



Entergy Operations, Inc.  
River Bend Station  
PO. Box 220  
St. Francisville, LA 70775

June 7, 1994

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

Subject: Special Report - Valid Failure of Division II  
Diesel Generator

File No.: G9.5, G9.25.1.3

RBG-40632

Gentlemen:

Enclosed is Entergy Operations, Inc. Special Report concerning a valid failure of the Division II diesel generator at River Bend Station. Attachments 1 and 2 are being submitted pursuant to River Bend Station Technical Specification 4.8.1.1.3 and 6.9.2.

Sincerely,

James J. Fiscaro  
Director - Nuclear Licensing

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attachments

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cc: U.S. Nuclear Regulatory Commission  
Region IV  
611 Ryan Plaza Drive, Suite 400  
Arlington, TX 76011

NRC Resident Inspector  
P.O. Box 1051  
St. Francisville, LA 70775

Mr. Edward T. Baker  
M/S OWFN 13-H-15  
U.S. Nuclear Regulatory Commission  
11555 Rockville Pike  
Rockville, MD 20852

## ATTACHMENT 1

### REPORTED CONDITION

At 2330 on 05/08/94, a valid start failure occurred on the Division II standby diesel generator (DG), 1EGS\*EG1B. The valid failure occurred when the DG failed to excite and generate any output voltage following a start during the performance of STP-309-0612, "Diesel Generator Division II 24-Hour Run." In accordance with Regulatory Position C.2.e.(1) of Regulatory Guide 1.108, this is considered a valid start failure. This Special Report is provided in accordance with the requirements of River Bend Station Technical Specifications 4.8.1.1.3 and 6.9.2.

### INVESTIGATION

At 2330 on 05/08/94, the Division II DG was "cold" started in accordance with surveillance test procedure STP-309-0612, "Diesel Generator Division II 24-Hour Run." This surveillance test is performed on a frequency of once every 18-months and demonstrates the DG 24-hour performance run in accordance with Technical Specification 4.8.1.1.2.f.8. During the performance of this surveillance the engine started satisfactorily but the generator failed to reach rated voltage and frequency. Upon discovery, the DG was immediately secured and placed in the Maintenance Mode to investigate the problem. Suspecting a failure in the excitation circuitry, the Excitation Cabinet that houses the exciter shutdown relay and the reset logic was inspected. No evidence of relay overheating was found and no odor was present which might indicate a burnt relay coil.

The excitation circuitry is composed of a field flash relay, exciter shutdown relay, and exciter shutdown logic. When the DG is returned to the Operate Mode after engine shutdown, the exciter shutdown relay resets to the "unlatched" position. In the unlatched position, the circuitry is set up to automatically flash the generator field during the next DG start. After engine start, the relay remains in the unlatched position until engine shutdown when it resets to the latched position and forces generator voltage to zero volts. In most instances the generator will build-up voltage without flashing if there is any residual voltage in the generator rotor. The field flashing simply accelerates the voltage build-up process.

Prior to this failure, on May 5, 1994, the DG was "soft" started with the field flash circuit de-energized and tagged out. The DG achieved the required rated voltage and frequency in approximately 10 to 20 seconds. On May 7, 1994, the Exciter Shutdown Relay (1EGE\*K1) was replaced to correct a faulty latch mechanism that was detected when the relay was manually latched during a previous maintenance run. After the relay was replaced, the DG was started successfully four (4) times. The most recent start had been just twelve (12) hours prior to the valid start failure.

On May 9, 1994, after the valid start failure, the following checks were performed with the DG Mode Switch in the Maintenance Mode:

- \* The relay contact positions associated with the exciter shutdown logic were verified (the exciter shutdown relay was in the latched position). All components which were checked functioned properly.
- \* The exciter shutdown relay was manually reset (unlatched) and observed to change state to the reset (latched) position. The relay automatically re-latched, as designed, since the unit shutdown signal was still present. The interaction was repeated approximately five (5) times.
- \* The exciter shutdown relay was electrically reset (unlatched) by depressing the Exciter Shutdown Reset push-button and observed to change state to the reset (latched) position. The relay automatically re-latched, as designed, since the unit shutdown signal was still present. The interaction was repeated approximately ten (10) times.

With the DG Mode Switch in the Operate Mode, the following checks were performed:

- \* The exciter shutdown relay position was inspected. The relay dropped out as expected. The DG Mode Switch was cycled approximately five (5) times. Each time the exciter shutdown relay operated as expected.
- \* The field flash components were tested during a diesel start. All components which were checked functioned properly upon the diesel start. No abnormalities were identified, and the DG achieved the required rated voltage and frequency.
- \* The DG was started three (3) additional times. The failure, however, could not be duplicated.

### ROOT CAUSE

Analysis of the excitation circuitry and troubleshooting results indicate that the exciter shutdown relay did not reset (unlatch) when the DG Mode Switch was taken to the Operate Mode following the last shutdown. When this occurs the relay remains in the latched (shutdown) position. In the latched position the relay main contacts are closed and the potential transformers that supply the voltage regulator are shorted. With this shorted condition on the voltage regulator input, the phase to phase voltage collapses and the generator output is forced to zero volts. The River Bend Station Emergency Response Information System (ERIS) data was consistent with this analysis and documented condition.

The most likely cause of the exciter shutdown relay remaining latched when the reset voltage was applied is that the force generated by the reset coil was not sufficient to overcome the latch friction. A visual inspection of the latch mechanism showed a shiny rubbed area on the latch where the trigger lever engages the latch. The latch, having just been replaced, could have had a burr or other roughness that increased the friction at the trigger lever and prevented operation.

A current test of the relay does not provide indication that it is a high resistance contact. The mechanical operation of this contact could have caused the high resistance connection to clear; thus, self correcting the problem. Attempts to determine the cause of failure or to duplicate the abnormality were not successful. The exciter shutdown relay has operated approximately twenty-five (25) times and the DG has been successfully started three (3) times since the valid start failure with no indications of malfunction or problems observed.

#### CORRECTIVE ACTION

All credible failure modes relate to the exciter shutdown relay being improperly set in the latched position during the DG start. However, the actual cause of the failure to field flash is indeterminate. In order to ensure operability of the Division II DG, it will be necessary to verify that the exciter shutdown relay logic has been properly reset after each DG shutdown or cycling of the DG Mode Switch. Operations Standing Order 109 has been issued to require the performance of a verification check on both the Division I and II DGs. The standing order also provides direction for the immediate troubleshooting of the DG should the operator encounter a similar voltage/frequency failure.

This standing order will remain in-place until either:

- (1) A conclusive cause is determined and appropriate corrective actions taken, or
- (2) A modification is implemented that provides indicating lights on the panel allowing the DG operator to monitor the status of the exciter shutdown relay and the operating procedure is revised to require the operator to check the light.

These checks ensure that the DG will produce rated voltage when required to operate.

## ATTACHMENT 2

### DIESEL GENERATOR UNIT DESIGNATION AND NUMBER

Division II, 1EGS\*EG1B

### LENGTH OF TIME UNAVAILABLE

N/A - Diesel Generator was out-of-service for RF-5 and remained in LCO #94-xx before and after this failure. Maintenance and testing activities are prior to restoring DG to OPERABLE status.

### CURRENT SURVEILLANCE TEST INTERVAL

STP-309-0612	"Refueling Outage"
STP-309-0202	"31 days"

### TEST INTERVAL CONFORMS TO TECHNICAL SPECIFICATION

Yes

### FAILURES FOR DIVISION II EDG

1 valid failure in last 20 valid tests  
1 valid failure in last 100 valid tests

### NUMBER OF VALID FAILURES IN PREVIOUS 100 VALID TESTS OF ALL DGS AT RBS

0