6) | | | REPORT DATE (7) | | | OTHER FACILITIES INVOLVED (8) | | | | | | | |
|--------------------|-----|---|----------------|-------------------|-----------------|-----------------|---|------|-------------------------------|---|------------------|---|---|---|---|---|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | MC | Y | YEAR | FACILITY NAMES | | DOCKET NUMBER(S) | | | | | |
| 0 | 7 | 0 | 2 | 8 | 7 | 8 | 7 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 7 | 0 | 2 | 8 | 7 | 8 | 7 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| OPERATING MODE (9) | | THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check one or more of the following) (11) | | | | | | | | | | | | | | |
| 1 | | 20.402(b) <input checked="" type="checkbox"/> 20.406(e) <input checked="" type="checkbox"/> 50.73(a)(2)(iv) <input checked="" type="checkbox"/> 73.71(b) <input type="checkbox"/> | | | | | | | | | | | | | | |
| POWER LEVEL (10) | | 0 8 8 20.406(a)(1)(i) <input type="checkbox"/> 50.36(a)(1) <input type="checkbox"/> 50.73(a)(2)(v) <input type="checkbox"/> 73.71(d) <input type="checkbox"/> | | | | | | | | | | | | | | |
| | | 20.406(a)(1)(ii) <input type="checkbox"/> 50.36(a)(2) <input type="checkbox"/> 50.73(a)(2)(vi) <input type="checkbox"/> OTHER (Specify in Abstract below and in Text, NRC Form 365A) <input type="checkbox"/> | | | | | | | | | | | | | | |
| | | 20.406(a)(1)(iii) <input type="checkbox"/> 50.73(a)(2)(i) <input type="checkbox"/> 50.73(a)(2)(vii)(A) <input type="checkbox"/> | | | | | | | | | | | | | | |
| | | 20.406(a)(1)(iv) <input type="checkbox"/> 50.73(a)(2)(ii) <input type="checkbox"/> 50.73(a)(2)(vii)(B) <input type="checkbox"/> | | | | | | | | | | | | | | |
| | | 20.406(a)(1)(v) <input type="checkbox"/> 50.73(a)(2)(iii) <input type="checkbox"/> 50.73(a)(2)(ix) <input type="checkbox"/> | | | | | | | | | | | | | | |

LICENSEE CONTACT FOR THIS LER (12)

NAME
L. W. MOFFATT, NUCLEAR SAFETY SUPERVISOR

TELEPHONE NUMBER

AREA CODE
9 0 4 7 9 5 - 6 4 8 6

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

| CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO NPROS | CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO NPROS |
|-------|--------|-----------|--------------|---------------------|-------|--------|-----------|--------------|---------------------|
| X | I E | I N V T S | 2 5 0 | Y | | | | | |
| X | A A | B K R G | U 3 0 | 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 2, 1987, Crystal River Unit 3 was operating at 88.4% Rated Thermal Power, generating 771 MWe. Surveillance testing on Channel B of the Reactor Protection System was in progress. The B Control Rod Drive Mechanism (CRDM) circuit breaker opened normally when the shunt trip device was tested, but would not reclose after testing.

While investigation into the B CRDM breaker problem was in progress, the inverter supplying power to the A vital bus failed. The A vital bus automatically transferred to its alternate power source. During the transfer the bus experienced a slight voltage dip which caused the A CRDM breaker to open. Since both breakers were open simultaneously, all power was removed from the control rod drive mechanisms. This caused all control rods to fall to the fully inserted position and shut down the reactor. The CRDM breaker that would not close has been replaced. The inverter has been repaired and a modification has been prepared to lower the undervoltage setpoint.

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LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104

EXPIRES 8/31/85

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|--|-------------------------------------|----------------|----------------------|--------------------|----------|----|----|
| FACILITY NAME (1) CRYSTAL RIVER UNIT #3 | DOCKET NUMBER (2) 0500030287 | LER NUMBER (8) | | | PAGE (3) | | |
| | | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | | | |
| | | 87 | 009 | 00 | 02 | OF | 03 |

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

EVENT DESCRIPTION

On July 2, 1987, Crystal River Unit 3 was operating at 88.4% Rated Thermal Power, generating 771 MWe. Reactor Protection System [JC] functional testing was in progress on the B Channel. At 1032, the B Control Rod Drive Mechanism (CRDM) breaker [AA,BKR] was opened by the shut trip device [AA,BKR] as part of the surveillance, but could not be reclosed following the test.

Troubleshooting of this problem was in progress at 1042, when the inverter [EF,INVT] supplying power to the A vital Bus [EF,BU] failed. (This failure was not related to the problem with the B CRDM breaker.) The loads on the A vital bus were automatically transferred to the alternate AC power source [EB,XFMR] when the inverter failed. However, the A CRDM breaker opened during the transfer. Opening of the A CRDM breaker while the B CRDM breaker was open removed all power from the control rod drive mechanisms. This caused all the control rods [AA] to fall to the fully inserted position, shutting down the reactor. Opening of both CRDM breakers also caused an automatic turbine [TA] trip. The Reactor Protection System anticipatory reactor trip was actuated when the turbine trip occurred.

CAUSE

This event was initiated by the failure of the inverter supplying power to the A vital bus while the B CRDM breaker was open. The cause of the event was opening of the A CRDM breaker due to the A vital bus experiencing a voltage dip during the time between transfer from normal source power to the alternate power source. The combination of a voltage dip and a time lag to transfer caused the undervoltage sensor to actuate and trip the breaker open.

The inverter failed because a capacitor [EF,CAP] in the square wave switching circuit failed. The cause of the capacitor failure is under investigation.

The cause of the failure of the B CRDM breaker to reclose has not been determined.

CORRECTIVE ACTION

The capacitor that failed, and all capacitors in the same bank, in the A vital bus inverter have been replaced. An investigation will be conducted to determine the cause of the capacitor failure.

The B CRDM breaker has been replaced and tested satisfactorily. An analysis will be conducted to determine why the breaker that was removed would not reclose during surveillance testing.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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EXPIRES 8/31/85

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| 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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| | 0 3 OF 0 3 | | | | | |

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

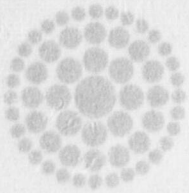
It has been recognized that a voltage dip below the setpoint is experienced during the transfer to the alternate source. A modification has been prepared and scheduled for installation during the Refuel VI outage to lower the undervoltage setpoint. It is expected the new setpoint will be lower than the voltage dip experienced during the transfer.

SAFETY CONSIDERATIONS

The opening of the A CRDM breaker was a conservative action which occurred because of the design setpoint of the shunt trip undervoltage sensor. The failure of the B CRDM breaker to reclose did not interfere with its ability to perform its safety function, since opening and remaining open is the safety function of the breaker. The Reactor Protection System (Anticipatory Reactor Trip) was the only safety system challenged during this event and it responded as expected. The reactor was safely shut down and there were no inadvertent releases of radioactive material as a result of this event. Therefore, public health and safety were not affected.

PREVIOUS SIMILAR EVENTS

Two previous similar events were identified in which inverter problems led to reactor trips. LER 81-21 reported an inverter failure which resulted in a partial loss of Non-Nuclear Instrumentation power and a reactor trip. LER 85-23 reported an inverter problem, which resulted in the plant operators manually tripping the turbine, causing a reactor trip.



**Florida
Power**
CORPORATION

August 3, 1987
3F0887-02

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 No. 87-09-00

Dear Sir:

Enclosed is Licensee Event Report (LER) No. 87-09-00 which is submitted in accordance with 10 CFR 50.73.

Should there be any questions, please contact this office.

Sincerely,

Ken W. Simpson
for

E. C. Simpson
Director, Nuclear
Operations Site Support

WLR:mag

Enclosure

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

Mr. T. F. Stetka
Senior Resident Inspector

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