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)
St. Lucie, Unit 2	0 5 0 0 0 3 8 9	1 OF 0 6

TITLE (4) Both Diesel Generators Simultaneously Out of Service Due to One Personnel Error and One Component 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 7	0 9	8 6	8 6	0 1 1	0 0	0 8	0 8	8 6	N/A	0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
20.405(a)(1)(i)	50.36(c)(1)	X 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
Mark S. Dryden, Shift Technical Advisor	AREA CODE 3 0 5 4 6 5 - 3 5 5 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
A	E K	6 5	W 2 9 0	Y					
B	E K	F A N	X 9 9 9	Y					

SUPPLEMENTAL REPORT EXPECTED (14)

X YES (If yes, complete EXPECTED SUBMISSION DATE) ☐ NO

EXPECTED SUBMISSION DATE (15): MONTH 1 2 | DAY 3 1 | YEAR 8 6

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

On July 9, while Unit 2 was at full power, the 2A Emergency Diesel Generator (D/G) was taken out of service due to failure to meet its required start time. The redundant 2B D/G was started to satisfy the redundant D/G operability. The 2B D/G came up to voltage and frequency within the required start time. Upon completing the surveillance run the 2B D/G was stopped due to observation of one of its cooling fans rubbing its shroud. A determination was made to declare the 2B D/G out of service. Repairs on the 2B D/G were completed and the 2B D/G set was returned to operable status within the Technical Specification time limit. The intermediate cause of the 2B D/G cooling fan event was due to vibration within the cooling unit, thereby, causing the set screws in the fan hub to loosen. The root cause of the vibration within the cooling units is associated with the fan drive belt flapping. A continuing effort is underway to correct the belt flapping. The failure of the 2A D/G was caused by overtightening of a friction clutch locknut. An immediate inspection of torque values of the friction clutch locknuts in the remaining St. Lucie diesel generators was made. D/G maintenance personnel have been instructed to make every attempt to contact the vendor, particularly, in the area where information may not be provided or discussed in the technical manual.

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

EVENT DESCRIPTION:

At 0854 hours on July 9, 1986, St. Lucie Unit 2 was operating at 100%. The Unit remained at 100% throughout the event.

At 0855 hours on July 9, 1986, the 2A Emergency Diesel Generator (D/G) (EIIS:EK) was started for a once per seven (7) days surveillance test (once per 7 days based on three (3) valid failures within the last 100 valid starts). The 2A D/G failed to meet the required generator voltage and frequency of 4160±420 volts and 60±1.2Hz within 10 seconds after the start signal. An alarm was received which indicated that one of the engines in the 2A D/G set had failed to start. The engine fail to start alarm is actuated by high differential temperature between the turbo charger exhausts of the engines in the D/G set. The power unit consists of two(2) EMD diesel engines, a 12 cylinder-645E4 and a 16 cylinder-645E4, driving one (1) Electric Products generator coupled with EMD tandem couplings, forming a diesel-generator assembly. The 2A D/G was manually tripped by the operator at 0856 hours.

At 0915 hours on July 9, 1986, the redundant 2B D/G was started to satisfy Technical Specification ACTION (a) of Limiting Condition of Operation (LCO) 3.8.1.1, i.e. the performance of Surveillance Requirement 4.8.1.1.2a.4(redundant D/G operability check) within one (1) hour and at least once per eight (8) hours thereafter. This surveillance was performed since the 2A D/G had to be removed from service based on the 08:55 failure. The 2B D/G came up to voltage and frequency within ten(10) seconds, therefore, meeting the Surveillance Requirement; 4.8.1.1.2a.4. At 0917 hours the 2B D/G was stopped due to an operator observation of one (1) of the 12-cylinder cooling fan blades rubbing the cooling fan shroud.

A decision was made to take the 2B D/G out of service to evaluate the seriousness of the rub. In accordance with ACTION (e) of LCO 3.8.1.1, operability of offsite power sources was verified and immediate actions were taken to repair both the 2A and 2B Diesel Generators.

The 2B D/G rub was determined to be minor and at 1048 hours repairs were completed on the 12-cylinder engine cooling fan. The 2B D/G was started for an operational check and met the required start time. The 2B D/G was declared back in service at 1059 hours. With the 2B D/G back in service ACTION (a) of LCO 3.8.1.1 was maintained.

Trouble shooting of the 2A D/G revealed a problem in the mechanical portion of the Woodward governor The problem was corrected and the 2A D/G was returned to service at 2010 hours on July 9, 1986.

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

CAUSE OF EVENT:

COLLAR PREVENTS AXIAL →

2B Diesel Generator set

The intermediate cause of the 2B D/G 12-cylinder engine cooling fan event was vibration within the 12-cylinder engine Vertical Cooler Unit (ES-165), thereby, causing the set screws in the fan hub to loosen. With the loosening of the fan hub set screws, the fan shifted and began rubbing the shroud. The root cause of the vibration within the Cooler Unit, is a design problem associated with fan drive belt flapping. A continuing engineering effort is underway to correct the belt flapping and thus reduce the resulting vibration.

2A Diesel Generator Set

The intermediate cause of the 2A2 diesel failing to start was the failure of a roll pin (Ref. No. 82340-44) in the mechanical section of the Woodward EGB-13P engine governor. This governor consists of an electrical section which operates at or near rated engine speed, and a mechanical section which is mainly used during engine startup and shutdown. During startup, a small speed setting motor is used to run up the mechanical governor to allow the engine to reach rated speed where the electrical governor assumes control of engine speed. This speed setting motor operates on the linkage of the mechanical governor by a friction clutch.

Investigations revealed a roll pin which holds the intermediate gear on the pinion shaft of the speed setting controls had broken. This gear arrangement drives the dial stop gear which actuates the upper and lower stops of the speed setting motor. With the failure of the roll pin the speed setting motor runs continuously. Continuous running of the speed setting motor caused excessive wear on the friction clutch which, in turn, allowed excessive slippage of the friction drive shaft and prevented the mechanical governor from demanding sufficient fuel flow to pick up load on the 12-cylinder engine and allowing the electric portion of the governor from taking control at the designated engine speed.

The root cause of the roll pin failure was the result of friction clutch adjustments made on the 2A 12-cylinder D/G mechanical governor as described in LER 389-86-006 (SEE PREVIOUS SIMILAR EVENTS SECTION). The root cause of LER 389-86-006 was determined to be a loose locknut in the friction clutch. This allowed excessive slippage and prevented the mechanical governor from demanding sufficient fuel flow to pick up load on the 2A 12-cylinder engine. The corrective action was to tighten the loose locknut on the clutch. The friction clutches are supplied as assembled units and are not required to be disassembled and inspected as part of the vendor's recommended preventative maintenance program.

Previous to tightening the loose locknut a review of the technical manual was completed to determine the torque valve for the locknut. A torque valve was not supplied in the technical manual. A self-determined adjustment was made and the engine was retested with positive results. Upon later conversations with the vendor it was learned that the locknut and the clutch of the 2A 12-cylinder D/G mechanical governor had been tightened beyond the vendor prescribed torque valve. The overtightened locknut provided the stress necessary for the roll pin in the speed setting control to break. Thus, the root cause of this component failure was a cognitive personnel error by utility maintenance personnel.

EVENT ANALYSIS

The event is reportable under 10 CFR 50.73(a)(2)(v) as neither diesel generator set was operable between the time the 2A D/G failed and the 2B D/G was returned to service. This condition is allowed for a period not to exceed two (2) hours by LCO 3.8.1.1, provided both offsite power sources are available. Both offsite power sources were operable throughout this event and the time both D/G sets were out of service was less than two (2) hours (1 hour 44 minutes). Also, as per Surveillance Requirement 4.8.1.1.3, Reports: All diesel generator failures, valid or non-valid, shall be reported to the Commission pursuant to Specification 6.9.1.

The 2A D/G governor component failure was readily detected during routine surveillance testing. The event was determined to be a valid failure in accordance with regulatory guide 1.108.

The 2B D/G 12-cylinder cooling fan event was observed while satisfying ACTION (a) of LCO 3.8.1.1. The effect of the cooling fan rubbing the shroud did not inhibit the 2B D/G set from coming up to voltage and frequency within ten (10) seconds. During troubleshooting it was determined that had it been necessary for the 2B D/G to perform its safety function the 12-cylinder cooling fan would have worn the point of contact on the shroud to where no further rubbing would have occurred. The 2B D/G was taken out of service strictly as a precautionary measure and based on the above observation it was determined that the event would not be considered a valid failure per reg. guide 1.108.

In the unlikely event of a complete loss of AC power (onsite and offsite) for St. Lucie 2 and, for the benefit of a conservative analysis, the simultaneous loss of offsite power and one diesel generator at St. Lucie 1, the remaining diesel generator in St. Lucie 1 is able to operate the minimum safeguard loads such that both Units are maintained in a safe, hot stand-by condition. The present St. Lucie design does have the capability of electrically connecting the two units (Reference: St. Lucie 2 UFSAR, Updated Final Safety Analysis Report, Section 8.3.1.1.2,Pg.8.3-19d).

This was the fourth valid failure in the last 100 valid tests. Thus, the current surveillance interval is once per (3) days. This surveillance interval is in conformance with the schedule of regulatory position c.2.d of Reg. Guide 1.108.

CORRECTIVE ACTONS

2B D/G SET

The 2B D/G cooling fan shroud was removed and the fan was repositioned in order to provide sufficient clearance between the fan blade tips and the fan shroud. Upon completion of the re-positioning, the fan hub set screws were securely tightened. Corrective actions resulting from this event are:

A. A list of instructions has been developed describing steps to be taken for preventative maintenance inspections of the D/G vertical cooling fan units. The purpose of these instructions is to check for loose bolts and to insure fan drive integrity.

B. In the intermediate to long term, investigation and testing is underway to locate the source of excessive vibration. Evaluation of the testing results will be used to modify the St. Lucie Unit 2 D/G sets and, thereby, reduce and or eliminate the excessive vibration.

2A D/G SET

The 2A2 D/G governor roll pin was replaced by replacing the dial panel assembly in total; this included both the roll pin and the friction clutch. Adjustments to the stop cams had to be made and a test run was performed with satisfactory results. Corrective actions resulting from this event are:

A. An immediate inspection of torque valves of the like component, i.e., friction clutch locknuts, in the remaining St. Lucie Plant D/G's was made.

B. D/G maintenance personnel have been instructed to make every attempt to contact the appropriate vendor should component adjustments be necessary, particularly, in the area where information may not be provided or discussed in the technical manual.

ADDITIONAL INFORMATION

FAILED COMPONENT INFORMATION

The failure of each D/G set was unrelated. The 2A D/G governor is a Woodward Model EGB-13P. The roll pin (broken component in governor) Reference No. is 82340-44. The 2B D/G cooling fan is part of an ES-165 Vertical Cooler Assembly designed by the O&M Manufacturing Company.

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

PREVIOUS SIMILAR EVENTS

LER 389-86-6 reported a previous event where both diesel generators were simultaneously out of service for the following related causes:

On March 10, 1986, the 2B Emergency Diesel Generator (D/G) was taken out of service to repair an idler pulley wheel on the belt-driven engine cooling fan. On March 12, while performing a required operability surveillance on the redundant 2A D/G, one of the two engines in the diesel generator set failed to start. Repairs on the 2B D/G were completed and the unit was returned to operable status within the time limit allowed by the applicable Technical Specification. The damage to the idler pulley is believed to be related to the belt flapping problem which has been observed on the 12 Cylinder engines in the D/G set. The failure of the 2A D/G was caused by a loose locknut in the friction clutch assembly which operates the mechanical governor used for engine startup. Corrective actions were to repair both diesels and inspect the remaining idler pulley wheels on the diesels for similar failures. The friction clutches on the remaining engine governors were inspected during the Unit 2 refueling outage, April 1986.

SUPPLEMENTAL REPORT

Upon completion of the engineering effort to correct the belt flapping in the D/G set cooling units, a supplemental report describing the cause and correction will be submitted.