



South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

November 15, 1999  
NOC-AE-000706  
File No.: G02  
10CFR50  
STI: 30985407

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555-0001

South Texas Project  
Units 2  
Docket Nos. STN 50-499  
Special Report Regarding a Valid Failure of  
Standby Diesel Generator 22 on October 18, 1999

Pursuant to South Texas Project Technical Specifications 4.8.1.1.3 and 6.9.2, the South Texas Project submits the attached Special Report regarding a valid failure of Standby Diesel Generator 22 on October 18, 1999.

Licensee commitments are found in the corrective action section of the attachment. If you should have any questions on this matter, please contact either Mr. S. M. Head at (361) 972-7136 or me at (361) 972-7800.

G. L. Parkey  
Plant General Manager

kaw/

Attachment: Special Report Regarding a Valid Failure of Standby Diesel Generator 22 on  
October 18, 1999

IE22

PDR ADOCK 0500499 S

cc:

Ellis W. Merschhoff  
Regional Administrator, Region IV  
U.S. Nuclear Regulatory Commission  
611 Ryan Plaza Drive, Suite 400  
Arlington, Texas 76011-8064

Thomas W. Alexion  
Project Manager, Mail Code 0-4D3  
U. S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

Cornelius F. O'Keefe  
c/o U. S. Nuclear Regulatory Commission  
P. O. Box 910  
Bay City, TX 77404-0910

J. R. Newman, Esquire  
Morgan, Lewis & Bockius  
1800 M. Street, N.W.  
Washington, DC 20036-5869

M. T. Hardt/W. C. Gunst  
City Public Service  
P. O. Box 1771  
San Antonio, TX 78296

A. Ramirez/C. M. Canady  
City of Austin  
Electric Utility Department  
721 Barton Springs Road  
Austin, TX 78704

Jon C. Wood  
Matthews & Branscomb  
One Alamo Center  
106 S. St. Mary's Street, Suite 700  
San Antonio, TX 78205-3692

Institute of Nuclear Power  
Operations - Records Center  
700 Galleria Parkway  
Atlanta, GA 30339-5957

Richard A. Ratliff  
Bureau of Radiation Control  
Texas Department of Health  
1100 West 49th Street  
Austin, TX 78756-3189

D. G. Tees/R. L. Balcom  
Houston Lighting & Power Co.  
P. O. Box 1700  
Houston, TX 77251

Central Power and Light Company  
ATTN: G. E. Vaughn/C. A. Johnson  
P. O. Box 289, Mail Code: N5012  
Wadsworth, TX 77483

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D.C. 20555-0001

# **ATTACHMENT**

## **Special Report Regarding a Valid Failure of Standby Diesel Generator 22 on October 18, 1999**

**Description of Event:**

On October 18, 1999, Standby Diesel Generator 22 was started for the purpose of performing a monthly operability run and a 5500 kW load test. At 1246 hours on October 18, 1999, after Standby Diesel Generator 22 had been operating at 100% of rated load for six minutes, the output breaker on Standby Diesel Generator 22 tripped. Coincident with the output breaker trip, the generator undervoltage annunciator and the directional over-current relay (device 67/50D) at the B train 4.16 kV Engineered Safety Features (ESF) switchgear were actuated. The actuation of the directional over-current relay (67/50D) resulted in the Standby Diesel Generator 22 output breaker trip. As expected, the diesel engine continued to run after the output breaker tripped. Following the output breaker trip, the generator output was not at the expected rated voltage and frequency; therefore, the diesel generator was secured. This event occurred while Unit 2 was in a refueling outage (2RE07) and operating in Mode 6.

Troubleshooting was performed and identified a failed power diode in the generator excitation circuit. When this component was tested, it was observed that instead of blocking current flow when reverse biased, the failed power diode allowed current flow in the reverse bias and forward bias modes. In effect, the failed power diode was short-circuited. The failed power diode is designated as CR4 in the excitation circuit. CR4 is one of six power diodes in the rectifier bridge that produces the required field current (i.e. excitation) to supply the loads connected to the generator. The failed power diode was replaced.

A successful post-maintenance test run was completed on October 19, 1999. The monthly operability run and 5500 kW load reject test were successfully completed on October 19, 1999. At 1848 on October 19, 1999, Standby Diesel Generator 22 was declared operable.

**Cause of the Event:**

The cause of the Standby Diesel Generator 22 output breaker trip was the failed power diode CR4. The failed power diode resulted in a short circuit across one branch of the rectifier bridge. When the generator is operating isolated from the grid, this short circuit in the rectifier bridge would prevent Standby Diesel Generator 22 from maintaining a rated voltage of 4.16 kV. When the generator is operating in the parallel mode (i.e. connected in parallel with the grid), the short circuit in the rectifier bridge would prevent Standby Diesel Generator 22 from supplying the reactive power (VARs) required by connected loads. The failure of the power diode caused the Standby Diesel Generator 22 excitation system to malfunction. The malfunction of the excitation system resulted in a transient that caused the directional over-current relay (67/50D) to actuate and initiate a Standby Diesel Generator output breaker trip.

**Event Analysis:**

The failed power diode CR4 is one of six power diodes in the rectifier bridge that produces the required field current to supply the voltage and reactive power demands of the loads connected to the generator. The short circuited power diode would have prevented the generator from maintaining rated voltage when the machine was operated isolated from the grid or meeting reactive power demands when the machine was operated in parallel with the grid. This condition would therefore, render Standby Diesel Generator 22 inoperable. Since the generator's function

to maintain rated voltage or supply reactive power demands had failed, the power diode failure has been classified as a valid failure.

As a result of the power diode failure, Standby Diesel Generator 22 was unavailable for 26 hours and 21 minutes. The inoperability of Standby Diesel Generator 22 did not require entry into any limiting conditions of operation, because the failure occurred while Unit 2 was in Mode 6 (2RE07 refueling outage) and the A train and C train Standby Diesel Generators were operable. In Mode 6, with water level in the refueling cavity less than 23 feet above the reactor pressure vessel flange, the South Texas Project Technical Specification 3.8.1.2 requires at least two of the Standby Diesel Generators to be operable.

Including this valid failure, there has been one valid failure in the last 20 valid tests, one valid failure in the last 50 valid tests, and one valid failure in the last 100 valid tests. Per the requirements of Technical Specification Table 4.8-1 (Diesel Generator Test Schedule), the test frequency for the surveillance requirements of 4.8.1.1.2.a will remain at once per 31 days.

**Corrective Actions:**

1. The failed power diode CR4 was replaced.
2. Standby Diesel Generator 22 passed the appropriate post maintenance testing.
3. Standby Diesel Generator 22 successfully completed a monthly operability run and a 5500 kW load reject test.
4. Actions to prevent problem recurrence are being developed and are being tracked in the corrective action program.

**Additional Information:**

This is the first occurrence of this rectifier diode failing in the South Texas Project's Standby Diesel Generators' excitation circuits. A review of an "issues/returns" report for the diode's class-bin (592-383) indicates that this is the first occurrence of a failed diode.

To date, a review of industry databases (EPIX and NPRDS) and INPO operating experience reports identified three similar failures. Connecticut Yankee 1, Susquehanna 1, and Grand Gulf 1 have experienced a malfunction of their diesel generator excitation system due to a failed rectifier diode. These events occurred in May 1993, March 1992, and December 1988 respectively.

The Standby Diesel Generator is a Cooper-Bessemer model KSV-20 engine rated at 5500 kW. The generator is a Portec, Inc., A.C. synchronous generator type L-11102, frame size 160 and rated at 6875 KVA. The static exciter voltage regulator is a NEI Parsons Peebles, model 72 12400 100. The power diode is a model 1N4056R.