

## LICENSEE EVENT REPORT (LER)

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

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNEB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) South Texas Unit 2 DOCKET NUMBER (2) 05000 499 PAGE (3) 1 OF 6

TITLE (4) Inadvertent Test-Mode Starts of Standby Diesel Generators

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
06	07	94	94	-- 005 --	05	07	19	95	South Texas, Unit 1	05000 498
									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)	35	20.402(b)	20.405(c)	X	50.73(a)(2)(iv)	73.71(b)					
		20.405(a)(1)(i)	50.36(c)(1)		50.73(a)(2)(v)	73.71(c)					
		20.405(a)(1)(ii)	50.36(c)(2)		50.73(a)(2)(vii)	OTHER					
		20.405(a)(1)(iii)	50.73(a)(2)(i)		50.73(a)(2)(viii)(A)	(Specify in Abstract below and in Text NRC Form 366A)					
		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)(ix)						

## LICENSEE CONTACT FOR THIS LER (12)

NAME Scott Head - Supervisor, Compliance TELEPHONE NUMBER (Include Area Code) (512) 972-7136

## COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDs	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDs

## SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE) NO: X EXPECTED SUBMISSION DATE (15) MONTH DAY YEAR

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

On June 7, 1994, Unit 2 was in Mode 1 at 35% power. Standby Diesel Generator 22 had satisfactorily completed the monthly Standby Diesel Generator Operability test, been unloaded, and been placed in cooldown. Approximately three minutes into the cooldown cycle, the Standby Diesel Generator trouble alarm annunciated and generator voltage and frequency returned to normal operating parameters. Standby Diesel Generator 22 had received an unexpected test-mode start signal. An inadvertent test-mode start also occurred on Standby Diesel Generator 22 on July 25, 1994. Also, on August 1, 1994, Unit 1 Standby Diesel Generator 13, received a spurious test-mode start signal that resulted in a start of a portion of the Standby Diesel Generator auxiliaries with no actual start of the Standby Diesel Generator. Four additional test-mode starts occurred on May 4 and May 7 (Standby Diesel Generators 21 and 22, respectively) and May 18 (Standby Diesel Generators 13 and 22). An additional test-mode start occurred on August 1, 1995 on Standby Diesel Generator 21. This last failure involved a hard rather than intermittent failure of the D fiber optic board. As a result, the engine was kept in operation until plant conditions allowed securing the engine for entry into a Limiting Condition for Operation to affect repairs. Inadvertent test-mode starts would not prevent any of the Standby Diesel Generators from performing their safety function. Corrective actions include: installation of noise suppression devices to reduce the susceptibility of inadvertent starts due to electronic noise; replacement of fiber optic boards; and physical separation of AC and DC cables on safety class and non-safety class circuits, and installing a key-lock switch for each Standby Diesel Generator. In addition, fiber optic board performance will be pursued with the vendor.

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**TEXT CONTINUATION**

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

DESCRIPTION OF EVENT:

On June 7, 1994, Unit 2 was in Mode 1 at 35% power. Standby Diesel Generator 22 had satisfactorily completed performance of the monthly Standby Diesel Generator Operability test, been unloaded, and been placed in the cooldown cycle. Approximately three minutes into the cooldown cycle, the Standby Diesel Generator trouble alarm annunciated and generator voltage and frequency returned to normal operating parameters. Standby Diesel Generator 22 had experienced an unexpected start (with no operator action) while in the cooldown cycle. The start was verified to originate from a test-mode start signal and not an emergency start signal. At 1630 hours, the Standby Diesel Generator was again placed in the cooldown cycle and was secured after a five minute cooldown. This indicated that the voltage spike within the start circuit was intermittent or that it varied in magnitude sufficient to induce a start signal infrequently. The inadvertent start occurred when the first cooldown timer deenergized.

On July 25, 1994, while Unit 2 was in Mode 1 at 100% power, Standby Diesel Generator 22 experienced a test-mode start for no apparent reason. No testing, maintenance, or other work activities were in progress at the time of the start. On August 1, 1994, while Unit 1 was in Mode 1 at 100% power, Standby Diesel Generator 13 received an apparent test-mode start signal resulting in a start of a portion of the Standby Diesel Generator auxiliaries with no start of the Standby Diesel Generator. Current indication is a "spurious" start command occurred in the non-class portion of one of the two start circuits.

On May 4, 1995, at 0848 hours, Standby Diesel Generator 21 experienced a test mode start. On May 7, 1995, at 2022 hours, Standby Diesel Generator 22 experienced a test-mode start. On May 18, 1995, Standby Diesel Generators 13 and 22 experienced test mode starts, at 0404 hours and 1407 hours, respectively. No work activities were in progress at the time of the starts which could have resulted in an inadvertent start of a Standby Diesel Generator. During these test-mode starts, no abnormal annunciator alarms were discovered in the Control Rooms or at each individual Standby Diesel Generator control panel.

On August 1, 1995, while Unit 2 was in Mode 1 at 100% power, Standby Diesel Generator 21 experienced a test mode start. At 1533 hours, the Standby Diesel Generator was placed in cooldown in preparation for securing. During the cooldown cycle, the engine received an additional test-mode start signal causing speed and voltage parameters to return to normal operating levels. Due to existing plant conditions with a cross-train Limiting Condition for Operation in effect, the diesel was kept in operation, paralleled to the grid at approximately 60% full load until August 3, at 0520 hours, when the cross-train Limiting Condition for Operation was exited. At this point, Standby Diesel Generator 21 was emergency stopped, and a Limiting Condition for Operation for this diesel was entered. Trouble shooting revealed a hard failure of the fiber optic board locking in a test-mode start signal.

CAUSE OF EVENT:

Unacceptably high power transistors collector-emitter current caused by leakage. The leakage was attributed to ionic contamination introduced during the transistor manufacturing process.

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

## ANALYSIS OF EVENT:

The inadvertent test-mode starts of Standby Diesel Generators are classified Engineered Safety Feature Actuations and are reportable pursuant to 10CFR50.73(a)(2)(iv).

The Standby Diesel Generators are part of the Class 1E 4.16 KV AC Power System. The Class 1E 4.16 KV AC Power System is composed of three trains designed to provide a reliable source of power to the safety-related equipment essential to all modes of plant operation including emergency shutdown following any design basis event. Upon a loss of off-site power, each of the three Standby Diesel Generators supply backup power to the associated 4.16 KV bus to mitigate the consequences of postulated accidents. These inadvertent Standby Diesel Generator test-mode starts did not affect the ability of the Standby Diesel Generators to perform their intended safety function.

## CORRECTIVE ACTIONS:

The following corrective actions have been taken to prevent unintentional starts (most of these corrective actions have been previously described in Unit 2 Licensee Event Report 94-003):

1. Equipment repair, which replaced parts found to be weak or non-functioning.
2. Electronic noise reduction by adding:
  - a) filters to the DC power supplies to reduce the magnitude of external circuit electronic noise detected in the engine control panel, and
  - b) ceramic capacitors and surge suppression diodes across the Allen Bradley "Run" relays to reduce the inductive response contributing to the noise induced starts.

The electrical noise reduction modifications will lower the probability but not eliminate the possibility of additional unexpected test-mode starts.

3. As a result of an ongoing assessment of the Diesel Generator Control Panel reliability, an evaluation will be performed to determine the feasibility of replacing the entire control panel with Programmable Logic Control (current state-of-the-art technology). This evaluation will be completed by December 31, 1995.

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CORRECTIVE ACTIONS: (Continued)

4. Preventive maintenance activities for replacement of the fiber-optic boards on a five year frequency have been approved and scheduled. Concurrent with item 6 (fiber optic board performance improvements), the need for replacement and appropriate frequency will be re-evaluated.
5. A key-lock switch will be installed for each Standby Diesel Generator to isolate the test-mode start circuitry from the emergency mode start circuitry.
6. The fiber optic board performance improvements will be pursued with the fiber optic board vendor.

Should another test-mode start occur on any of the South Texas Project Standby Diesel Generators, a revision to this License Event Report will be submitted.

ADDITIONAL INFORMATION:

The Standby Diesel Generators are type KSV-20-T, four stroke, turbocharged engines manufactured by Cooper Energy Services.

See attached table regarding inadvertent starts of Standby Diesel Generators since September 1993.

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**STANDBY DIESEL GENERATOR INADVERTENT START HISTORY SINCE 9/93**

Date	SDG #	Description	Corrective Actions Taken	Diesel Condition Category*	Start Cause Category*
9-17-93	11	While replacing a fiber-optic cable on Standby Diesel Generator 11, the diesel experienced an unplanned start.	Implemented specialized Standby Diesel Generator maintenance crew.	M	M
10-11-93	12	Standby Diesel Generator 12 experienced a start signal which does not appear to have been initiated by any personnel.	Replaced fiber optic boards B.D. Replaced certain varistors.	M	E
10-19-93	22	Standby Diesel Generator 22 started inadvertently. - Unit 2 LER 93-015	1) Revised vendor manual to incorporate varistor characteristics. 2) Installed vent fans in control cabinets. 3) Initiated installation of varistors on 4X1, 4EX3, and 3UP. 4) Tested/replaced varistors and transistors in all diesel control cabinets. 5) Initiated varistor failure mode evaluation.	S	E
12-31-93	12	Standby Diesel Generator 12 auto started in test mode while I&C was connecting a Graphtec recorder in preparation for surveillance procedure performance. - Unit 1 LER 93-023	Checked all test equipment - all satisfactory.		M
2-16-94	21	During performance of simulated run on Standby Diesel Generator-21, a start signal was received when control was taken out of "Pull to Lock". Problem was narrowed to 4X2 "start relay" circuit, including "D" board transistor circuit Q26.	Cleaned connection on fiber optic board D.	M	E
3-1-94	21	Standby Diesel Generator 21 auto started in normal mode for no apparent reason. When Standby Diesel Generator 21 was placed in cooldown mode, the Standby Diesel Generator unexpectedly returned to the normal mode. - Unit 2 LER 94-001	1) Replaced fiber optic boards G,C, & J. 2) Put Warning signs on Standby Diesel Generator Control Panels. 3) Initiated fiber optic board replacement PMs. 4) Installed T-Mod to monitor control circuitry.	S	S
3-5-94	21	Standby Diesel Generator 21 started in test mode without an apparent start signal. An I&C tech was inside the Standby Diesel Generator control panel inspecting relays and circuit cards with a flashlight. - Unit 2 LER 94-001	5) Reduced control panel interior lights' wattage. 6) Replaced fiber optic cable to fiber optic board D, circuit 2.	S	M



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## **STANDBY DIESEL GENERATOR INADVERTENT START HISTORY SINCE 9/93**

Date	SDG #	Description	Corrective Actions Taken	Diesel Condition Category*	Start Cause Category*
4-29-94	21	Standby Diesel Generator 21 started for no apparent reason. - Unit 2 LER 94-003	1) Installed filters on DC power supplies to control panels. 2) Installed capacitors on 4X1, 4EX3, 3UP. 3) Initiated action to reroute DC power cables away from control circuitry. 4) Initiated action to remove fiber optic boards from starting circuitry.	S	S
5-12-94	13	Standby Diesel Generator 13 started for no apparent reason. - Unit 2 LER 94-003		S	S
5-15-94	2	Standby Diesel Generator 22 started for no apparent reason. - Unit 2 LER 94-003		S	S
6-7-94	22	Standby Diesel Generator 22 started for no apparent reason. - Unit 2 LER 94-005, Rev. 0	Replaced the 3 fiber optic boards in the test mode start circuit with new (factory fresh) boards on 8-2-94.	R	S
7-25-94	22	Standby Diesel Generator 22 started for no apparent reason. - Unit 2 LER 94-005, Rev. 1			
8-1-94	13	Standby Diesel Generator 13 received a partial test mode start signal. Some auxiliaries started and one receiver partially blew down, but the diesel did not start. - Unit 2 LER 94-005, Rev. 1	Replaced 3 fiber optic boards.	S	S
5-4-95	21	Standby Diesel Generator 21 started for no apparent reason. - Unit 2 LER 94-005, Rev. 3	Replaced 3 fiber optic boards (B,D,G).	S	S
5-7-95	22	Standby Diesel Generator 22 started for no apparent reason. - Unit 2 LER 94-005, Rev. 3	None at this time	S	S
5-18-95	13	Standby Diesel Generator 13 started for no apparent reason. - Unit 2 LER 94-005, Rev. 3	Replaced 3 fiber optic boards (B,D,G).	S	S
5-18-95	22	Standby Diesel Generator 22 started for no apparent reason. - Unit 2 LER 94-005, Rev. 3	Replaced 3 fiber optic boards (B,D,G).	S	S
5-20-95	22	Standby Diesel Generator 22 started due to newly installed faulty fiber optic board.	Replaced faulty fiber optic board	M	E
8-1-95	21	Standby Diesel Generator 21 started for no apparent reason. The engine had a repeat start while being secured. - Unit 2 LER 94-005, Rev. 5	Replace 3 fiber optic boards (B,D,G) Bench testing found fiber optic board D faulty.	S	E

\* **Diesel Condition Category:** The diesel status prior to start. M = In Maintenance, S = In Standby, R = Running

**Start Cause Category:** The cause of the start: M = Maintenance induced, O = Operations induced, E = Equipment failure induced,

S = Assumed due to known circuit susceptibility to electronic noise