PHILADELPHIA ELECTRIC COMPANY

LIMERICK GENERATING STATION

P. O. BOX A

SANATOGA, PENNSYLVANIA 19464

(215) 327-1200 EXT. 2000

M. J. McCORMICK, Jr., P.E.
PLANT MANAGER
LIMERICK GENERATING STATION

October 17, 1990
Docket No. 50-352
License No. NPF-39

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

SUBJECT: Special Report
Limerick Generating Station - Unit 1

This Special Report concerns an Emergency Diesel Generator surveillance test failure due to a malfunctioning voltage regulator rectifier bank.

Reference:	Docket Nos. 50-352
Report Number:	1-90-019
Revision Number:	00
Event Date:	September 15, 1990
Report Date:	October 17, 1990
Facility:	Limerick Generating Station P.O. Box A, Sanatoga, PA 19464

This Special Report is being submitted pursuant to Technical Specifications (TS) Section 6.9.2, as required by TS Surveillance Requirement 4.8.1.1.3 Reports - All diesel generator failures. This report is being submitted two days late due to the additional time required to provide adequate information on Corrective Actions and to address generic implications. We regret any inconvenience that this delay may have caused.

Very truly yours,

M. J. McCormick, Jr.

JKP:cah

cc: T. T. Martin, Administrator, Region I, USNRC
T. J. Kenny, USNRC Senior Resident Inspector, LGS

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1/1

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)
Limerick Generating Station	0 5 0 0 0 3 5 2	1 OF 0 5

TITLE (4)
Special Report for Diesel Generator Surviellance Test Failure

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 9	1 5	9 0	9 0	—	0 1 9	— 0 0	1 0	1 7	9 0		0 5 0 0 0

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 0 0	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)	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)	Special Report
		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
G. J. Madsen, Regulatory Engineer, Limerick Generating Station	AREA CODE 2 1 5 — 3 2 7 - 1 2 1 0

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
X YES (If yes, complete EXPECTED SUBMISSION DATE)	NO		0 2	0 1	9 1

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On September 15, 1990, with Unit 1 in a refueling outage, plant personnel were performing Surveillance Test (ST) Procedure ST-1-092-113-1, "D13 Diesel Generator 4 KV SFGD Loss of Power LSF/SAA and Outage Testing" on the Unit 1 D13 Emergency Diesel Generator (EDG). A Division 3 Safeguard Bus overvoltage condition occurred during energization of the safeguard bus by the D13 EDG. The EDG output breaker was manually tripped from the Main Control Room and the D13 EDG was declared inoperable. Additionally, various loads on the Division 3 Safeguard Bus incurred blown fuses and minor breaker malfunctions during this event. The equipment powered by the Division 3 Safeguards Bus was declared inoperable. Following immediate corrective actions, the equipment powered by the Division 3 Safeguard Bus was declared operable on September 18, 1990, and the D13 EDG was declared operable on September 30, 1990. The terminated test was classified as a valid test failure in accordance with the guidance in Regulatory Guide 1.108. The cause of the event was a malfunction in the number one EDG rectifier bank contained in the voltage regulation circuit. A failure analysis is being performed to determine the root cause of the rectifier failure. The results of the analysis and any planned corrective actions will be provided in a supplement to this report. An evaluation of the equipment failures that resulted from the overvoltage condition is being performed. A generic concern related to the testing of the redundant rectifier bank was identified and will be addressed in a separate report.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Limerick Generating Station	0 5 0 0 0 3 5 2	9 0	— 0 1 9	— 0 0	0 2 OF 0 5

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

Reporting Requirements:

Technical Specification (TS) Section 3/4.8, Electrical Power Systems Surveillance Requirements

TS Surveillance Requirement 4.8.1.1.3, Reports - All diesel generator failures, valid or non-valid, shall be reported to the commission in a Special Report pursuant to Technical Specification 6.9.2 within 30 days. Reports of diesel generator failures shall include the information recommended in Regulatory Position C.3.b of Regulatory Guide (RG) 1.108, Revision 1, August 1977.

TS Section 6.9.2, Special Reports

TS Section 6.9.2 - Special reports shall be submitted to the Regional Administrator of the Regional Office of the NRC within the time period specified for each report.

Description of the Event:

On September 15, 1990, with Unit 1 in a refueling outage, plant personnel were performing Surveillance Test (ST) Procedure ST-1-092-113-1, "D13 Diesel Generator 4 KV SFGD Loss of Power LSF/SAA and Outage Testing" on the Unit 1 D13 Emergency Diesel Generator (EDG). The frequency of this ST is once per refueling cycle and includes a dead bus start of the EDG simulating a Loss of Offsite Power (LOOP) start of the EDG. While the functional ST procedure was being performed, a Division 3 AC Safeguard Bus overvoltage condition occurred during energization from the D13 EDG on the simulated loss of offsite power. As a result of the overvoltage condition, the D13 EDG output breaker was manually tripped by operations personnel from the Main Control Room (MCR) and the EDG control switch was placed to 'STOP'. Immediately after securing the EDG, the operators closed the 101 Safeguard Bus Breaker to the Division 3 Safeguards Bus to re-energize the bus. The D13 EDG was declared inoperable at of 0355 hours on September 15, 1990 due to the overvoltage condition. Operators performed the appropriate TS ACTIONS for TS Section 3.8.1.2 for Unit 1 with one diesel generator inoperable.

Additionally, due to the overvoltage condition, various loads on the Division 3 Safeguard Bus incurred blown fuses and minor breaker malfunctions. The equipment powered by the Unit 1 Division 3 Safeguards Bus was declared inoperable because of the electrical equipment malfunctions, and the appropriate TS ACTIONS were taken in accordance with TS Section 3.8.3.2 for Unit 1 and 3.8.3.1 for Unit 2. Unit 2 was affected since the Division 3 Safeguard Bus provides power to equipment common to both units.

Following the investigation into the causes and the implementation of immediate corrective actions for this event, the equipment powered by the Division 3 Safeguard Bus was declared operable by 1745 hours on September 18, 1990, and the D13 EDG was declared operable by 2220 hours on September 30, 1990.

The terminated test was classified as a valid test failure using the guidance of RG 1.108, "Periodic Testing of Diesel Generator Units Used As Onsite Electric Power Systems At Nuclear Power Plants." For the D13 EDG, this failure constitutes the first failure in the last 20 valid demands and therefore, the EDG test interval will remain at 31 days in accordance with TS Table 4.8.1.1.2-1.

Analysis of the Event:

The D13 EDG was out of service for 15 days and 17 hours as a result of this event. The D13 EDG would not have been able to provide emergency power to the Division 3 Safeguard Bus during this time period. However, in the event of an actual loss of offsite power condition, the remaining three operable diesel generators could have provided adequate power to maintain the safe shutdown of Unit 1 since the unit was already in a shutdown mode due to a scheduled refueling outage. In addition, since Unit 1 was already in a shutdown mode of operation, only two EDGs are required to be operable in accordance with TS. The systems powered by the Division 3 Safeguards Bus were declared inoperable for three (3) days and 14 hours as a result of this event. Redundant equipment was operable to support the operation of Unit 1 and Unit 2 or mitigation of an accident, if necessary, during this time period.

Cause of the Event:

The cause of this event was initially suspected to be a failure of a switch within the voltage regulator on the D13 EDG. Extensive troubleshooting by plant personnel involved several loaded and unloaded EDG starts using the normal monthly operability ST, which involves slow starts and fast starts of the EDG. Performance of these tests failed to reproduce the overvoltage condition. On September 16, 1990, the rectifier bank selector switch was replaced to correct a previously identified problem. It was thought at the time that the selector switch problem could have caused the overvoltage condition. The EDG ST procedure that simulates a LOOP condition was repeated, but again an overvoltage condition was observed. The EDG was immediately tripped from the MCR. Subsequent troubleshooting on the voltage regulator system did not provide any explanation for the problem, since all equipment appeared to be operating satisfactorily. The manufacturer of the voltage regulator (Basler Electric Co.) was then notified. A field representative from Basler Electric Co. reviewed and assisted in the subsequent troubleshooting on site which also indicated that the EDG systems were operating satisfactorily. The field representative then recommended installing additional instrumentation to monitor specific components of the regulator circuit. Additional testing was then performed with the added monitoring instrumentation. After an evaluation of the test results, the vendor indicated that a problem with the rectifier bank, contained within the voltage regulator, may be a possible cause of the event.

Plant personnel once again decided to reperform the D13 EDG ST procedure that simulates a LOOP condition. This ST was reperformed and once again an overvoltage condition was identified. The EDG was immediately tripped and, based on a preplanned troubleshooting sequence, the number one rectifier bank, was swapped to the redundant number two rectifier bank, contained in the same voltage regulation

circuit. Subsequently, on September 30, 1990, the ST procedure was successfully performed on the D13 EDG with the number two rectifier bank with no overvoltage condition. The number one rectifier bank was removed from service and a failure analysis was initiated to determine the root cause of the rectifier failure. The results of the analysis will be provided in a supplement to this report.

Two test failures of the D13 EDG occurred during troubleshooting of this event. These tests were classified as invalid tests in accordance with Regulatory Position C.2.c(7) of RG 1.108, however since they were performed during troubleshooting these test failures do not impact the test interval specified in TS Table 4.8.1.1.2-1.

Corrective Actions:

The necessary corrective actions to prevent recurrence of the rectifier failure will be determined when the analysis for the failure is completed. The results of the analysis and any planned corrective actions will be provided in a supplement to this report.

On September 22, 1990, a data search on the Nuclear Plant Review Data System (NPRDS) was performed to determine if this particular type of failure had occurred previously at another plant. No other similar failures were identified.

Once the cause of the overvoltage condition was determined on September 30, 1990, we identified a generic concern related to the testing of the redundant rectifier banks. Prior to August 2, 1989, the rectifier banks for the Unit 1 EDGs were switched alternately between the number one rectifier bank and the number two bank at the beginning of the performance of the monthly operability EDG tests. As a result of this practice, one set of rectifier banks had been tested during monthly operability STs and during LOOP testing, while the redundant bank had only been tested in the monthly operability test condition. The newly identified failure mode for the rectifier bank can only be identified during LOOP conditions and therefore LOOP testing must be performed for each rectifier bank that is in service in order to ensure operability of the Diesel Generator System.

On October 1, 1990, based on a review of the limited available station records (i.e., previously performed Monthly STs), plant personnel administratively controlled the rectifier bank switches for the other Unit 1 and Unit 2 EDGs. The switch positions selected were concluded to be the position that had been previously during the performance of the LOOP and monthly operability STs. A full verification of the rectifier bank switch positions was performed by October 17, 1990 based upon review of the permanent records contained offsite (i.e., LOOP STs). On October 15, 1990, it was determined that one of the Unit 1 EDGs, D14, was not aligned to the proper rectifier bank. Since this EDG was inoperable for testing, there were no immediate operability concerns. The D14 EDG will have the proper rectifier bank switch position alignment prior to declaring the EDG operable.

On October 17, 1990, it was determined that the rectifier banks switches for two of the Unit 2 EDGs, D21 and D23, were not properly aligned. The rectifier bank selector switches were properly re-aligned within 1 hour of reaching this conclusion. All of the operable Unit 1 and Unit 2 EDG rectifier bank selector switches are now properly aligned to the rectifier bank which had been in service during the last performance of the LOOP ST.

A Nuclear Network Operating Experience message was issued on October 17, 1990, for the identification of this newly discovered failure mode for the rectifier banks during LOOP tests.

The switching of the rectifier banks resulted in conditions where rectifier banks were in service with the EDGs and their rectifiers were not being properly tested under LOOP conditions. The rectifiers were switched during performance of the monthly EDG operability ST prior to August 1989. On August 2, 1989, the specific steps for switching the rectifier banks were administratively removed from the procedure. This condition has been evaluated for reportability and will be reported in a separate LER.