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 SAGER,D.A. Florida Power & Light Co.
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SUBJECT: Special rept:on 950517,1B EDG engine start failure alarm
 sounded 30 min into surveillance run.Caused by failure of
 one cylinder.1B EDG declared out of svc.Failed governer
 assembly replaced.Failed assembly sent out for insp.

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FPL

Florida Power & Light Company, P.O. Box 128, Fort Pierce, FL 34954-0128

June 17, 1995

L-95-176
10CFR50.36

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

Re: St. Lucie Unit 1
Docket No. 50-335
Special Report
Date of Event: May 17, 1995
Emergency Diesel Generator Failure

The attached Special Report is being transmitted pursuant to the requirements of St. Lucie Unit 1 Technical Specifications 4.8.1.1.3 and 6.9.2. The report provides notification of a 1B Emergency Diesel Generator failure during a scheduled surveillance run.

Should there be any questions on this information, please contact us.

Very truly yours,

D. A. Sager
Vice President
St. Lucie Plant

DAS/EJB

Attachment

cc: Stewart D. Ebnetter, Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, St. Lucie Plant

210000

9506230059 950617
PDR ADCK 05000335
S PDR

SPECIAL REPORT

I. TITLE

1B Emergency Diesel Generator valid failure due to the failure of the 1B2 governor to control the fuel rack.

II. INITIAL CONDITIONS

St. Lucie Unit 1 and Unit 2 were at 100% power.

III. EVENT SEQUENCE

On May 17, 1995 at 0833 the 1B Emergency Diesel Generator (EDG) on St. Lucie Unit 1 was started to perform a surveillance in accordance with Technical Specification 4.8.1.1.2. The 1B EDG was started locally and loaded electrically to 3500 KW. Approximately 30 minutes into the surveillance run, the control room annunciator "Emergency Diesel Generator 1B One Engine Start Failure" alarmed. Upon investigation of the alarm, the control room operators also noticed that the electrical load on the 1B EDG had dropped to 2000 KW. The control room operators correctly determined that one engine (1B2 - 12 cylinder) was no longer carrying its portion of the load. The 1B EDG was unloaded and declared out of service at 0917. In accordance with Technical Specification 3/4.8.1.1 the 1C Auxiliary Feedwater Pump and all "A" train components required by Technical Specifications were verified to be operable.

The failure of the 1B2 engine to carry its load constitutes a valid failure of the 1B EDG. Testing was conducted on the 1B EDG to determine the cause of this failure. The 1B EDG was started and taken to 900 RPM. Investigation revealed the 1B1 engine was driving all of the EDG components and the 1B2 engine's fuel rack was fully closed, indicating the failure of the 1B2 engine's governor. The 1B2 engine's governor assembly was subsequently replaced. Surveillance testing was performed satisfactorily and the 1B EDG was declared back in service at 0800 May 19, 1995. The 1B EDG was out of service for approximately 48 hours.

IV. CAUSE OF THE EVENT

The cause of the 1B2 EDG's governor failure appears to be a failure of the actuator portion of the governor that positions the fuel rack. An inspection of the failed governor will be performed by MKW Power Systems, Inc. at their facilities. A report on the root cause for this failure and for corrective actions to preclude another similar failure will be provided to FPL by MKW Power Systems, Inc. following their inspection.

V. CORRECTIVE ACTIONS

- 1) Electrical Maintenance replaced the failed governor on the 1B2 EDG.
- 2) Operations performed a surveillance on the 1B EDG in accordance with Technical Specification 3/4.8.1.1 and returned the 1B EDG to service.
- 3) Electrical Maintenance has sent the governor assembly to MKW Power Systems, Inc. for inspection and root cause determination. Electrical Maintenance will evaluate the results to determine if additional preventive maintenance measures need to be implemented.

VI. SUPPORTING INFORMATION

- This was the second valid failure of the 1B EDG in the previous 20 valid tests (last failure was 10/28/94).

- This was the seventh valid failure of the 1B EDG in the last 100 valid tests. The sixth valid failure took place on 10/28/94 and an accelerated testing program was begun according to Technical Specifications. An incorrect interpretation of the Technical Specifications caused the accelerated testing, addressing the sixth failure, to be terminated earlier than required (LER 335-95-002-00).

- The 1B EDG was out of service for approximately 48 hours until the governor could be replaced and a successful surveillance test performed.

- The surveillance schedule required because of this failure remains at every 7 days until the number of failures in the last 100 valid tests has been reduced to five (5) or less and the number of failures in the last 20 valid tests has been reduced to one or less. Sixteen additional successful tests will have to be performed to return the surveillance schedule to every 31 days.



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VII. SUPPLEMENTAL INFORMATION

In accordance with Technical Specification 4.8.1.1.3, supplemental information as required by Regulatory Position C.3.b of Regulatory Guide 1.108 is provided.

7TH FAILURE

The failure of the 1B EDG on May 17, 1995 was the 7th failure in the last 100 valid tests.

CORRECTIVE ACTIONS

- 1) Electrical Maintenance replaced the failed governor on the 1B2 EDG.
- 2) Operations performed a surveillance on the 1B EDG in accordance with Technical Specification 3/4.8.1.1 and returned the 1B EDG to service.
- 3) Electrical Maintenance has sent the governor assembly to MKW Power Systems, Inc. for inspection and root cause determination. Electrical Maintenance will evaluate the results to determine if additional preventive maintenance measures need to be implemented.

ENGINEERED-SAFETY-FEATURE EQUIPMENT ELECTRIC POWER RELIABILITY

The St. Lucie Nuclear Plant electrical system provides a diversity of power supplies.

- 1) Three 240 kv transmission lines connect the St. Lucie Nuclear Plant to the Midway substation and the Florida Power and Light Company grid. Normal ac power is supplied by the main generator through the auxiliary transformers. If a failure of the normal ac source occurs a fast-dead bus transfer takes place in approximately 3 cycles and ac power is then supplied through the startup transformers from the grid via offsite power.
- 2) In the event of a complete loss of offsite power, plant ac power will be supplied by the emergency diesel generators.
- 3) In the event of a loss of offsite power and the Unit 1 EDGs, ac power is supplied from the Unit 2 EDGs via the station blackout crosstie.

VII. SUPPLEMENTAL INFORMATION (continued)**ENGINEERED-SAFETY-FEATURE EQUIPMENT ELECTRIC POWER
RELIABILITY (continued)**

Based on plant operation to date, overall reliability of electric power for engineered-safety-feature equipment has proven to be very high when both onsite and offsite sources are considered.

SUMMARY OF VALID FAILURES**October 21, 1991 - Failure one**

During the performance of the load test required by Technical Specification 4.8.1.1.2.e.6 the 1B EDG automatically tripped on high jacket water temperature in the first 5.5 hours of the 24 hour load run. The root cause of the trip was a fatigue failure of the 12 cylinder engine's radiator fan idler pulley shaft at a high stress location. The 1A EDG and 1B EDG 12 cylinder engine fan shafts were replaced with different material and machined to reduce the stress risers at the shaft diameter changes. The 1B EDG 24 hour load run was being performed when the plant was in MODE 5 and the 1B EDG was not required to be inservice.

October 22, 1991 - Failure two

Following the repair of the 10/21/91 failure the 1B EDG was declared back in service following a one hour surveillance run. The load test required by Technical Specification 4.8.1.1.2.e.6 was again started but was halted after 12.5 hours to tighten up the 12 cylinder engine's radiator fan belts. During the belt tightening procedure, cracks were found in the fan/belt bearing support frame. Evaluation of the structure revealed a natural frequency at the third harmonic of the 1B EDG rotational speed. The presence of this harmonic frequency near the natural frequency of the fan structure explained the reduced life of the fan shaft and frame. All welds were inspected and weld repaired if required. Stiffener plates were also installed to increase the service life of the fan components. Vibration dampeners were installed in the power takeoff shafts of the Unit 1 EDGs to reduce the amplitude of the torsional vibrations being transmitted to the fan assembly frame. Following the repairs the 1B EDG 24 hour load run was successfully performed. The 1B EDG 24 hour load run was being performed when the plant was in MODE 5 and the 1B EDG was not required to be inservice.

VII. SUPPLEMENTAL INFORMATION (continued)**SUMMARY OF VALID FAILURES (continued)****November 29, 1991 - Failure three**

Following the start of the 1B EDG, operations personnel noted that upon generator excitation output voltage continued to climb above nominal voltage. The problem was traced to the voltage regulator circuit and a failed automatic voltage regulator card. The component was replaced and the 1B EDG was returned to service following the successful surveillance test. The 1B EDG run was being performed when the plant was in MODE 5 and the 1B EDG was not required to be inservice.

April 3, 1992 - Failure four

The 1B EDG was being started to perform a required weekly surveillance run but the generator output breaker would not close when called on. The problem was traced to the under frequency permissive relay. The faulty relay was replaced and the surveillance run was performed without further incident. The 1B EDG run was being performed when the plant was in MODE 1 and the EDG was in an accelerated surveillance frequency.

April 24, 1992 - Failure five

The 1B EDG was being started to perform a required weekly surveillance run. The 1B EDG automatically tripped 40 minutes into the surveillance run due to high jacket water temperature. The root cause of the trip was a fatigue failure of the 16 cylinder engine's radiator fan idler pulley shaft at a high stress location. This failure was the same as the failure on October 21, 1991 but took place on the 16 cylinder engine. Plans had been previously made to replace these shafts during the next refueling outage. The 1A EDG and 1B EDG 16 cylinder engine's fan shaft were replaced with different material and machined to reduce the stress risers at the shaft diameter changes. The fan bearing support frame was also modified to improve fan vibration. The 1B EDG run was being performed when the plant was in MODE 1 and the EDG was in an accelerated surveillance frequency.



VII. SUPPLEMENTAL INFORMATION (continued)**SUMMARY OF VALID FAILURES (continued)****October 28, 1994 - Failure six**

The 1B EDG was being automatically started as part of the loss of offsite power testing. The 1B EDG had been started and stopped repeatedly during the conduct of these tests and was once again being run when megavars failed low and generator load began to increase. Local operators smelled smoke and tripped the EDG. Investigation revealed a burned wire at the magnetic amplifier terminal block. The burned wire caused the generator to lose its self excitation voltage and regulator control. The cause of the burned wire was a loose connection between the wire and the terminal block which caused an increase in resistance leading to overheating of the wire. The affected wire was repaired. The field current circuit, mag-amp coils, and the 1B EDG generator windings were meggered with satisfactory results. The terminal blocks of the 1A and 1B EDGs were inspected for loose wires. The 1B EDG was returned to service and the testing completed satisfactorily. The 1B EDG run was being performed when the plant was in MODE 5 and the 1B EDG was not required to be inservice.

May 17, 1995 - Failure seven

The 1B EDG was started to perform a required surveillance run. Approximately 30 minutes into the surveillance the 12 cylinder engine failed to carry its load and the 1B EDG was secured. Further testing revealed the 1B1 engine was driving all of the EDG components and the 1B2 engine's fuel rack was fully closed, indicating the failure of the 1B2 engine's governor. The governor assembly was subsequently replaced and the surveillance testing was satisfactorily completed. The 1B EDG run was being performed when the plant was in MODE 1.

VII. SUPPLEMENTAL INFORMATION (continued)

CONTINUED OPERATION BASIS

The three failures involving the radiator fan and support frame were adequately resolved with the implementation of a plant modification. The modification replaced the fan shafts using higher strength material and installed torsional vibration dampeners in the power takeoff shafts to the fan assemblies. The failure of the output breaker relay, the voltage regulator, and the overheated wire have all been adequately resolved with the performance of preventive maintenance procedures that require periodic inspection of the EDG relays, voltage regulator, and wire connections. The corrective actions to be implemented for the failure of the governor will be determined following the inspection and root cause evaluation by MKW Power Systems Inc.

The reliability of the 1B EDG has been increased with the implementation of the above corrective actions. The first five failures took place in the first 30 valid tests. The sixth failure happened after another 46 successful valid tests had been performed. With the exception of the failures of the radiator fan shafts and support frame, the other failures have not been repeat failures which points to an effective preventive maintenance program.

Based upon the high reliability of the offsite power system for the St. Lucie Nuclear Plant, the redundancy built into the St. Lucie design to accommodate a single-failure, the reliability of the 1A EDG, and in light of the corrective actions taken for the recent 1B EDG failures, continued plant operation is justified.