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RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 88-001-00:on 880605,design deficiency in diesel generator breaker logic prevents connection to shutdown.
W/8 ltr.

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NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO 3150-0104
EXPIRES 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Browns Ferry Unit 3	0 5 0 0 0 2 9 6	1 OF 0 4

TITLE (4)
Design Deficiency in Diesel Generator (DG) Breaker Logic Prevents Three DGs from Connecting to Shutdown Boards During Loss of Coolant/Loss of Power Test

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR
0 6	0 5	8 8	8 8	0 0 1	0 0	0 7	0 1	8 8

OTHER FACILITIES INVOLVED (8)	
FACILITY NAMES	DOCKET NUMBER(S)
Browns Ferry Unit 1	0 5 0 0 0 2 5 9
Browns Ferry Unit 2	0 5 0 0 0 2 9 6

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
N		20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)		20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)
0 0 0		20.405(a)(1)(ii)	50.36(c)(2)	X 50.73(a)(2)(vii)	X 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)	10 CFR Part 21
		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
Stephen B. Jones, Engineer, Plant Operations Review Staff	2 0 5 7 2 9 - 3 7 8 8

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	

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 June 5, 1988, during the performance of a loss of power/loss of coolant accident test, breakers connecting diesel generators 3A, 3C, and 3D to their respective 4KV shutdown boards opened just after closing and would not automatically reclose because an open signal sealed in the logic. An operator momentarily deenergized the power to the breaker logic which reset the logic. When the logic was repowered the breakers closed as required.

The sequence of events, the time response characteristics of each DG and certain logic components, the closure circuit logic,and the trip circuit logic all contributed to the condition. The breaker circuit is being evaluated and will be modified as required to eliminate the possibility of the breaker not closing on a valid close signal.

This event occurred with all three units shut down and defueled.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Browns Ferry Unit 3	0 5 0 0 0 2 9 6	8 8	— 0 0 1	— 0 0	0 2 OF 0 4

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

DESCRIPTION

This event occurred with all three units defueled. The event affected the unit 3 diesel generators (DGs) (EIIS identifier EK), but the condition has been determined applicable to all three units.

On June 5, 1988, a loss of power/loss of coolant accident (LOP/LOCA) test was performed. One of the eight DGs was disabled prior to the test to simulate a DG failure. At 1320 hours, the offsite power supply to the plant was disconnected. Approximately 6 seconds later a simulated accident signal was injected into the plant logic. The seven operable DGs started, came to speed, and tied onto their respective 4kV shutdown board (EIIS identifier EB) between 6.5 seconds and 8 seconds. The breakers (BRK) connecting DGs 3A, 3C, and 3D to their associated shutdown boards opened just after the breakers had closed and remained open. An operator was dispatched to the 4kV shutdown board rooms. The operator transferred one of the shutdown board's control power from its normal supply to the alternate supply. This momentarily deenergized the breaker logic. When power was restored, the breaker closed. This evolution was then repeated on the other shutdown boards where the DG breakers had tripped. All three DG breakers closed and remained tied to the 4kV shutdown boards.

CAUSE OF EVENT

An investigation into the cause of the failure has determined the DG circuit breaker logic will allow the breaker to trip and lock out under a certain sequence of events. The sequence of events that led to the discovery of the problem is given below along with a further explanation of the mechanics of the event.

At time zero a loss of offsite power to the plant was initiated which deenergized the 4kV shutdown boards. This initiated undervoltage detection relays (27) which started the DGs 1.5 seconds after the LOP. At 5 seconds undervoltage relay (General Electric [GE] model number 12IAV54E1A) timed out as designed and closed a contact in the DG breaker logic close circuitry. At approximately 6.5 seconds into the LOP/LOCA test, three of the DGs reached rated speed which closed a contact in the breaker closure circuitry, thus completing the close logic. The DG breakers (GE model Number AMH-4.76-250-1D) then closed as expected when the close coil (52X) was energized. Note the other DGs did not come to speed as quickly as the three that experienced the problem. Upon breaker closure, auxiliary contacts will energize the spring charging motor (52M) and the antipump coil (52Y). The charging time takes approximately 2 seconds. Energizing the antipump coil (52Y) opens contacts in the breaker closing coil (52X) circuitry, preventing the breaker from reclosing during the charging time period and also closes a contact that connects the antipump coil (52Y) to the breaker closure

circuitry. This circuit configuration is a standard arrangement utilized to protect large breakers from rapid cycling. At about the same time that the three DG breakers closed, an accident signal was simulated (approximately 6 seconds after the LOP as part of the test sequence). This signal generates a common accident signal (CAS relays) which closes a contact that generates a DG breaker trip. Since the DG breaker had already closed, the DG breakers tripped as designed. This deenergized the shutdown board which would retrigger the 5 second undervoltage relays. This is an undervoltage relay with a inductive motor which takes approximately the same time to go to full reset as to pick up (5 seconds). Therefore, when the undervoltage was sensed on the shutdown board, the undervoltage relay was only partially reset. The relay reversed direction and reclosed contacts a short time later, thus completing the undervoltage trip logic, and which simultaneously completed the diesel breaker close logic. Since the breaker spring had not completely recharged within this time, this breaker close signal sealed in the antipump 52Y relays through its contact in the close circuitry. With the antipump coil sealed in, the breaker closure coil is blocked, thus preventing the breaker from actually closing. The basic problem centers around the time sequencing of the trip and relay logic which applied a breaker close signal in the same time frame of the spring charging motor rewind.

This circuit is the same in all eight DGs. The sequence of events, the time response characteristics of each DG and the logic components discussed above, the closure circuit logic, and the trip circuit logic all contribute to the condition. The breaker logic circuit original design was in this configuration. Changes to the circuit did not contribute to the problem. The original DG breaker circuit design was supplied by GE.

CORRECTIVE ACTION

The circuit is being evaluated to determine what can be done to prevent the breaker from locking out. Necessary modifications to the circuit will be performed.

ANALYSIS CONDITION

The condition can prevent a DG from connecting to a 4kV shutdown board if a LOP/LOCA occurs in the proper sequence. This sequence must occur within a one second window. If this sequence does not occur, the DG breaker will work as designed. If the improbable sequence of events had occurred, it could have had severe consequences if more than one DG on unit 1/2 or more than one DG on unit 3 had failed to tie to their shutdown boards. The plant design allows for the single failure of only one DG on an accident unit. Reactor operators would have responded as they did during the test and manually closed the breaker. This would permit the DGs to supply power to their respective shutdown boards.

A fuel handling accident is the only design basis event that can occur in the present plant configuration that could require DGs. Three DGs, A, B, and 3D, would be required to power standby gas treatment which is required to maintain secondary containment. The loss of secondary containment has been analyzed for the current fuel handling activities and would not result in exceeding of regulatory release limits.

This condition was determined to be part 21 reportable on June 15, 1988, after the investigation discovered the condition was a deficiency in the original circuit design.

PREVIOUS SIMILAR EVENTS - None

COMMITMENTS - Evaluate circuit and modify to prevent breaker trip seal in during LOP/LOCA sequence of events.

Tennessee Valley Authority
Browns Ferry Nuclear Plant
Post Office Box 2000
Decatur, Alabama 35602

JUL 05 1988

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

Dear Sir:

TENNESSEE VALLEY AUTHORITY - BROWNS FERRY NUCLEAR PLANT UNIT 3 - DOCKET NO. 50-296 - FACILITY OPERATING LICENSE DPR-68 - REPORTABLE OCCURRENCE REPORT BFRO-50-296/88001

The enclosed report provides details concerning the design deficiency in diesel generator (DG) breaker logic which prevented three DGs from connecting to shutdown boards during loss of coolant/loss of power test. This report is submitted in accordance with 10 CFR 50.73 (a)(2)(v), 10 CFR 50.73 (a)(2)(vii), and 10 CFR Part 21.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

J. G. Walker
Plant Manager
Browns Ferry Nuclear Plant

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U.S. Nuclear Regulatory Commission
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NRC Resident Inspector, Browns Ferry Nuclear Plant

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