

# ACCELERATED DISTRIBUTION DEMONSTRATION SYSTEM

## REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 9010030264    DOC. DATE: 90/09/27    NOTARIZED: NO    DOCKET #  
 FACIL: 50-388 Susquehanna Steam Electric Station, Unit 2, Pennsylv    05000388  
 AUTH. NAME    AUTHOR AFFILIATION  
 WEHRY, R.R.    Pennsylvania Power & Light Co.  
 STANLEY, H.G.    Pennsylvania Power & Light Co.  
 RECIP. NAME    RECIPIENT AFFILIATION

SUBJECT: LER 90-018-00: on 900830, sand intrusion resulted in two diesel generators becoming inoperable.

DISTRIBUTION CODE: IE22T    COPIES RECEIVED: LTR 1 ENCL 1 SIZE: 6 W/9 ltr.  
 TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

NOTES: LPDR 1 cy Transcripts.

05000388

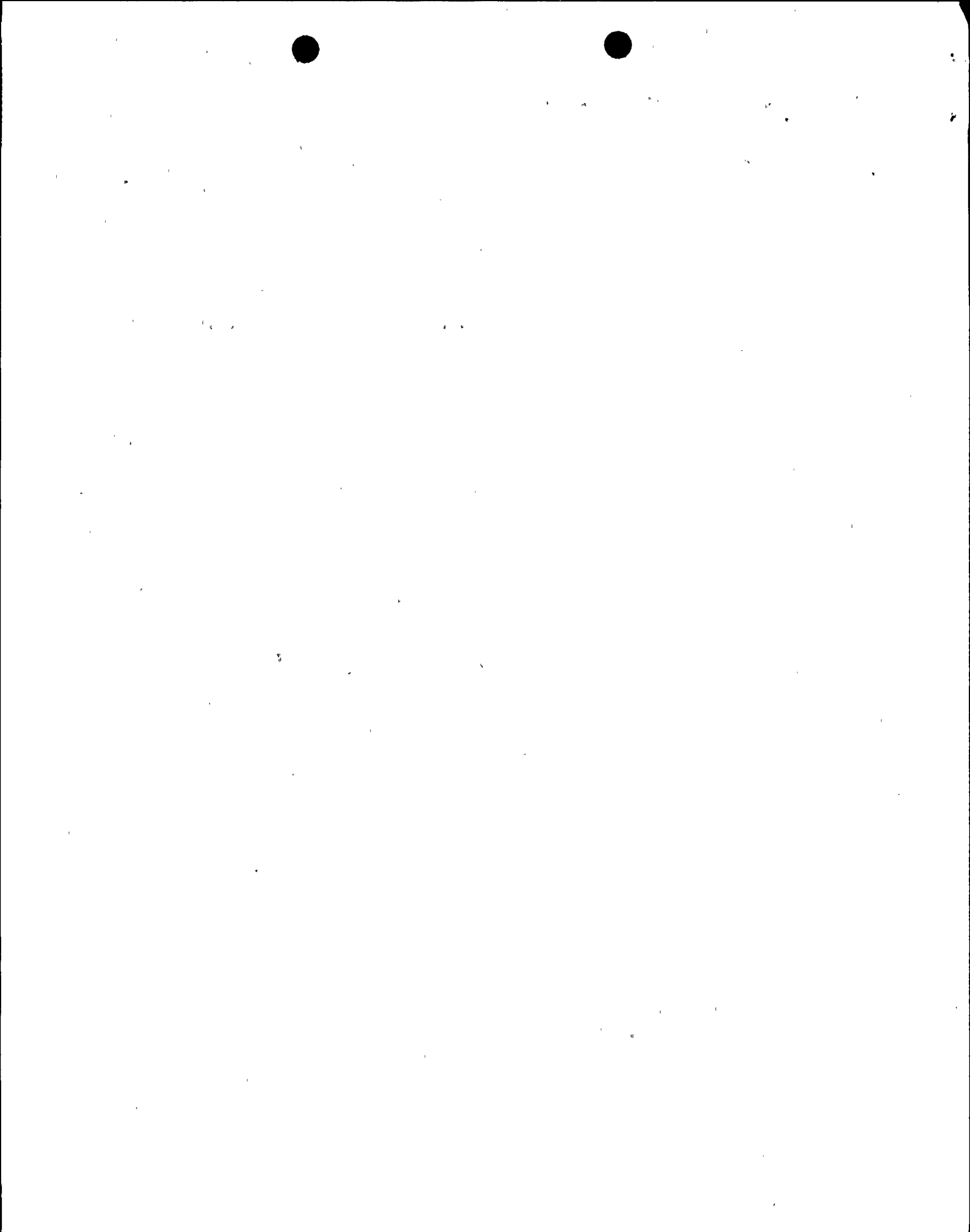
	RECIPIENT		COPIES			RECIPIENT		COPIES	
	ID CODE/NAME		LTR	ENCL		ID CODE/NAME		LTR	ENCL
	PD1-2 LA		1	1		PD1-2 PD		1	1
	THADANI, M		1	1					
INTERNAL:	ACNW		2	2		ACRS		2	2
	AEOD/DOA		1	1		AEOD/DSP/TPAB		1	1
	AEOD/ROAB/DSP		2	2		NRR/DET/ECMB 9H		1	1
	NRR/DET/EMEB 7E		1	1		NRR/DLPQ/LHFB11		1	1
	NRR/DLPQ/LPEB10		1	1		NRR/DOEA/OEAB11		1	1
	NRR/DREP/PRPB11		2	2		NRR/DST/SELB 8D		1	1
	NRR/DST/SICB 7E		1	1		NRR/DST/SPLB8D1		1	1
	NRR/DST/SRXB 8E		1	1		<del>REG-FILE-02</del>		1	1
	RES/DSIR/EIB		1	1		RGNI FILE 01		1	1
EXTERNAL:	EG&G BRYCE, J.H		3	3		L ST LOBBY WARD		1	1
	NRC PDR		1	1		NSIC MAYS, G		1	1
	NSIC MURPHY, G.A		1	1		NUDOCS FULL TXT		1	1
NOTES:			2	2					

NOTE TO ALL "RIDS" RECIPIENTS:

PLEASE HELP US TO REDUCE WASTE! CONTACT THE DOCUMENT CONTROL DESK, ROOM P1-37 (EXT. 20079) TO ELIMINATE YOUR NAME FROM DISTRIBUTION LISTS FOR DOCUMENTS YOU DON'T NEED!

*A10-4*  
*ent*

FULL TEXT CONVERSION REQUIRED  
 TOTAL NUMBER OF COPIES REQUIRED: LTR 35 ENCL 35



Pennsylvania Power & Light Company

Two North Ninth Street • Allentown, PA 18101 • 215 / 770-5151

September 27, 1990

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

SUSQUEHANNA STEAM ELECTRIC STATION  
LICENSEE EVENT REPORT 90-018-00  
FILE R41-2  
PLAS - 443

---

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

Attached is Licensee Event Report 90-018-00. This event was determined reportable per 10CFR50.73(a)(2)(vii) in that a single cause resulted in two independent channels becoming inoperable in a single system.

  
H.G. Stanley  
Superintendent of Plant - Susquehanna

RRW/mjm

cc: Mr. T.T. Martin  
Regional Administrator, Region I  
U.S. Nuclear Regulatory Commission  
475 Allendale Road  
King of Prussia, PA 19406

Mr. G.S. Barber  
Sr. Resident Inspector  
U.S. Nuclear Regulatory Commission  
P.O. Box 35  
Berwick, PA 18603-0035

00101

9010030264 900927  
PDR ADOCK 05000388  
S PNU



LICENSEE EVENT REPORT (LER)

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.

FACILITY NAME (1) <b>Susquehanna Steam Electric Station - Unit 1</b>		DOCKET NUMBER (2) <b>0 5 0 0 0 3 18 17</b>	PAGE (3) <b>1 OF 0 15</b>
---	--	---	------------------------------

TITLE (4)  
**Sand Intrusion Resulted in Two Diesel Generators Becoming Inoperable**

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	8	3	0	9	0	0	1	8	0	0	0	9	2	7	9	0	0	5	0	0	0	3	18	17
										<b>SSSES - Unit 2</b>		<b>0 5 0 0 0 3 18 18</b>												

OPERATING MODE (9) <b>1</b>	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)										
POWER LEVEL (10) <b>1 0 0</b>	<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.405(c)	<input type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 73.71(b)							
	<input type="checkbox"/> 20.405(a)(1)(i)	<input type="checkbox"/> 50.36(c)(1)	<input type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> 73.71(c)							
	<input type="checkbox"/> 20.405(a)(1)(ii)	<input type="checkbox"/> 50.36(c)(2)	<input checked="" type="checkbox"/> 50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 365A)							
	<input type="checkbox"/> 20.405(a)(1)(iii)	<input type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)								
	<input type="checkbox"/> 20.405(a)(1)(iv)	<input type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)								
	<input type="checkbox"/> 20.405(a)(1)(v)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)								

LICENSEE CONTACT FOR THIS LER (12)

NAME <b>Richard R. Wehry - Compliance Engineer</b>	TELEPHONE NUMBER AREA CODE <b>7 1 7 5 4 2 - 13 6 6 14</b>
---	---

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)

YES (If yes, complete EXPECTED SUBMISSION DATE)  NO

EXPECTED SUBMISSION DATE (15)

MONTH	DAY	YEAR

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

On August 30, 1990, with both Unit 1 and Unit 2 operating at 100% power, the 'B' Emergency Diesel Generator (EDG) was declared inoperable due to its lubricating oil having a high chromium concentration. Further investigation revealed significant scoring of numerous cylinder liners and piston rings. Similar scoring of several cylinder liners and piston rings had been found earlier (on 8/28/90) on the 'D' EDG which had been out of service for modifications and inspections. The 'E' EDG was substituting for the 'D' EDG during this evolution. Sand (aluminum oxide) was discovered in the combustion air manifolds of both 'D' & 'B' EDG's. A root cause investigation was commenced. It was determined that sand had apparently been inadvertently introduced to the engines during recent cleaning and coating of the tube side of the engine combustion air intercoolers. A deficient work plan failed to specify adequate sealing requirements to prevent sand intrusion into the intake air side of the intercoolers during sandblast cleaning of the tube side. Further review revealed a near-miss similar incident had occurred in 1987. A satisfactory upgrade of the work plan was not incorporated at that time. Corrective actions include the rework of both EDG's, revising the intercooler cleaning and coating work plan to provide details necessary to assure that intercooler air side cleanliness is maintained, reviewing the event with the work groups involved and revising the station piping and component cleanliness specification to include cleanliness requirements for EDG combustion air, lubricating oil, fuel oil and jacket water subsystems.

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)		
		YEAR 9   0	SEQUENTIAL NUMBER -   0   1   8	REVISION NUMBER -   0   0			

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

DESCRIPTION OF EVENT

On August 30, 1990, with both Unit 1 and Unit 2 operating at 100% power, the 'B' Emergency Diesel Generator (EDG; ELIS Code: EK) was declared inoperable due to its lubricating oil having a high chromium concentration. Further investigation revealed significant scoring of numerous cylinder liners and piston rings. Similar scoring of several cylinder liners and piston rings had been found earlier (on 8/28/90) on the 'D' EDG which had been out of service for modifications and inspections. The 'E' EDG was substituting for the 'D' EDG during this evolution. Sand (aluminum oxide) was discovered in the combustion air manifold areas of the 'D' EDG on 8/29/90 and the 'B' EDG on 8/30/90.

CAUSE OF EVENT

A root cause investigation was commenced to determine how the sand had been introduced into the EDG combustion air manifold areas. The investigation concluded that the sand apparently had been introduced during recent cleaning and coating of the tube side (tube sheet) of the of the engine combustion air intercoolers (heat exchangers) which are located between the turbocharger intake air compressor discharge and the cylinder intake manifolds. A deficient work plan failed to specify adequate sealing requirements to prevent sand intrusion into the intake air side of the intercoolers during sandblast cleaning of the tube side of the intercoolers. Intake air, passing through the intercoolers, picked up the residual sand and introduced it to the engine. Once in the engine, the sand became an abrasive acting between the engine piston rings and cylinder liners, resulting in the heavy scoring. The investigation further revealed that a near-miss precursor to this event had occurred in 1987 during a similar cleaning and coating of the intercooler tube sheets. In 1987, prior to installation of the first two intercoolers which had been cleaned and coated, sandblast debris had been observed on the cooling fins of the combustion air side and required cleaning. The remaining intercoolers, that were cleaned and coated in 1987 utilized additional air side sealing methods which prevented sand intrusion into the intercooler air side during sandblasting. However, the lessons learned in the 1987 near-miss incident were not incorporated into work procedures for intercooler cleaning and coating. This was determined to be the primary root cause of this event.

In addition, different work group personnel, having less EDG work experience, were involved in the work evolution this time. As a result of the deficient work plan and less knowledge of the importance of maintaining cleanliness on the EDG intercooler air side than those personnel involved in 1987, the intercoolers were not adequately protected during sandblasting, which

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-630), 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)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		9   0	-   0   1   8	-   0   0	0   3	OF	0   5

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

apparently allowed some sand intrusion into the air side of the intercoolers and re-installation on the engines without verifying air side cleanliness.

Also contributing to this event was the lack of cleanliness requirements for the EDG combustion air subsystem in the station's piping and component cleanliness specification.

REPORTABILITY/ANALYSIS

This event was determined reportable per 10CFR50.73(a) (2) (vii) in that a single cause (sandblasting sand intrusion) resulted in two independent channels (EDG's 'B' and 'D') becoming inoperable in a single system.

The 'D' EDG had been removed from service on 8/26/90 for modification work and for post engine overhaul inspections, required as a result of engine rebuilding which had been completed earlier in 1990. The 'E' EDG, which is a fifth and spare EDG at Susquehanna, was substituted for the 'D' EDG during this evolution. During the 'D' engine inspection, significant scoring of several cylinder liners and piston rings was found on 8/28/90. On 8/29/90 aluminum oxide (sandblasting sand) was discovered in the 'D' EDG cylinder intake air manifold area. Coincident with the discovery of the cylinder damage, a high chromium concentration was determined to be present in the lubricating oil. The source and significance of chromium had not been immediately recognized, but coupled with the inspection results, the source of chromium was determined to be from the scored cylinder liners.

A review of recent lubricating oil analyses for the remaining EDG's was performed. The review yielded an elevated concentration of chromium present in recent samples from the 'B' EDG. On 8/30/90, the 'B' EDG was declared inoperable at 1200 hours and a 72 hour Limiting Condition for Operation (LCO) was entered per Technical Specification 3.8.1.1. Further investigation revealed significant scoring of numerous cylinder liners and piston rings and the presence of sand in its combustion air intake manifold area.

Lube oil analyses for the remaining EDG's did not show increased levels of chromium. The intercoolers installed on the 'C' EDG had been removed from the warehouse and had not undergone the cleaning and coating evolution in 1990. The intercoolers which had been removed from the 'C' EDG were cleaned and coated and installed on the 'A' EDG during its overhaul in 1990. However, borescopic inspections revealed no cylinder damage on the 'A' EDG. Also, the air intake manifolds, which had been removed from the engine to support installation of an engine modification, were found to contain no evidence of aluminum oxide (sand). The 'E' EDG utilizes a different style of intercooler which has not required sandblasting and coating due to the intercooler tubeside

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   9   0	LER NUMBER (6)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
		9   0	-   0   1   8	-   0   0	0   4	OF 0   5

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

being constructed of a different material (copper-nickel). As such, the 'A', 'C' and 'E' EDG's were unaffected by the conditions found on the 'D' and 'B' EDG's.

On September 1, 1990, a waiver of compliance from the Technical Specification 3.8.1.1 72 hour Action requirement was requested to increase the action time from 72 hours to 15 days, in order to allow for rework of the 'B' EDG and to avert the shutdown of both Susquehanna units. A waiver of compliance for a four day extension was granted by NRC Region I on 9/4/90 in order for PP&L to prepare and submit an emergency Technical Specification Amendment request for the additional extension needed. On 9/6/90 the NRC granted PP&L a one-time extension of 15 days for restoration of the 'B' EDG. The rework and testing of the 'B' EDG was completed and LCO 3.8.1.1 was cleared at 2350 hours on 9/10/90.

There were no safety consequences or compromise to public health or safety as a result of this event. Had the EDG's been called upon during this time frame, three EDG's were available, as required by the Susquehanna safety analysis, to mitigate the consequences of an accident on one unit and safely shut down the other unit. In addition, the EDG's were not called upon to perform their safety function during the time that only three out of four EDG's were operable.

In accordance with the guidance provided in NUREG 1022 Supplement 1, Items 14.1 and 14.10, the required submission date for this report was determined to be October 1, 1990.

CORRECTIVE ACTIONS

The 'B' EDG was reworked, successfully retested and declared operable at 2350 hours on 9/10/90. The rework included the replacement of damaged pistons, liners and associated components, changeout of lubricating oil and extensive cleaning of the engine intercoolers and intake air manifold areas. The 'D' EDG is being similarly reworked.

Actions to prevent recurrence include:

- Revising the EDG intercooler cleaning and coating work plan to provide the necessary details to assure that intercooler air side cleanliness is maintained during future evolutions;
- Reviewing this event with the applicable work groups to re-emphasize the importance of ensuring that work plans/procedures are revised when found to be in error or when clarifications or additional information is warranted to prevent an occurrence, prevent a recurrence or enhance how work is done;

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 (8)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
		9   0	-   0   1   8	-   0   0	0   5	OF 0   5

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

- 0 Revising the station's piping and component cleanliness specification to include proper cleanliness requirements for EDG combustion air, as well as, fuel oil, lubricating oil and jacket water subsystems.

ADDITIONAL INFORMATION

Failed Components Identification: Not applicable.

Previously Reported Similar Events: None.