



PECO NUCLEAR

A Unit of PECO Energy

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10CFR50.73

February 21 1997

Docket Nos. 50-352
50-353
License Nos. NPF-39
NPF-85

Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Licensee Event Report
Limerick Generating Station - Units 1 and 2

This LER reports the discovery of safety-related logic components that were not tested per Technical Specification Surveillance Requirements. The original testing procedures did not contain all of the required testing.

Reference:	Docket Nos. 50-352 50-353
Report Number:	1-97-001
Revision Number:	00
Event Date:	October 26, 1984 Unit 1 June 22, 1989 Unit 2
Discovery Date:	January 22, 1997
Report Date:	February 21, 1997
Facility:	Limerick Generating Station Box 2300, Sanatoga, PA 19464-2300

This LER is being submitted pursuant to the requirements of 10CFR50.73(a)(2)(i)(B) and 10CFR50.73(a)(2)(vii).

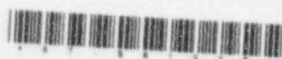
Very truly yours,

DBN:dbn

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H. J. Miller, Administrator Region I, USNRC
N. S. Perry, USNRC Senior Resident Inspector, LGS

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LICENSEE EVENT REPORT (LER)

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ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) Limerick Generating Station, Unit 1						DOCKET NUMBER (2) 05000 352			PAGE (3) 1 OF 8			
TITLE (4) Safety-Related Logic Circuits Not Fully Tested												
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 NAME	DOCKET NUMBER		
10	26	84	97	-- 001 --	0	02	21	97	Limerick, Unit 2	05000 353		
									FACILITY NAME	DOCKET NUMBER		
										05000		
OPERATING MODE (9)		1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)									
POWER LEVEL (10)		100	20.402(b)			20.405(c)			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)			X 50.73(a)(2)(vii)		OTHER	
			20.405(a)(1)(iii)			X 50.73(a)(2)(i)			50.73(a)(2)(viii)(A)		(Specify in Abstract below and in Text. NRC Form 366A)	
			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 James L. Kantner - Manager, Experience Assessment								TELEPHONE NUMBER (Include Area Code) (610) 718-3400				
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 15 single-spaced typewritten lines) (16) In January and February 1997, the engineering review performed in response to NRC Generic Letter (GL) 96-01 identified 3 issues involving contacts within a EDG/4kV subsystem logic channel that were not tested per the Technical Specification (TS) Surveillance Requirements (SR). These contacts are similarly contained in each of the 4 EDG/4kV subsystems for each unit. The untested contact circuits involve the Emergency Diesel Generator output breaker trip while in test logic, the off site power voltage monitoring logic, and the 4kV load breaker connected position trip logic. All of the contacts have been tested and restored to an operable status and only one contact failed to operate correctly. The TS SR had not been met since the original plant start-up resulting in operation prohibited by TS. The actual and potential consequences from these conditions were minimal. Inadequate review of the logic circuits and/or misinterpretation of the TS SR scope during the original procedure development and subsequent reviews resulted in the incorrect procedures. The review of the safety-related logic channels as stipulated in the response to GL 96-01 has been completed for Unit 1 and Unit 2. No additional deficiencies were identified. The appropriate procedures will be revised prior to the next performance.												

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

Unit Conditions Prior to the Event

Unit 1 was in Operational Condition (OPCON) 1 (Power Operation) at 100% power when this event was discovered. Unit 2 was in OPCON 1 at 77% power when this event was discovered. Unit 1 and Unit 2 have operated at various power levels since the concern described in this report first existed. There were no systems, components, or structures out of service that contributed to this event.

Background

In response to the requested actions contained in NRC Generic Letter (GL) 96-01, "Testing of Safety-Related Logic Circuits," a review of the appropriate logic channels was performed for Limerick Generating Station (LGS) Units 1 and 2. This review was to verify the accuracy of the original methodology used during original plant startup which determined the logic components required to be tested per the Technical Specifications (TS). This review was also to verify that the current procedures are testing all of the required components. The TS require the performance of Logic System Functional Test (LSFTs) for various safety-related systems.

A LSFT is defined as a test of all logic components, i.e., all relays and contacts, all trip units, solid state logic elements, etc., of a logic circuit, from sensor through and including the actuated device, to verify operability. The LSFT may be performed by any series of sequential, overlapping or total system steps such that the entire logic system is tested. As stated in the LGS response to the Generic letter, the review of the LSFTs for Unit 2 was completed prior to startup from the 2R04 refueling outage scheduled for February, 1997. The review was performed on a system basis involving twelve (12) systems and included the electrical components needed to fulfill the TS requirements as well as other relevant electrical components that perform a safety function. The last systems to be reviewed were the Emergency Diesel Generator (EDG, EIIS:EK) and 4kV Distribution systems. No untested components were identified until the EDG system logic channels were reviewed in January 1997.

Description of the Event

On January 22, 1997, the engineering review performed in response to NRC GL 96-01 identified two (2) issues involving contacts within a EDG/4kV subsystem logic channel that were not tested in the existing surveillance testing and preventive maintenance programs for LGS as required by the TS. These contacts are similarly contained in each of

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the four (4) EDG/4kV subsystems associated with each unit (i.e., subsystems D11, D12, D13 and D14 for Unit 1 and D21, D22, D23 and D24 for Unit 2). Later on February 6, 1997, an improper test method was identified during the preparation of the testing for the above identified concerns. Due to an improper placement of a voltmeter prescribed by the test, a contact closure in the EDG/4kV subsystem logic channel was not verified. This additional concern affected ten (10) load breakers on the 4kV busses.

The untested contact circuits are described below along with the immediate corrective actions taken to comply with the applicable Technical Specifications (TS) Section requirement.

1. EDG Output Breaker Trip While in Test Logic

Each EDG output breaker trip logic includes an automatic breaker trip if a Loss of Coolant Accident (LOCA) signal occurs when the EDG output breaker is closed and the associated 4kV electrical bus is connected to one of the two offsite power sources (i.e., feeder breaker 101 or 201 closed for the associated 4kV bus). This trip isolates the EDG from the offsite source and places the EDG in a stand-by mode. The contacts that determine if the running EDG is connected to an offsite power source (i.e., feeder breaker 101 or 201 closed based on feeder breaker position) were not always tested. The testing included one of the two feeder breakers depending on which breaker was closed during the test. The testing was not re-performed using the other feeder breaker. This deficiency affected each EDG output breaker (i.e., eight (8) breakers).

This logic is required to be tested once per twenty-four (24) months per TS Surveillance Requirement (SR) 4.8.1.1.2.e.11 and is only applicable while the EDG is connected to an offsite power source. Until the contacts are satisfactorily tested for each EDG, the specific EDG will be declared inoperable whenever the EDG is connected to an offsite power source. Under this condition, the action requirements of TS Section 3.8.1.1 will be implemented. Once this concern was verified to exist, the Unit 2 D24 EDG was undergoing a test and was immediately declared inoperable by operations personnel and the appropriate TS actions were implemented.

All sixteen (16) contacts have been tested and all but one contact operated correctly. The one failed contact was located in the logic circuit of the Unit 1 101 feeder breaker to the D11 4kV bus circuit. This contact has been replaced and satisfactorily retested. This contact failed due to high contact resistance.

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2. Offsite Power Voltage Monitoring Logic

The offsite power voltage monitoring logic circuit for each 4kV bus feeder breaker provides a trip of the closed feeder breaker based on a degraded voltage condition. The feeder breaker trips whenever bus voltage is below 94% for nine (9) seconds coincident with a LOCA signal. The feeder breaker also trips whenever bus voltage is below 94% for sixty (60) seconds with or without a LOCA signal. The LOCA signal contacts in the feeder breaker trip logic circuits were not tested. This deficiency affected all sixteen (16) 4kV bus feeder breakers.

This logic is required to be tested once per twenty-four (24) months per TS SR 4.3.3.2. The existing testing included all of the remaining associated feeder breaker trip logic including a permanent test switch jumper around the LOCA signal contact. When this issue was identified, there was no straight forward and safe method available to test these contacts with the two reactors at power. The TS actions for the inoperable logic circuits under TS Section 3.3.3 were delayed for twenty-four (24) hours under the provision of TS SR 4.0.3. A temporary revision to the trip logic was implemented under 10CFR50.59 to remove the untested LOCA contact from the circuit by closing the test switch jumper. This in effect would provide a trip of a feeder breaker whenever the associated bus voltage is below 94% for nine (9) seconds, with or without a LOCA signal. This change was approved and implemented within the twenty-four (24) hour time period and removed the requirement to test the particular LOCA contact. The affected logic circuits were then declared operable. All sixteen (16) contacts have been tested and operated correctly.

3. 4kV Load Breaker Connected Position Trip Logic

Each 4kV bus load breaker trip logic circuit includes an automatic breaker trip if a LOCA or Loss of Offsite Power (LOOP) signal occurs when the breaker is in the connected position. The contacts in each of the breakers that determine breaker position were not adequately tested due to an improper placement of a voltmeter prescribed by the test. The test intended to verify that the contact was closed by measuring zero voltage across the contact. However, the placement of one of the test leads would provide a zero voltage reading with the contact open or closed. This deficiency affected a total of ten (10) load breakers on the 4kV busses (e.g., breakers for the Drywell Chiller Motor, Control Rod Drive pump motor and Residual Heat Removal Service Water pump motor).

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This logic is required to be tested once per twenty-four (24) months per TS SR 4.8.1.1.2.e.4 and 6. The TS actions for the inoperable logic circuits under TS Section 3.8.1.1 were delayed for twenty-four (24) hours under the provision of TS SR 4.0.3. The breaker position contacts were satisfactorily tested for the ten (10) affected breakers within the twenty-four (24) hour time period thereby removing the requirement to complete the actions of TS Section 3.8.1.1.

In each of the three (3) cases above, the TS SRs had not been satisfactorily met since original start-up of each unit (i.e., October 26, 1984, for Unit 1 and June 22, 1989, for Unit 2). Since station personnel were unaware that the contacts were not tested, the applicable TS actions were not taken within the required times resulting in operation prohibited by TS. These conditions are being reported in accordance with the requirements of 10CFR50.73(a)(2)(i)(B) and 10CFR50.73(a)(2)(vii).

During the logic circuit review, two (2) additional issues were identified involving contacts within a EDG/4kV subsystem logic channel that were not tested. These contacts are not required to be tested by a TS SR but do provide a safety function. These issues are described below.

4. EDG Electrical Start Logic

The start logic for each individual EDG consists of an 'A' electrical start logic and a parallel 'B' electrical start logic. When an EDG start condition is created (e.g., LOOP), both electrical start logic circuits are energized and initiate the two independent EDG air start solenoids to crank the engine. Each air start solenoid receives an initiation signal from both the 'A' and 'B' electrical start logic circuits. The two electrical start logic circuits were not independently tested and therefore a failure of one circuit would not be identified during the testing. This deficiency affected all four (4) EDGs on each unit (i.e., a total of eight (8) EDGs).

The 'A' and 'B' start logic circuits are not required to be tested independently per TS. Provided that both redundant electrical start logic circuits remain functional as tested (e.g., relays and fuses installed) the EDG remains operable. Once this concern was identified, it was verified that the 'A' and 'B' electrical start logic circuits for all eight (8) EDGs were operable and no TS actions were required to be taken.

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5. Load Shedding of 4kV Loads on a LOCA Signal

Each 4kV bus logic circuit includes a load shed feature to trip all loads from the associated 4kV bus immediately following a LOCA signal. This feature ensures the offsite power source connected to the 4kV bus is not overloaded or adversely impacted by non-safety-related equipment during the automatic loading sequence of the emergency loads required to mitigate the accident. For the D21 and D22 4kV buses, the LOCA signal contacts that initiate the load shed were not tested.

This logic is required to support the operability of an offsite source but is not required to be tested per TS. When this issue was identified, there was no straight forward and safe method available to test these contacts with the two reactors at power. An electrical analysis was performed which removed the requirement to load shed the unconfirmed loads by limiting the pre-accident loads on the D21 and D22 4kV buses. Until these contacts were tested, this limitation was used to ensure that the automatic loading of the emergency loads would not overload the offsite power source during the accident mitigation. These contacts have been tested and operated correctly.

Analysis of the Event

The actual consequences for these conditions were minimal since a condition requiring the untested contacts to perform the specific design function did not occur. Additionally, no event occurred where the EDGs were required to perform the design function in response to a LOCA or LOOP condition.

The potential consequences of these conditions were also minimal based on the following discussions.

All but one of the contacts operated correctly when tested. If a LOCA signal had occurred while the D11 EDG was running and connected to the 101 offsite source the D11 EDG output breaker would not have tripped and the D11 EDG would have continued to run connected to the 101 offsite source. The D11 4kV bus emergency loads would have connected to the bus slightly earlier than specified since the D11 EDG output breaker would have been closed (i.e., sensed LOCA/LOOP condition). An EDG electrical overload condition may have occurred resulting in a trip of the EDG or the 4 kV bus, however, the bus would have automatically transferred to the alternate offsite source (i.e., the 201 bus).

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If other untested circuit breaker contacts had malfunctioned coincident with a LOCA condition (with an EDG not in test), additional loads may have remained connected to the emergency buses in excess of the initial conditions assumed in the voltage regulation study. This condition could result in a trip of the associated 4kV bus or offsite source. The electrical protection relays and logic for the 4kV bus breakers (e.g., under voltage, over current, differential phase overcurrent) were operable and would have prevented damage to the EDG or 4kV bus.

If the voltage monitoring LOCA contacts had malfunctioned coincident with a LOCA condition, the isolation of the emergency buses from a degraded offsite source would have been delayed by approximately 51 seconds. The voltage analysis has indicated that a degraded condition would not be expected to occur when the offsite power source grid is operating within its normal range. Historical data has demonstrated that the grid has been at least 4% above the voltage range of concern 100% of the time.

Cause of the Event

In each of the three (3) cases described, the test procedures did not contain the required testing to satisfy the TS SR. These test procedures were developed during original start-up of Unit 1 and became the basis for the original Unit 2 test procedures. The logic circuits are very complex involving a significant number of components to be tested. Inadequate review of the logic circuits and/or misinterpretation of the TS SR scope during the original procedure development and subsequent reviews resulted in the incorrect procedures. Specific reviews of the affected tests were performed during the review of the NRC Information Notices issued prior to NRC GL 96-01. However, these reviews were limited to the specific issue identified in the Information Notice. In each case the original test methodology was concluded to be correct and a broader review was determined to be not warranted.

Corrective Actions

All of the untested contacts have been tested and restored to an operable status.

The review of the safety-related logic channels as stipulated in the response to GL 96-01 has been completed for LGS Unit 1 and Unit 2. No

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additional deficiencies were identified as a result of the review. It is concluded that the safety-related logic channels are adequately tested, and the identified deficiencies do not indicate a deficient methodology.

The appropriate Surveillance Test procedures will be revised prior to the next performance to incorporate the required testing identified during the review.

Previous Similar Occurrences

None