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REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:8909220109 DOC.DATE: 89/09/13 NOTARIZED: NO DOCKET #
FACIL:50-316 Donald C. Cook Nuclear Power Plant, Unit 2, Indiana & 05000316
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SUBJECT: LER 89-014-00:on 890814,reactor protection sys actuation due to malfunction of CR instrumentation distribution inverter.
W/8 ltr.

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INDIANA MICHIGAN POWER

September 13, 1989

United States Nuclear Regulatory Commission
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Operating License DPR-74
Docket No. 50-316

Document Control Manager:

In accordance with the criteria established by 10 CFR 50.73 entitled Licensee Event Reporting System, the following report is being submitted:

89-014-00

Sincerely,

W. G. Smith, Jr.
Plant Manager

WGS:clw

Attachment

cc: D.H. Williams, Jr.
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NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
D. C. COOK NUCLEAR PLANT - UNIT 2	0 5 0 0 0	1 OF 0 8

TITLE (4) REACTOR PROTECTION SYSTEM ACTUATION DUE TO MALFUNCTION OF CONTROL ROOM INSTRUMENTATION DISTRIBUTION INVERTER

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)
										0 5 0 0 0
0 8	1 4	8 9	8 9	0 1 4	0 0	0 9	1 3	8 9		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
T. P. BEILMAN INSTRUMENTATION AND CONTROL DEPARTMENT SUPERINTENDENT	AREA CODE 6 1 6 — 4 6 5 - 5 9 0 1

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	
E	E I F	I N V	S 2 5 0	Y							

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 August 14, 1989 at 1601 hours, a Reactor Protection System (RPS) actuation (reactor trip) occurred when operators transferred the Control Room Instrumentation Distribution (CRID) IV (vital bus) inverter to its normal Class 1E power supply and the inverter failed. When the CRID IV inverter failed, a reactor trip signal was initiated due to the Reactor Coolant Pump (RCP) circuit breaker position indication open (fed from CRID IV).

Prior to the trip (at approximately 1540 hours), the CRID inverter had transferred to its alternate non-class 1E power supply at the same time that a control power fuse had blown on Power Range Nuclear Instrumentation System (NIS) Channel IV (N-44). Subsequent investigation determined that the CRID inverter failure was due to a failed silicon controlled rectifier (SCR) in the static transfer switch. This also resulted in the failure of fuses and power supplies in various components fed from the CRID.

The faulted SCR's were replaced and the CRID inverter declared operable. All components fed from the CRID were inspected and, where necessary, fuses and/or power supplies were replaced.

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D. C. COOK NUCLEAR PLANT - UNIT 2	0 5 0 0 0 3 1 6	8 9	— 0 1 4	— 0 0	0 2 OF 0 8

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

Conditions Prior To Occurrence

Unit Two in Mode One (power operation) at 100 percent power.

Description of Event

On August 14, 1989 at approximately 1540 hours, operators reported that the control power fuse (EIIS/EF-FU) for Power Range Nuclear Instrumentation Channel (NIS) (EIIS/IG-CH) N-44 had blown. At the same time, the Control Room Instrumentation Distribution (CRID) IV (vital bus) inverter (EIIS/EF-INV) had transferred to its alternate non-class 1E power supply. At the time, it was believed that the blown fuse may have caused CRID IV inverter to transfer. Operations pulled the control and instrument fuses for N-44 per procedure and contacted Instrumentation and Control (I&C) personnel to trip the remaining bistables associated with N-44, and to determine the cause of the blown fuse.

While I&C was preparing to troubleshoot N-44, Operations prepared to transfer the CRID IV inverter back to its normal Class 1E supply (EIIS/EF). This power supply transfer was initiated to provide the availability of an alternate power source (in the event of the failure of the primary power source) during the troubleshooting process. When the non-licensed operator (NLO) in the CRID inverter room pushed the "Inverter to Load" push button on the inverter, the alternate source pilot light went out and the inverter failure and fan failure lights came on. The "Inverter Supplying Load" pilot light came in dimly and then went out. He then pushed the push button a second time and believed that the inverter transferred properly, as there were no indications to the contrary. However, inverter output voltage was indicating approximately 84 VAC in the control room (normal voltage is 120 VAC). The reactor trip occurred when the inverter low output voltage caused the Reactor Protection System (EIIS/JE) to sense the #24 Reactor Coolant Pump (RCP) (EIIS/AB-P) breaker position (fed from CRID IV) indicating open above Permissive P8.

Following the trip sequence [opening of the reactor trip breakers (EIIS/JE-BKR), turbine (EIIS/TA-TRB) trip, insertion of reactor control rods (EIIS/AA-ROD), feedwater isolation (EIIS/JB) and automatic starting of the motor driven auxiliary feedwater pumps (EIIS/BA-P)], Operations personnel immediately implemented Emergency Operating Procedure 2 OHP 4023.E-0 to verify proper response of the automatic protection system and to assess plant conditions for indicated appropriate recovery actions. Due to the failure of CRID IV, various control room instrumentation indications and components were unavailable. These included the protection system status lights, #24 RCP operating parameter indication (EIIS/SB-PI), Steam Generator wide range level indication (EIIS/AB-LI), Loop 4 indication for auxiliary water flow (EIIS/BA-FI), main steam pressure indicators MPP-212 and 242 (EIIS/SB-PI), one channel of steam generator narrow range level (EIIS/JB-LI), and loss of the use of steam dump system (EIIS/SB-V).

Operators tripped the #24 RCP, as they had no indication available. They manually activated the main turbine solenoid (SOL) trip (EIIS/TA-SSV) and the AMSAC (EIIS/JG), because they had no status light for main turbine trip, although the turbine stop valve (EIIS/TA-V) position indication indicated full closed.

Two rod bottom lights did not light (rod position indicators [RI] showed the rods at less than 25 steps). Per procedure, operators emergency borated for five minutes. It was later determined that a leaking capacitor on one rod bottom bistable and a burned out resistor on the other had caused the problem and was not related to the CRID IV failure. These items were subsequently repaired. Because of the loss of steam dumps, operators used the main steam power operated relief valves (EIIS/SV-RV) to stabilize the plant until steam dump control was re-established.

Operators also noted that the speed indication (EIIS/BA-SI) for the Turbine Driven Auxiliary Feedpump had failed. It was later determined that this was due to a broken lead on the magnetic pickup for the tachometer and was not related to the CRID IV failure. This was repaired and the pump tested per Operations procedure.

Following the trip, I&C personnel began investigation into the cause of the CRID IV inverter failure, and the possible affects of the low voltage condition (84 VAC) on components fed from the CRID IV inverter. This included an examination of Train B of the Solid State Protection System (SSPS), and N-44 and other miscellaneous drawers in the Nuclear Instrumentation system.

It was found that the low voltage condition had caused high current flow to loads fed from CRID IV, resulting in a number of individual breakers tripping open, fuses blowing and power supplies burning up.

Attachment No. 1 is a listing of those components that were found to have been adversely affected by the inverter failure.

The cause of the low inverter output which led to the reactor trip was determined to be due to a failed silicon controlled rectifier (SCR) in the static transfer switch. This SCR had experienced a rare failure mode with the SCR gating close which blocks the output. The remaining SCR continued to function, producing sufficient voltage to allow the transfer to occur, but unable to supply sufficient power to the equipment.

All CRID loads that were damaged during the event were repaired (fuses and/or power supplies replaced), and tested to ensure operability.

Cause of the Event

The cause of the event is due to a faulted SCR in the CRID IV inverter static switch circuitry. This resulted in very low output voltage (84 VAC) resulting in a reactor trip from #24 Reactor Coolant Pump breaker position indicating open above Permissive P8. The low voltages also resulted in high current demand by equipment supplied by CRID IV, causing damaged components and blown fuses.

Analysis of Event

This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv) as an event that resulted in an unplanned automatic actuation of the Engineered Safety Features, including the Reactor Protection System.

The automatic protection responses, including reactor trip and its associated actuations were verified to have functioned properly as a result of the reactor trip signal. Based on the above, it is concluded that the event did not constitute an unreviewed safety question as defined in 10 CFR50.59(a)(2) nor did it adversely impact the health and safety of the public.

Corrective Action

The CRID IV inverter was repaired and declared operable on August 16, 1989. All components powered from the CRID IV were evaluated for damage and repaired/tested as necessary to verify operability. I&C has developed a guideline for checkout of a CRID inverter to verify that the inverter and static switch are operating correctly if a CRID should auto transfer. This guideline will be performed before operators are instructed to transfer back to the Class 1E power supply and thus eliminate the chance of a reactor trip and potential equipment damage due to the causes of this event.

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

Failed Component Identification

Plant I.D. No.: 2-CRID-IV-INV
Manufacturer: Solidstate Controls, Inc.
Model No.: SV25075 (7.5 KVA)
EIIS Code: EF/INVT

Previous Similar Events

None.

ATTACHMENT NO. 1

Breakers That Tripped		Equipment Affected
Rack 12:	MPP-212	SG 1 Steam Pressure
	MPP-242	SG 4 Steam Pressure
	BLP-110	SG Loop 1 level differential pressure transmitter
	BLP-120	SG Loop 2 level differential pressure transmitter
	BLP-130	SG Loop 3 level differential pressure transmitter
	BLP-140	SG Loop 4 level differential pressure transmitter
	NPS-153	Pressurizer pressure transmitter
	PPP-300	Lower Containment pressurizer transmitter
	ELS-951	RWST level transmitter
	FFI-240	Aux Feedwater to SG #4
Rack 13:	NTR-141	Loop 4 RTD T_H
	NTP-140	Loop 4 RTD T_H
	NTP-241	Loop 4 RTD T_C
	NTP-240	Loop 4 RTD T_C
	FFI-241	Feedwater to SG #4 flow indicator transmitter
Cabinet 22 CG-4:	ILA-131	Accumulator Tank 3 Level Transmitter
	ILA-141	Accumulator Tank 4 Level Transmitter
	IPA-131	Accumulator Tank 3 Level Transmitter
	IPA-141	Accumulator Tank 4 Level Transmitter
	QTI-240	RCP Loop 4 low bearing
	QTI-40	RCP Loop 4 No. 1 seal
	NTA-252	Pressurizer vapor temperature
	IFI-54	Loop 4 cold injection
	QFA-240	Seal water injection transmitter
	QDA-40	RCP Loop 4 seal water
Cabinet 23 CG-4:	ITR-311	Residual heater #1 RTD
	QTC-302	Letdown heat exchanger RTD
	NTA-152	Pressurizer relief discharge temperature
	IPA-310	RHR pump #1 discharge
	QPC-301	Letdown heater low pressure
	IPA-250	Boron injection tank
	IFI-310	Residual heater #2 outlet
	QLC-452	Volume control tank
	IFI-311	Residual heater #2 outlet
	QRV-303	Letdown to volume control tank diversion valve
	FRV-240	Loop 4 feedwater control valve
	CRV-470	Letdown Hx CCW valve
	QRV-301	Letdown heater control valve

ATTACHMENT NO. 1

Breakers That Tripped	Equipment Affected	
Cabinet 24		
CG-4:	TY-412C	Delta T/T I/I's
	TY-422C	Delta T/T^{avg} I/I's
	TY-432C	Delta T/T^{avg} I/I's
	TY-442C	Delta T/T^{avg} I/I's
	TY-505D	Delta T/T^{avg} I/I's
	TY-411D	Delta T/T^{avg} I/I's
	TY-421D	Delta T/T^{avg} I/I's
	TY-431D	Delta T/T^{avg} I/I's
	TY-441D	Delta T/T^{avg}_{avg} I/I's
Cabinet 24:	NPT-411	Reactor Coolant Loop 1 Differential Pressure SG Level
	NPT-421	Reactor Coolant Loop 2 Differential Pressure SG Level
	NPT-431	Reactor Coolant Loop 3 Differential Pressure SG Level
	NPT-441	Reactor Coolant Loop 4 Differential Pressure SG Level
Cabinet 25		
CG-4	Control Bank A position	
	Control Bank B position	
	Control Bank C position	
	Control Bank D position	
	Rod Insertion Recorder:	
	Bank A limit	
	Bank A position	
	Bank B limit	
	Bank B position	
	Bank C limit	
	Bank C position	
	Bank D limit	
	Bank D position	
	Average power 01, 02, 03 & 04	
	PPA-313	Upper containment pressurizer transmitter
	Rod control auto rods in	
	Rod control auto rods out	
	Rod control rod speed demand	
Incore thermocouple cabinet B	Train B Incore Temperature Indication	

ATTACHMENT NO. 1

List of Fuses Blown

SSPS Train B #2 48V Power Supply
SSPS Train B #2 15V Power Supply
Demux 48V Power Supply
Demux 15V Power Supply
NR-44 Power range NI recorder
SG-14 Overpower recorder
FRV-210 SG water level control valve Loop 1 auto/manual station
NRV-164 Pressurizer water spray valve auto/manual station
QRV-450 Boric acid transfer pump TK #2 "S" recirc. manual station
Feedwater differential pressure controller
Pressurizer safety and relief valve flow monitor
SG-31 Incore thermocouple Train B recorder
GRV-341 Nitrogen supply to accumulator tanks vent valve controller
N-44 Power range control power fuses
Comparator and rate drawer
Instr. power and control power fuses
Audio count rate drawer:
1. Audio channel PWR
2. Timer scaler PWR
Miscellaneous control and indication drawer instr. fuses

Damaged Components

2-QDA-40 RCP #4 No. 1 seal differential pressure transmitter

Miscellaneous control and indication drawer low voltage power supplies (2)