NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
South Texas, Unit 2	05000 499	1 OF 4

TITLE (4)
Failure to meet Technical Specification requirements for inoperable Standby Diesel Generator 21

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 NAME	DOCKET NUMBER
01	15	98	98	-- 001 --	00	02	16	98		05000
									FACILITY NAME	DOCKET NUMBER
										05000

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)					
POWER LEVEL (10)	100	20.2201(b)	20.2203(a)(2)(v)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)
		20.2203(a)(1)	20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)
		20.2203(a)(2)(i)	20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
		20.2203(a)(2)(ii)	20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
		20.2203(a)(2)(iii)	50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A
		20.2203(a)(2)(iv)	50.36(c)(2)		50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Scott M. Head - Licensing Supervisor	(512) 972-7136

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
X	EK	AMP	P076	N						

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On January 15, 1998, Unit 2 was in Mode 1 at 100% power. On January 15, 1998, the results of a failure analysis were received regarding abnormal voltage regulation indications noted for Standby Diesel Generator 21 during previous testing. Per Nuclear Regulatory Commission Regulatory Guide 1.9, it was determined that a condition had existed that could have resulted in a start failure if a diesel start demand had occurred. A conservative decision was made to consider Standby Diesel Generator 21 inoperable during the time that this condition existed. During part of the time that the diesel was conservatively considered to be inoperable, the required actions of Technical Specification 3.8.1.1 had not been performed. The period of inoperability when Technical Specification actions were not taken started at 0106 hours on December 28, 1997 and ended at 1947 hours on December 30, 1997 when the diesel was removed from service for troubleshooting. Standby Diesel Generator 21 was returned to operable status on January 1, 1998, at 2320 hours. The cause of this occurrence was the failure of the U3 operational amplifier in the diesel generator voltage regulator circuit. Corrective actions included replacing the voltage regulator board for Standby Diesel Generator 21 and completion of a satisfactory post maintenance test and surveillance test.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

DESCRIPTION OF EVENT:

On January 15, 1998, Unit 2 was in Mode 1 at 100% power. On January 15, 1998, the results of a failure analysis were received regarding abnormal voltage regulation indications noted for Standby Diesel Generator 21 during previous testing. Per Nuclear Regulatory Commission Regulatory Guide 1.9, it was determined that a condition had existed that could have resulted in a start failure if a diesel start demand had occurred. A conservative decision was made to consider Standby Diesel Generator 21 inoperable during the time that this condition existed. During part of the time that the diesel was conservatively considered to be inoperable, the required actions of Technical Specification 3.8.1.1 had not been performed.

During surveillance testing performed on December 27, 1997, abnormal voltage regulation symptoms were observed and diagnosed as an indication problem. Other conditions regarding performance of Standby Diesel Generator 21 were normal and surveillance testing acceptance criteria were met. On December 30, 1997, Standby Diesel Generator 21 was removed from service to troubleshoot the cause of the observed indication abnormalities. Static checks revealed some loose fuse to fuse clip connections serving the metering circuits with higher than expected resistance readings. This condition was corrected and the diesel was started for a post maintenance test on December 31, 1997. During the post maintenance test, abnormal indication symptoms were again observed but were much more pronounced than those observed on December 27, 1997. Analysis determined that the observed conditions were likely due to voltage regulator control problems. The voltage regulator and instantaneous preposition board were considered the likely suspect components and were replaced.

Following replacement of the suspect components, Standby Diesel Generator 21 performed satisfactorily during subsequent board alignments and during post maintenance testing. Surveillance testing was completed satisfactorily and Standby Diesel Generator 21 was declared operable at 2320 hours on January 1, 1998. The operability of Standby Diesel Generators 22 and 23 was verified to demonstrate that a common mode failure did not exist.

A failure analysis was performed on the Standby Diesel Generator 21 voltage regulator and instantaneous preposition board. The results determined that operational amplifier U3 on the voltage regulator board had failed with all pins open circuited. The operational amplifier U3 provides the firing signal that turns on one phase of the three-phase rectifier that provides excitation current to the rotor field of the generator. Since the diesel generator is self-excited, the failure of this phase of the regulator would cause a drop in one phase of the generator output voltage. This drop in one phase of the output voltage was one of the symptoms observed. The failed operational amplifier U3 degraded Standby Diesel Generator 21's voltage regulation capability in the emergency mode. This condition prevented Standby Diesel Generator 21 from fulfilling its design safety function. A conservative decision was made that the voltage regulator control malfunction could have resulted in the failure of the Standby Diesel Generator to start in response to an Emergency Mode start signal anytime after the last successful surveillance test conducted on December 27, 1997. Therefore, the period of inoperability was determined to start at 0106 hours on December 28, 1997, which was the conclusion of the last satisfactory surveillance test. Standby Diesel Generator 21 was inoperable for approximately 118 hours. From 0106 hours on December 28, 1997 until the

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DESCRIPTION OF EVENT (CONTINUED):

diesel was taken out of service at 1947 hours on December 30, 1997 for troubleshooting, the required actions of Technical Specification 3.8.1.1 had not been performed.

This occurrence is classified as a Valid Failure of Standby Diesel Generator 21. Including this Valid Failure, there have been 3 Valid Failures of Standby Diesel Generator 21 in the last 20 Valid Tests, 3 Valid Failures in the last 50 Valid Tests, and 3 Valid Failures in the last 100 Valid Tests. During this period, Standby Diesel Generator 21 surveillance testing was already at increased frequency since a Valid Failure that occurred on November 11, 1997, and remained on an increased frequency of at least weekly in accordance with the South Texas Project Technical Specifications. The 3 Valid Failures of Standby Diesel Generator 21 have been determined to be unrelated. Currently, Standby Diesel Generator 21 has returned to a normal surveillance test frequency of at least once every 31 days.

A review of equipment history did not indicate any other occurrences regarding Standby Diesel Generator failures at the South Texas Project attributed to malfunctioning voltage regulator operational amplifiers. A review of the Equipment Performance and Information Exchange System did not reveal any problems experienced at other plants attributed to the type of failure reported in this occurrence.

CAUSE OF EVENT:

The cause of this occurrence was the failure of the U3 operational amplifier in the diesel generator voltage regulator circuit.

ANALYSIS OF EVENT:

Failure to meet the requirements of Technical Specifications is reportable pursuant to 10CFR50.73 (a)(2)(i)(B). The Standby Diesel Generators are part of the Class 1E 4.16kV AC Power System. The Class 1E 4.16kV AC Power System is composed of three trains designed to provide a reliable source of power to safety-related equipment essential to all modes of plant operation including emergency shutdown and accident mitigation following any design basis event. Upon loss of offsite power, each of the three SDGs start automatically and supply backup power to their associated 4.16 kV buses. Two trains of Standby Diesel Generators will provide safe shutdown capability and mitigate the South Texas Project analyzed design basis events. Standby Diesel Generators 22 and 23 remained operable during this occurrence. There were no adverse safety or radiological consequences from this event.

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CORRECTIVE ACTIONS:

1. The voltage regulator board for Standby Diesel Generator 21 was replaced.

2. A satisfactory post maintenance test and surveillance test was completed for Standby Diesel Generator 21.

ADDITIONAL INFORMATION:

A component failure analysis of the operational amplifier U3 and further review of industry information is planned.

The Standby Diesel Generator is a Cooper-Bessemer model KSV-20 engine rated at 5500KW. The voltage regulator is an NEI Parson Peebles Electric Products model 72 12400 100. The operational amplifier U3 is a RCA model CA3094AE.

No Licensee Event Reports have been submitted in the last two years by the South Texas Project to the Nuclear Regulatory Commission regarding failure to meet Technical Specification 3.8.1.1 for an inoperable Standby Diesel Generator due to a component failure.