



PECO ENERGY

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10CFR 50.73
TS 6.9.2

February 14, 1994
Docket No. 50-352
License No. NPF-39

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

SUBJECT: Licensee Event Report
Special Report
Limerick Generating Station-Unit 1

This LER and Special Report concerns the start failure of the Unit 1 D14 Emergency Diesel Generator (EDG) during its monthly operability test run. The cause of the failure is a 1D1 Air Start System distributor mistiming coincident with an inoperable redundant 1D2 Air Start System distributor due to a leaking valve. A condition prohibited by Technical Specifications (TS) existed in that the D14 EDG was not capable of starting between September 28, 1993 and October 27, 1993 and the associated TS ACTIONS were not implemented within the required time period.

Reference:	Docket No. 50-352
Report Number:	1-93-013
Revision Number:	01
Event Date:	October 26, 1993
Report Date:	February 14, 1994
Facility:	Limerick Generating Station P.O. Box 2300, Sanatoga, PA 19464-2300

This revised LER is being submitted to provide the cause and corrective actions of the event. Changes to this LER are indicated by revision bar markers in the right hand margins. This LER is being submitted pursuant to the requirements of 10CFR50.73(a)(2)(i)(B), and the Special Report is being submitted in accordance with TS Section 6.9.2.

Very truly yours,

cc: T. T. Martin, Administrator Region I, USNRC
N. S. Perry, USNRC Senior Resident Inspector, LGS

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LICENSEE EVENT REPORT (LER)

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TITLE (4) LER and Special Report Concerning the Failure of the D14 Emergency Diesel Generator to Start During its Monthly Operability Test Run.

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	0	26	9	3	0	1	0	21			0 5 0 0 0
											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)	50.73(a)(2)(iv)	73.71(b)						
	20.405(a)(1)(i)	50.38(c)(1)	50.73(a)(2)(v)	73.71(c)						
	20.405(a)(1)(ii)	50.38(c)(2)	50.73(a)(2)(vi)	<input checked="" type="checkbox"/> OTHER (Specify in Abstract below and in Text, NRC Form 306A)						
	20.405(a)(1)(iii)	<input checked="" type="checkbox"/> 50.73(a)(2)(iii)	50.73(a)(2)(vii)(A)	Special Report						
	20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(vii)(B)							
20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)								

LICENSEE CONTACT FOR THIS LER (12)

NAME Jim L. Kantner - Manager Experience Assessment, LGS	TELEPHONE NUMBER AREA CODE: 6 1 0 3 2 7 - 1 2 0 0
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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)

<input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)	<input checked="" type="checkbox"/> NO	EXPECTED SUBMISSION DATE (15) MONTH: DAY: YEAR:
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ABSTRACT (Limit to 7400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On 10/26/93, the D14 Emergency Diesel Generator (EDG) failed to start during its monthly operability test. One of the 2 redundant Starting Air Systems (SAS) (1D2) was out of service at the time due to a leaking solenoid valve. The leaking solenoid valve in the 1D2 SAS was replaced and the D14 EDG was successfully retested on 10/27/93. Investigation revealed that the 1D1 SAS distributor cam was mistimed due to inadequate procedural direction and verification during maintenance. The distributor cam was realigned and on 11/15/93, the D14 EDG was successfully tested using only the 1D1 SAS. Between 9/28/93, (the last successful D14 run) and 10/27/93, the D14 EDG would not have started since the 1D2 SAS was out of service while the 1D1 SAS distributor cam was mistimed. Since this condition was not observable until the subsequent start attempt, required TS ACTIONS for an inoperable EDG were not taken. No event requiring the D14 EDG to operate occurred, and the 3 remaining EDGs were operable. Inspections of the SAS for the remaining 7 Unit 1 and 2 EDGs were performed, and no problems were identified. Procedures will be revised to ensure proper cam timing.

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TEXT (If more space is required, use additional NRC Form 365A's) (17)

Unit Conditions Prior to the Event:

Unit 1 was in Operational Condition 1 (Power Operation) at 100% power level at the time of this event.

Description of the Event:

On October 26, 1993, Operations personnel were performing Surveillance Test (ST) Procedure ST-6-092-314-1, "D14 Diesel Generator Slow Start Operability Test Run." One of the two redundant Air Start Systems (1D2) was out of service due to a leaking Air Start Solenoid Valve (092-1307D). Per the ST procedure, the 1D1 Air Start System was being used to start the D14 Emergency Diesel Generator (EDG, EIIS:EK). Either Starting Air System (1D1 or 1D2) is fully capable of starting the EDG.

When Operations personnel placed the D14 EDG control switch to the start position, the prelube pump started and approximately three minutes later an operator observed air venting from the 1D1 Air Start System; however, the D14 EDG did not start. Operations personnel declared the D14 EDG inoperable and notified the System Managers.

Investigation identified that the distributor (EIIS:DTR) for the 1D1 Air Start System was functioning improperly. A work order request was generated to perform a detailed inspection of the distributor. In the interim, the leaking Air Start Solenoid Valve was replaced allowing restoration of the 1D2 Air Start System and the D14 EDG was successfully tested and returned to an operable condition on October 27, 1993.

A detailed inspection of the 1D1 Air Start System distributor was performed starting on November 5, 1993. It was revealed that the air start distributor cam was mistimed. The cam was realigned and its associated pilot valves were removed, inspected, and reinstalled. Each air cylinder on the 1D1 Air Start System was successfully tested by air barring the D14 EDG with each air cylinder aligned to its associated pilot valve/air start check valve combination. Testing of the air cylinders through this method identified that each pilot valve/air start check valve combination functioned properly. On November 15, 1993, the D14 EDG was successfully tested using the 1D1 Air Start System and the D14 EDG was then returned to an operable condition with both the 1D1 and 1D2 Air Start Systems available.

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

It has been determined there was only one time period where the 1D2 Air Start System for the D14 EDG was inoperable coincident with the 1D1 Air Start System distributor mistiming. This period was from September 28, 1993 at 1055 hours, to October 27, 1993 at 0430 hours. In this condition, the D14 EDG would not have started following a valid initiation signal. Therefore, a condition prohibited by Technical Specifications (TS) existed in that the D14 EDG was inoperable and the associated TS ACTIONS of TS Section 3.8.1.1, "A.C. Sources - Operating," were not implemented within the required time period. This report is being submitted in accordance with the requirements of 10CFR50.73(a)(2)(i)(B). Additionally, this report is being submitted as a Special Report pursuant to TS Section 6.9.2 as required by TS Surveillance Requirement 4.8.1.1.3, since this event resulted in a valid EDG test failure.

The D14 EDG failure was classified as a valid failure using the guidance of Regulatory Guide (RG) 1.108, "Periodic Testing of Diesel Generator Units Used As Onsite Electric Power Systems At Nuclear Power Plants," Revision 1, August 1977, Section C.2.e.(5). Since this D14 EDG valid failure is the first failure in the last 20 valid demands, the ST procedure monthly frequency is not required to be changed in accordance with TS Section 4.8.1.1.2.a.

Analysis of the Event:

The actual consequences of this event were minimal in that there was no event requiring the D14 EDG to perform its design function. There was no release of radioactive material to the environment as a result of this event. The D14 EDG was inoperable for approximately 28 days as a result of this event. The three remaining Unit 1 EDGs were each successfully tested and were operable the entire time the D14 EDG was inoperable.

Had an accident occurred coincident with a loss of offsite power in which the onsite Emergency AC Power System was called upon to perform its design function, a sufficient number of EDGs were operable to assure safe shutdown capability. An analysis referenced in the Limerick Generating Station Updated Final Safety Analysis Report states that safe shutdown of Unit 1 can be assured with as few as two EDGs. Accordingly, as stated in the Bases for TS Section 3/4.8.1, only two of the four EDGs are required to mitigate a Design Basis Accident.

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

Cause of the Event:

The cause of the D14 EDG start failure was the coincidence of the following three conditions:

1. The 1D1 air start distributor was mistimed,
2. the engine pistons came to rest in a specific alignment such that the 1D1 air start distributor supplied air to two opposing cylinders resulting in no piston motion or crank shaft rotation, and
3. the redundant 1D2 air start distributor was out of service due to a leaking air solenoid valve.

The air distributor mistiming most likely occurred on May 9, 1986, during D14 EDG engine maintenance. Testing of the D14 EDG immediately after this work and subsequent monthly testing, which often relied on the 1D2 air start system, did not detect this condition and the mistiming went undetected until 1993. The work instructions for the maintenance lacked adequate procedural direction and verification for the alignment and timing of the air start distributor cam. As a result, the air start distributor was replaced approximately 60 degrees out of alignment.

On September 28, 1993, the D14 EDG was successfully started and tested during the normally scheduled monthly operability run using procedure ST-6-092-314-1. At the completion of the test, the engine pistons and the air start distributor apparently came to rest in a position that would not allow the starting air from the mistimed 1D1 air start distributor to be admitted to the cylinders in a sequence to cause crank shaft rotation. In this position only the correctly aligned 1D2 air start distributor was capable of starting the EDG. As part of the Inservice Inspection test program, one of the redundant air start systems is used during the monthly EDG test runs. The air start system used is alternated monthly. The 1D1 air start distributor has consistently started the EDG in previous test runs. Prior to the test failure, the 1D1 air start distributor was successfully used on August 31, 1993.

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On September 28, 1993, at 1055 hours, the 1D2 air start system was removed from service due to an air leak in the air start solenoid valve. The D14 EDG was considered operable because the mistimed distributor and the specific engine piston arrangement were not observable and an existing engineering evaluation provided justification that the air start distributor subsystems were redundant and each was capable of starting the EDG.

The mistiming was not discovered during an engine overhaul that occurred on July 28, 1993. During this inspection, Preventive Maintenance (PM) procedure, PMQ-020-010, "Diesel Engine Examination and General Maintenance," called for verification of the proper alignment of the air start distributor cam. During this overhaul the distributor was not disassembled. The procedure step that provided the direction for cam alignment verification was confusing leading the utility and vendor technicians to not meet the intent of the timing check.

Actions Taken to Prevent Recurrence:

Timing check inspections that verify cam alignment for the upper and lower Air Start System distributors for the remaining seven Unit 1 and 2 EDGs have been performed, and no discrepancies were identified.

Procedure PMQ-020-010 will be revised prior to the next periodic inspection (currently scheduled for May 1994) to provide clarification of the actions necessary to ensure proper timing of the air start distributor.

Several other issues not related to the cause of this event were identified during the course of the investigation. We have decided to take the following actions as a conservative measure to further ensure the highest reliability of the EDGs:

1. A modification will be implemented during the next routine inspection for each EDG to connect the lower air start distributor piping to the aft bearing oil booster. This enhancement was recommended by Coltec in a letter issued on May 23, 1986, however, Limerick Generating Station (LGS) was not included in the distribution for this letter. Until these modifications are completed, the affected EDG will be considered inoperable, but available, if its upper air start distributor system is out of service.

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2. Although it was determined that tang/slot deformation did not contribute to this event an upgrade to the mechanical connection between the air start distributor shaft (tang/slot) and the overspeed governor shaft will be performed. This upgrade will increase the tang/slot engagement surface area and reduce the potential for deformation of the tang/slot. The upgrade is expected to be implemented on each EDG during its next scheduled 5 year overhaul. This upgrade was discussed in correspondence from Coltec on April 25, 1991. This communication was not in accordance with the established notification program for Coltec service information and indicated that a potential safety hazard did not exist.
3. A comprehensive review will be performed by June 1, 1994, in order to determine if any other relevant service information was not received from Coltec.
4. A comprehensive review of the EDG inspection and maintenance procedures will be performed by Engineering, Maintenance, and Coltec prior to the next EDG inspection (currently scheduled for May 1994).

Previous Similar Occurrences

There have been no previous occurrences of an EDG failure on either unit due to a mistimed distributor.

The LGS EDG reliability factor is greater than 98 percent.