ACCELERATED DISTRIBUTION DEMONSTRATION SYSTEM

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:9012260225 DOC.DATE: 90/12/13 NOTARIZED: NO DOCKET #
FACIL:50-287 Oconee Nuclear Station, Unit 3, Duke Power Co. 05000287

AUTH.NAME	AUTHOR AFFILIATION
LOWERY,H.R.	Duke Power Co.
BARRON,H.B.	Duke Power Co.
RECIP.NAME	RECIPIENT AFFILIATION

SUBJECT: LER 90-003-00:on 901113,control rod Group 7 dropped into core,resulting in manual reactor trip.Caused by failed solid state programmer which controls CRD stators.Programmer replaced.W/901213 ltr.

DISTRIBUTION CODE: IE22T COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 8
TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
	PD2-3 LA	1	1	PD2-3 PD	1	1
	WIENS,L	1	1			
INTERNAL:	ACNW	2	2	ACRS	2	2
	AEOD/DOA	1	1	AEOD/DSP/TPAB	1	1
	AEOD/ROAB/DSP	2	2	NRR/DET/ECMB 9H	1	1
	NRR/DET/EMEB 7E	1	1	NRR/DLPQ/LHFB11	1	1
	NRR/DLPQ/LPEB10	1	1	NRR/DOEA/OEAB	1	1
	NRR/DREP/PRPB11	2	2	NRR/DST/SELB 8D	1	1
	NRR/DST/SICB 7E	1	1	NRR/DST/SPLB8D1	1	1
	NRR/DST/SRXB 8E	1	1	REG FILE 02	1	1
	RES/DSIR/EIB	1	1	RGN2 FILE 01	1	1
EXTERNAL:	EG&G BRYCE,J.H	3	3	L ST LOBBY WARD	1	1
	NRC PDR	1	1	NSIC MAYS,G	1	1
	NSIC MURPHY,G.A	1	1	NUDOCS FULL TXT	1	1

R I D S / A D D S

NOTE TO ALL "RIDS" RECIPIENTS:

PLEASE HELP US TO REDUCE WASTE! CONTACT THE DOCUMENT CONTROL DESK, ROOM P1-37 (EXT. 20079) TO ELIMINATE YOUR NAME FROM DISTRIBUTION LISTS FOR DOCUMENTS YOU DON'T NEED!

R I D S / A D D S

FULL TEXT CONVERSION REQUIRED
TOTAL NUMBER OF COPIES REQUIRED: LTTR 33 ENCL 33

Duke Power Company
Oconee Nuclear Station
P.O. Box 1439
Seneca, S.C. 29679

(803) 882-5363

DUKE POWER

December 13, 1990

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

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 287/90-03

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 287/90-03 concerning equipment failure of the solid state programmer causes group 7 control rods to drop, resulting in a manual reactor trip.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(iv). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

H B Barron

H. B. Barron
Station Manager

RSM/ftr

Attachment

xc: Mr. S. D. Ebneter
Regional Administrator, Region II
U.S. Nuclear Regulatory Commission
101 Marietta St., NW, Suite 2900
Atlanta, Georgia 30323

Mr. L. A. Weins
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Mr. P. H. Skinner
NRC Resident Inspector
Oconee Nuclear Station

INPO Records Center
Suite 1500
1100 Circle 75 Parkway
Atlanta, Georgia 30339

M&M Nuclear Consultants
1221 Avenue of the Americas
New York, NY 10020

IE22
111

NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WTH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit 3	0 5 0 0 0 2 8 7	1 OF 0 7

TITLE (4) Equipment Failure of Solid State Programmer Causes Group 7 Control Rods to Drop, Resulting in Manual Reactor Trip

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)
1 1	1 3	9 0	9 0	0 0 3	0 0	1 2	1 3	9 0		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): N

POWER LEVEL (10): 1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check one or more of the following)* (11)

[ ] 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)	[X] OTHER *(Specify in Abstract below and in Text, NRC Form 366A)* 50.72
[ ] 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	
	AREA CODE	
Henry R. Lowery, Chairman Oconee Safety Review Group	8 0 3	8 8 5 - 3 0 3 4

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

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS
F	A A	X C	B 0 1 5	Yes					

SUPPLEMENTAL 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 November 13, 1990, at approximately 2256 hours, while at 100% Full Power, Oconee Unit 3 Control Rod Group 7 dropped into the core. From control room indicators Operations personnel recognized that the rod group had dropped and were able to trip the reactor from 60% Full Power before the Reactor Protective System could automatically trip the reactor on Low Reactor Coolant System Pressure. The post trip response was normal. Investigation of the dropped Control Rod Group revealed a failed Solid State Programmer, which controls power to the Control Rod Drive Stators. The programmer was replaced and the Unit was returned to critical at 0433 hours on November 14, 1990. The root cause of this event is identified as Equipment Failure.

BACKGROUND

Unit 3 core [EIIS:AC] design has 69 control rods [EIIS:ROD] that are divided into eight groups. Groups 1 through 4 are the safety rods and are in the full out position during normal power operation to provide safe shutdown capability. Groups 5 through 7 are the regulating groups and are used to control the reactor power during operation. Group 8 rods are the axial power shaping rods and are used to help control the power imbalance in the core within specified limits.

The Control Rod Drive (CRD) System [EIIS:AA] controls the operation of the control rods. Each of the regulating groups (5 through 7) has its own Programmer [EIIS:XC] as part of the regulating (normal) power supply [EIIS:JX]. An earlier optical/mechanical programmer model has been replaced on all units during recent refueling outages with a Model 496A Solid State Programmer. There is one auxiliary power supply which can be used to operate regulating rods as needed in case of a loss of one of the regulating power supplies. The Programmer accepts operational commands from the CRD System and converts them into low power outputs which control Silicon Controlled Rectifiers (SCRs) that sequentially energize the six phases of the CRD stator causing rod movement in or out. The trip function does not enter the programmer but interrupts the two redundant 24VDC power sources for the programmer. If the power output from the programmer goes to zero, no power is supplied to the motor drive windings and the rods fall to the core.

The Reactor Protective System (RPS) [EIIS:JC] is a safety related system which monitors parameters related to the safe operation of the plant. The RPS provides a two-out-of-four logic for tripping the reactor when a predetermined safety setpoint is exceeded. This is done via the reactor trip module relays [EIIS:RLY] which deenergize the control rod drive breakers and the SCR Control Relays, causing rod insertion.

EVENT DESCRIPTION

On November 13, 1990, at 2255:22 hours, while operating at 100% Full Power (FP), Unit 3 Control Rod Group 7 dropped into the core. No abnormal events, testing, or maintenance procedures were in progress immediately before or at the time this event occurred.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Oconee Nuclear Station, Unit 3	0 5 0 0 0 2 8 7	9 0	— 0 0 3	— 0 0	0 3 OF 0 7

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

When the control rods dropped, a reactor transient was induced. Reactor power rapidly decreased to 35% FP and Reactor Coolant System (RCS) pressure and temperature dropped. Power returned to 60% FP within seconds due to positive reactivity insertions from the negative Doppler and Moderator Temperature Coefficients during the temperature decrease.

The Control Room Operators (CROs) received several alarms, saw that Control Rod Group 7 In-Limit lights were all lit, and knew that the group had dropped. Reactor Protective System (RPS) Channel C tripped on Variable Low RCS Pressure. A CRO manually tripped the reactor at 2255:51 hours, 29 seconds after the Group 7 rods dropped into the core and prior to the receipt of a trip signal on a second channel of RPS. This was in accordance with station Operating Procedures which specify that the affected unit must be immediately tripped whenever more than one control rod has dropped into the core.

The immediate response of the plant was normal for such a trip. The turbine [EIIS:TRB] and generator [EIIS:GEN] tripped, both 4kv and 7kv electrical power supplies [EIIS:EA] transferred to the start-up source, the turbine stop valves [EIIS:V] closed, the main steam relief and turbine by-pass valves opened. All Control Rod Drive (CRD) breakers [EIIS:BRK] opened and the remaining control rod groups (groups 1 through 6) fell into the core.

The Primary response was normal. Reactor Coolant System (RCS) [EIIS:AB] pressure dropped to a low of approximately 1875 psig prior to the reactor trip, decreased to a low of approximately 1825 psig following the trip, and then increased and controlled at 2150 psig. RCS Hot Leg temperatures decreased from 600 F to 576 F and RCS Cold Leg temperature decreased from 555 F to 542 F prior to the trip. Following the trip, RCS Hot Leg and Cold Leg temperature converged and stabilized at approximately 555 F. Pressurizer level decreased to 95 inches prior to the trip. At 2256:18 hours, the CRO opened the High Pressure Injection (HPI) [EIIS:CB] Emergency Make-up Valve (HP-26) and started a second HPI pump [EIIS:P] to increase make-up to the RCS. This response is frequently taken after a trip in order to assure that Pressurizer level is maintained on scale and to keep level above the Pressurizer heater banks. The minimum Pressurizer level during this event was 75 inches. At 2258:42 hours, the CRO closed HP-26 and secured the second HPI pump. Pressurizer level then controlled between 120 inches and 160 inches.

Secondary response was also mostly as expected. Main Steam [EIIS:SB] pressure initially decreased from 885 psig to 845 psig as a result of the dropped Control Rod Group (decreasing heat source), without having time to recover prior to the reactor trip. Following the trip, Main Steam pressure initially increased to 1050 psig and appeared to control high at 1035 psig, at which time the CRO noted that the Turbine Bypass Valves indicated closed. The operator assumed that the Turbine Bypass Valve automatic controls were not functioning properly. The Transient Monitor indicates that the Turbine Bypass Valves had cycled open and closed several times between 2256 and 2257 hours, but were closed at 2257:39 when the CRO took manual control. He opened the Turbine Bypass Valves to lower Turbine Header pressure to it's proper post trip value of 1010 psig. Subsequently, it was observed that the Main Steam pressure gauge in the control room was reading approximately 20 psi higher than the transmitter feeding the ICS controls.

Feedwater [EIIS:SJ] flow and corresponding Steam Generator [EIIS:HX] levels responded appropriately. Feedwater flow initially decreased due to the runback signal called for by the dropped Control Rod Group, then properly increased with the increase in reactor power caused by the reactivity affects. Following the reactor trip, Feedwater flow decreased to control Steam Generator levels at a minimum level of 25 inches.

The unit Events Recorder (ER) [EIIS:IQ] malfunctioned immediately after receiving and printing the trip of RPS Channel C. Other transient and trip data normally indicated on the ER did not print out. This data is useful as the ER is the only data gathering device which records the exact sequence of events occurring within the same second. However, the remaining data gathering devices (i.e. Transient Monitor, Operator Aid Computer, strip charts, etc.) operated adequately to permit proper analysis of the event. The ER malfunction was repaired prior to the unit restart.

CONCLUSIONS

The root cause of this event is Equipment Failure. It was determined during post-trip diagnostics that the Solid State Programmer was not providing the proper output signal to the Control Rod Drive motors. This failure is NPRDS reportable. The Programmer is a model 496A, part number 71011901-042, manufactured by Babcock and Wilcox. Although the Programmer

NRC FORM 366A (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WTH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Oconee Nuclear Station, Unit 3	0 5 0 0 0 2 8 7	9 0	— 0 0 3	— 0 0	0 5 OF 0 7

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

was returned to the vendor for diagnostic testing and repair, the failure has not been reproduced and the exact cause of the Programmer failure has not been identified.

There have been ten events (nine reactor trips and one forced shutdown) at Oconee within the past two years where equipment failure was known or suspected to be the root cause. However, only two of these events involved the Control Rod Drive System and neither of those two events involved the same portions of the system. Therefore, this event is non-recurring and none of the corrective actions from these previous events could have prevented this event.

There were no personnel injuries, no releases of radioactive materials, or excessive exposures associated with this event.

CORRECTIVE ACTIONS

Immediate

1. Control Room Operators brought Unit to stable hot shutdown conditions.

Subsequent

1. Maintenance Instrument and Electrical (I&E) personnel diagnosed and replaced the failed Programmer. The Programmer was returned to Babcock and Wilcox (B&W) for further diagnostic testing, and root cause analysis.

2. The Events Recorder was repaired.

Planned

1. Because B&W cannot identify any fault in the Programmer itself, additional system testing/diagnostics will be performed by I&E during the next outage of sufficient length.

SAFETY ANALYSIS

The plant response to this event was relatively normal and as expected. No Engineered Safeguards [EIIS:JE] system actuations were either required or received.

Reactor Protective System (RPS) Channel C tripped on Reactor Coolant System (RCS) low pressure and the Control Room Operator (CRO) tripped the unit manually before a second channel actuated. The CRO responses maintained all parameters within nominal post-trip ranges. Specifically, RCS pressure dropped to 1825 psig, and controlled at 2150 psig. Pressurizer level dipped to 75 inches, and controlled between 120 and 160 inches. A second injection pump was manually started and run for approximately three minutes to help keep the pressurizer on scale during the initial cooling transient as the RCS temperatures converged to the post-trip setpoint of 555 degrees F. Steam generator levels dropped during the transient prior to the trip, then decreased smoothly to the post-trip setpoint of 25 inches. Steam pressure initially dropped to 845 psig before the trip, peaked at 1050 psig, then controlled at 1035 psig as shown on the control room gauge until the CRO lowered the setpoint control to adjust header pressure to 1010 psig.

The Final Safety Analysis Report (FSAR) sections 4.5.3, 7.6, and 15.7 contain analysis of a single dropped rod. The Nuclear Engineering Support Section of Duke Power Design Engineering generally feels that the dropping of a group of rods, while not specifically analyzed, would make it very difficult for the unit to successfully runback to a lower power level and not trip. Reactor power tilt/imbalance related problems due to multiple dropped rods from one group should be less significant than the consequences of a single rod drop due to the distribution of the group rods in the core. A manual or automatic trip would terminate the initial transient and prevent the reactor from exceeding design parameters. Station Operating Procedures require the immediate manual trip of the reactor if more than one control rod drops. In this event, the operators diagnosed the event and manually tripped the reactor within 29 seconds.

The exact nature of the Programmer failure is not known at this time, other than the fact that it interrupted power to the CRD motors, allowing the drives to release the rods. Other postulated failure modes could conceivably permit the Programmer to fail such that it would not properly respond to commands to move the control rods. Such a potential failure should result, at worst, in a reactor power increase which might challenge the RPS overpower trip logic. Such an event would result in an RPS trip which would open the CRD power circuit breakers, thus interrupting the power to the CRD motors independently of the programmer, and assuring a unit trip.

NRC FORM 366A
(6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WTH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Oconee Nuclear Station, Unit 3	0 5 0 0 0 2 8 7	9 0	— 0 0 3	— 0 0	0 7 OF 0 7

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

There were no personnel injuries, no releases of radioactive materials, or excessive exposures associated with this event. The health and safety of the public was not endangered by this event.