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SUBJECT: LER 89-024-00: on 891007, diesel generator C crankcase explosion.

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 TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc. W/8 ltr.

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November 3, 1989

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

SUSQUEHANNA STEAM ELECTRIC STATION
LICENSEE EVENT REPORT 89-024-00
FILE R41-2
PLAS - 389

Docket No. 50-387
License No. NPF-14

Attached is Licensee Event Report 89-024-00. This report is being made pursuant to 10CFR50.73(a)(2)(vii) in that it was judged prudent to notify the NRC on October 8, 1989 (per 10CFR50.72(b)(2)(iii)), when a crankcase explosion occurred on the 'C' Diesel Generator. This was the second Diesel Generator to experience a crankcase explosion in three weeks (Special Report PLAS-386 was issued on October 16, 1989 concerning a crankcase explosion on the 'B' Diesel Generator on September 16, 1989.). Preliminary investigations have shown no common cause of failure between the two events. Investigations into the causes of both occurrences are continuing. This LER also fulfills Technical Specification 4.8.1.1.4, which requires the submittal of a Special Report for all diesel failures, valid or invalid, per Regulatory Guide 1.108, Section C.3.b.


R.G. Byran
Superintendent of Plant - Susquehanna

RRW/mjm

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LICENSEE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) Susquehanna Steam Electric Station - Unit 1	DOCKET NUMBER (2) 0 5 0 0 0 3 8 7	PAGE (3) 1 OF 0 4
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TITLE (4)
Diesel Generator 'C' Crankcase Explosion

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	7	8	9	0	2	4	0	0	1	1	0	3	8	9	SSSES - Unit 2		0 5 0 0 0 3 8 8

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) 0 9 8	<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.406(c)	<input type="checkbox"/> 60.73(a)(2)(iv)	<input type="checkbox"/> 73.71(b)						
	<input type="checkbox"/> 20.406(a)(1)(i)	<input type="checkbox"/> 60.38(c)(1)	<input type="checkbox"/> 60.73(a)(2)(v)	<input type="checkbox"/> 73.71(e)						
	<input type="checkbox"/> 20.406(a)(1)(ii)	<input type="checkbox"/> 60.38(c)(2)	<input checked="" type="checkbox"/> 60.73(a)(2)(vi)	OTHER (Specify in Abstract below and in Text, NRC Form 368A)						
	<input type="checkbox"/> 20.406(a)(1)(iii)	<input type="checkbox"/> 60.73(a)(2)(i)	<input type="checkbox"/> 60.73(a)(2)(viii)(A)							
	<input type="checkbox"/> 20.406(a)(1)(iv)	<input type="checkbox"/> 60.73(a)(2)(ii)	<input type="checkbox"/> 60.73(a)(2)(viii)(B)							
	<input type="checkbox"/> 20.406(a)(1)(v)	<input type="checkbox"/> 60.73(a)(2)(iii)	<input type="checkbox"/> 60.73(a)(2)(ix)							

LICENSEE CONTACT FOR THIS LER (12)	
NAME Richard R. Wehry, Compliance Engineer	TELEPHONE NUMBER AREA CODE: 7 1 7 NUMBER: 5 4 2 - 3 6 6 4

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 checked="" type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE) <input type="checkbox"/> NO	EXPECTED SUBMISSION DATE (15)	MONTH: 0 2 DAY: 2 8 YEAR: 9 0
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ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

At 2303 hours on October 7, 1989, with Unit 1 operating at 98% power and Unit 2 in refueling, a crankcase explosion occurred on the 'C' emergency Diesel Generator (D/G) during its 18-month 24 hour run surveillance test. The D/G was shutdown from the control room, declared inoperable and an LCO was entered in accordance with Technical Specification 3.8.1.1. The 'E' D/G was substituted for the 'C' D/G and the LCO was cleared on 10/8/89. Failure of a single D/G is not reportable per 10CFR50.72. However, because this was the second D/G to experience a crankcase explosion in three weeks (the 'B' D/G experienced a crankcase explosion on 9/16/89), it was judged prudent to notify the NRC per 10CFR50.72(b)(2)(iii) in the event that a common mode of diesel failure could exist. Investigations to date and technical reviews show no common root cause between the two recent failures or with three previous crankcase explosions, nor any reason to believe that the D/G's cannot perform their design safety functions. The 'C' D/G crankcase explosion was attributed to heavy scoring of the no. 5 Right piston and cylinder liner, which generated the heat necessary for the explosion. Repairs were made, post maintenance and surveillance testing was successfully completed and the 'C' D/G was declared operable on 10/23/89. Investigations, including metallurgical analyses, into the actual causes of the 'C' D/G and 'B' D/G crankcase explosions are continuing. The results of the investigations will be reported in a supplement to this report.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) Unit 1 Susquehanna Steam Electric Station	DOCKET NUMBER (2) 0 5 0 0 0 3 8 7	LER NUMBER (6)			PAGE (3)		
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TEXT (If more space is required, use additional NRC Form 366A's) (17)

DESCRIPTION OF EVENT

On October 7, 1989 at 2228 hours the 'C' Diesel Generator (D/G; EIIS Code: EK) was started for the purpose of performing surveillance test SE-024-C05, "18-Month D/G 'C' 24 Hour Run and 4000 KW Load Rejection". Unit 1 was operating at 98% power and Unit 2 was shutdown for refueling. The D/G had been synchronized to the power system grid at 2240 hours and was subsequently loaded to greater than 4700 KW per test requirements. At 2303 hours a crankcase explosion occurred. Due to excessive smoke in the diesel bay, the operator was unable to get to the local control panel to shutdown the diesel with the emergency stop pushbutton. As such, the D/G was unloaded and manually shutdown from the control room, which results in the D/G completing an approximate 5 minute cooldown run and then stopping. Surveillance test SE-024-C05 was terminated. The 'C' D/G was declared inoperable and an ICO was entered in accordance with Technical Specification 3.8.1.1. Based on two D/G's experiencing crankcase explosions in three weeks ('B' D/G crankcase explosion on 9/16/89) it was judged prudent to notify the NRC and a 4 hour ENS phone call was made per 10CFR50.72(b) (2) (iii). Following substitution of the 'E' D/G for the 'C' D/G, ICO 3.8.1.1 was cleared on October 8, 1989.

CAUSE OF EVENT

Upon investigation into the cause of the crankcase explosion, heavy scoring of the no. 5 Right piston and cylinder liner was observed. This heavy scoring apparently generated the heat necessary for the crankcase explosion. Investigation also revealed heavy scuffing and metal discoloration of the no. 6 Left cylinder liner and scratching of its piston pin parallel with the pin.

The root cause of the 'C' D/G crankcase explosion has not been definitively determined. A metallurgical analysis is being performed to determine the root cause of this failure and the cause of the September 16, 1989 'B' D/G crankcase explosion. The results of these analyses will be provided in a supplement to this report.

REPORTABILITY/ANALYSIS

A crankcase explosion occurred on the 'C' D/G at 2303 hours on 10/7/89. Because this was the second D/G crankcase explosion in three weeks, it was judged prudent to notify the NRC. Due to the 4 hour ENS notification requirements, thorough investigation into the cause of the crankcase explosion could not be performed. Thus, as a conservative measure, a 4 hour ENS notification was made pursuant to 10CFR50.72(b) (2) (iii). Notification per 10CFR50.72(b) (2) (iii) requires a written report per 10CFR50.73(a) (2) (vii).

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20535, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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

Preliminary investigations of the 10/7/89 'C' D/G and the 9/16/89 'B' D/G failures show no common cause between these two failures nor with three previous diesel generator crankcase explosions since 1984. Investigations, including metallurgical analyses, into the cause of the 'C' and 'B' crankcase explosions are continuing. The results of the investigations will be provided in a supplement to this report.

As a result of the 'C' crankcase explosion, an operability review of the four remaining diesels ('A', 'B', 'D' and 'E') was conducted. It was concluded that the remaining diesels were operable and capable of performing their design functions. This conclusion was based on review of valid diesel generator testing performed in 1989 and review of the diesel generator surveillance test program.

A total of 59 valid tests were performed on the 'A', 'B', 'D' and 'E' diesel generators during this period. All of the tests were successful except for the 9/16/89 'B' D/G crankcase explosion. This data represents a start and load reliability of greater than 98 percent for 1989.

A review of engineering surveillance testing was also conducted. The Technical Specifications require comprehensive testing of all of the diesel generator emergency design functions. All tests are current.

PP&L believes that the high reliability and the successful surveillance program were justification for considering the 'A', 'B', 'D' and 'E' diesel generators operable following the 10/7/89 'C' D/G crankcase explosion. The 'C' D/G was declared operable on 10/23/89 following post maintenance testing, completion of SE-024-C05, "18-Month D/G 'C' 24 Hour Run and 4000 KW Load Rejection", and completion of SO-024-001, "Monthly Diesel Generator Operability Test".

There were no safety consequences or compromise to public health or safety as a result of this event. Three D/G's remained OPERABLE at all times as required by the SSES Safety analysis to safety shutdown the plant in the event of an accident. The 'E' D/G was substituted for the 'C' D/G within the time limits set forth in the Technical Specification Limiting Condition for Operation 3.8.1.1.

PP&L is vigorously addressing the D/G crankcase explosion events as significant, however, due to the potential for common cause of failure. The areas of D/G design, operation, maintenance and testing are all being examined relative to their effect on D/G operability and reliability.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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TEXT (If more space is required, use additional NRC Form 368A's) (17)

This report also fulfills the requirements of Technical Specification 4.8.1.1.4, which requires the submittal of a Special Report for all diesel generator failures, valid or invalid, as required by Regulatory Guide 1.108, Section C.3.b. The Diesel Generator Start Log indicates that there are two (2) 'C' diesel failures in the last one hundred (100) starts. The diesel test interval is one start in every fourteen (14) days, per Technical Specification Table 4.8.1.1.2-1.

CORRECTIVE ACTIONS

The no. 5 Right piston, piston pin, piston rings, cylinder liner and cylinder expansion seal were replaced. The no. 6 Left piston, piston pin and piston rings were replaced and the cylinder liner was cleaned using Scotch Brite. Following cleaning the cylinder liner was examined and found to be acceptable.

A post maintenance diesel run was conducted for purpose of break-in and sealing of the new components. A 24 hour loaded run was conducted in accordance with SE-024-C05, following which a one hour loaded run was performed in accordance with SO-024-001 (Monthly D/G Operability Test) and the 'C' D/G was declared operable on 10/23/89.

Investigations, including metallurgical analyses, into the causes of the 'C' D/G 10/7/89 and 'B' D/G 9/16/89 crankcase explosions are continuing. The results of the investigations will be provided in a supplement to this report.

A Task Force composed of station and corporate office personnel was formed to address the crankcase explosion events and to examine the areas of D/G design, operation, maintenance and testing relative to their effect on D/G operability and reliability.

ADDITIONAL INFORMATION

Similar incidents previously reported:

- Special Report PLAS-386, 'B' D/G Crankcase Overpressurization, dated 10/16/89
- Special Report PLAS-147, 'B' D/G Crankcase Overpressurization, dated 2/18/86