

# The Light company

Houston Lighting & Power South Texas Project Electric Generating Station P. O. Box 289 Wadsworth, Texas 77483

May 31, 1994  
ST-HL-AE-4805  
File No.: G26  
10CFR50.73

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

South Texas Project  
Unit 2  
Docket No. STN 50-499  
Licensee Event Report 94-003  
Inadvertent Test Mode Start of Standby Diesel Generators  
# 21, # 22, and # 13 due to Fiber-Optic Board  
Susceptibility to Noise in Conjunction with Transient DC Spikes

Pursuant to 10CFR50.73, Houston Lighting & Power submits the attached Unit 2 Licensee Event Report 94-003 regarding inadvertent test mode start of Standby Diesel Generators 21, 22, and 13 due to fiber-optic board susceptibility to noise in conjunction with transient DC spikes. These events did not have an adverse effect on the health and safety of the public.

This Licensee Event Report documents two Unit 2 inadvertent test mode starts and one Unit 1 inadvertent test mode start of Standby Diesel Generators. Consistent with guidance provided in NUREG 1022, these events are being combined into one Licensee Event Report because they are related events that are the result of the same general cause.

If you should have any questions on this matter, please contact Mr. J. M. Pinzon at (512) 972-8027 or me at (512) 972-7800.



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JMP/esh

Attachment: LER 94-003 (South Texas, Unit 2)

LER94003RD.02

A Subsidiary of Houston Industries Incorporated

05/31/94 12:42pm

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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 (MNB 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 5
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TITLE (4) Inadvertent Test Mode Start of Standby Diesel Generators Unit 2: # 21, and # 22 and Unit 1: # 13 due to Fiber-Optic Board Susceptibility to Noise in Conjunction with Transient DC Spikes

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
04	29	94	94	-- 003 --	00	05	31	94	South Texas, Unit 1	05000 498
									FACILITY NAME	DOCKET NUMBER
										05000

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)								
POWER LEVEL (10)	0	20.402(b)		20.405(c)	<input checked="" type="checkbox"/>	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)(x)				

LICENSEE CONTACT FOR THIS LER (12)

NAME Jairo Pinzon - Staff Engineer	TELEPHONE NUMBER (Include Area Code) (512) 972-5027
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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

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

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

On April 29, 1994, Unit 2 was in Mode 5 following a refueling outage. At 0202 hours, Unit 2 Standby Diesel Generator 21 experienced an inadvertent test mode start while in the Standby Mode. The start signal was received from the circuitry associated with the test mode which is automatically bypassed during an emergency start. The start was not concurrent with any other plant activity or evolution. Similarly, on May 12, 1994, while Unit 1 was in Mode 1 at 100% power, Standby Diesel Generator 13 inadvertently started while in the test mode due to unknown reasons. Additionally, on May 15, 1994, while Unit 2 was in Mode 3, Standby Diesel Generator 22 inadvertently started while in the test mode for no apparent reason. The cause of the inadvertent test mode starts of Standby Diesel Generators 21, 22, and 13 has been determined to be the fiber-optic boards' susceptibility to noise in conjunction with transient DC spikes. A modification was installed in the DC distribution panel which supplies the Standby Diesel Generator 21 control panel, to attenuate the level of DC noise and spikes. An additional modification was installed on Standby Diesel Generator 21 to specific diesel control circuit relays to dampen the inductive responses of these relays to DC power disturbances. These modifications have been installed on the Unit 2 Standby Diesel Generators and will be installed on the Unit 1 Standby Diesel Generators during scheduled train outages.

LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

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South Texas, Unit 2	05000 499	94	-- 003 --	00	2 OF 5

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

DESCRIPTION OF EVENT:

On April 29, 1994, Unit 2 was in Mode 5 following a refueling outage. At 0202 hours, Unit 2 Standby Diesel Generator 21 experienced an inadvertent test mode start. The Standby Diesel Generator was secured, and declared inoperable. The Nuclear Regulatory Commission was notified at 0354 hours via the Emergency Notification System. This event is reportable in accordance with 10CFR50.73(a)(2)(iv).

At the time of the inadvertent test mode start, Standby Diesel Generator 21 was in the Standby Mode. The start signal was received from the circuitry associated with the test mode which is automatically bypassed during an emergency start. The start was not concurrent with any other plant activity or evolution. Review of plant events, computer records, and operator statements failed to reveal any coincidental equipment operation that could explain the initiating event.

A team was assembled to review the available data and provide troubleshooting recommendations which were given to the craft for sequencing the troubleshooting efforts. Investigation of the circuits by maintenance personnel was performed with no apparent causes found. Energized, de-energized, ground, visual, loose lead, and individual component checks were all performed with satisfactory results.

The maintenance activities on Standby Diesel Generator 21 prior to this event, as a result of corrective actions from other inadvertent test mode starts, included replacement of the solid-state components of the susceptible fiber-optic boards. Individual transistor replacements on these boards were performed.

Corrective actions from a previous event on Standby Diesel Generator 21 included a modification to remove the fiber-optics from the starting circuits and replacing them with isolation relays. The modification was still in the evaluation phase at the time of the last start event. A test circuit using the components of the diesel start circuit was constructed in the shop for testing. Spikes were introduced into the DC supply to test the circuit response. The circuits triggered on spikes with amplitudes ranging from five volts for infrequent actuations to eight volts with consistent actuation.

Monitoring of DC noise within the Standby Diesel Generator 21 control panel found noise of about two volts nominal. In addition, during a twenty minute period noise spikes reached fifteen volts (the circuit was not, however, armed for a start at that time). Review of plant evolutions found no cause for the apparent increase in signal strength. Upon isolating the diesel control panel from the DC supply, the noise increased to an indicated forty volts on the incoming power. Using an oscilloscope, the noise signature was traced back to the Elgar 25 Kva inverter. A similar signature was also found on Standby Diesel Generator 23.

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

DESCRIPTION OF EVENT: (Continued)

Similarly, on May 12, 1994, while Unit 1 was in Mode 1 at 100% power, Standby Diesel Generator 13 started while in the test mode due to unknown reasons. Additionally, on May 15, 1994, while Unit 2 was in Mode 3, Standby Diesel Generator 22 started while in the test mode for no apparent reason. It is believed that the causes of these events are the same as that which caused Standby Diesel Generator 21 to autostart. As such, these events are being combined into this Licensee Event Report.

CAUSE OF EVENT:

The cause of the inadvertent test mode starts of Standby Diesel Generators 21, 22, and 13 has been determined to be the fiber-optic boards' susceptibility to noise in conjunction with transient DC spikes. Discussions with the inverter vendor indicated that the noise level for the type of inverter installed at the South Texas Project is not unusual. An option that provides the DC isolation for the inverter had not been specified during the original purchase. The vendor for the Diesel Generator control panel indicated, however, that the fiber-optic boards are sensitive to noise coming in on the 125 vdc supply. The vendor stated that although no specification exists for the DC feed, an acceptable level of input noise for the fiber-optic board's circuit would be 500 mvolts.

A potential contributing cause of this event was the fact that the original Agastat relays, which contained internal diode suppression, were replaced with hermetically sealed relays which did not contain this noise suppression circuit.

ANALYSIS OF EVENT:

The inadvertent test mode starts of Standby Diesel Generators are classified as actuations of Engineered Safety Features and therefore are reportable pursuant to 10CFR5.73(a)(2)(iv). This Licensee Event Report documents two Unit 2 inadvertent test mode starts and one Unit 1 inadvertent test mode start of Standby Diesel Generators. Consistent with the guidance provided in NUREG 1022, these events are being combined into one Licensee Event Report because they are related events that are the result of the same general cause.

The Standby Diesel Generators are part of the Class 1E 4.16KV 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 start automatically. The 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 starts did not affect the ability of the Standby Diesel Generators to perform their intended safety function or their ability to start upon demand.

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

CORRECTIVE ACTIONS:

The following corrective actions have been taken or will be taken as a result of these events:

- 1) Preventive maintenance activities for the fiber-optic boards have been initiated to specify periodic replacement. Work instructions will be developed prior to the scheduled performance date for these activities.
- 2) A modification will be installed on the DC distribution panel to attenuate DC circuit noise and spikes prior to entry into the control panel. This modification has been installed on the Unit 2 Standby Diesel Generators and will be installed on the Unit 1 Standby Diesel Generators during scheduled train outages.
- 3) A modification will be installed in the control panel to dampen the inductive response of relays 4X1, 4EX3 and 3UP (Allen Bradley relays). This modification has been installed on the Unit 2 Standby Diesel Generators and will be installed on the Unit 1 Standby Diesel Generators during scheduled train outages.
- 4) A temporary modification was installed for connection of monitoring equipment to the diesel control circuit while maintaining Standby Diesel Generator 21 operable.
- 5) Houston Lighting & Power will evaluate modifying the test circuit to utilize isolation relays in place of the fiber-optic boards presently used for Class 1E to non-Class 1E isolation in the starting circuit. This evaluation will be completed prior to the next scheduled refueling outage.
- 6) To address the potential contributing cause, Houston Lighting & Power is evaluating whether there is a generic design control issue due to the fact that the noise suppression circuits were not part of the replacement design.

ADDITIONAL INFORMATION:

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

During the past three years, three events were reported regarding inadvertent starts of Standby Diesel Generators:

Unit 2 Licensee Event Report 93-015 was submitted documenting the inadvertent start of Standby Diesel Generator 22. The cause was attributed to spurious failure of a transistor.

LICENSEE EVENT REPORT (LER)  
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ADDITIONAL INFORMATION:(Continued)

Unit 1 Licensee Event Report 93-023 was submitted documenting an inadvertent start of Standby Diesel Generator 12 during testing. The cause of this event was most likely the result of an electrical arc between the Standby Diesel Generator panel and the test equipment.

Unit 2 Licensee Event Report 94-001 was submitted documenting an inadvertent start of Standby Diesel Generator 21. The inadvertent start was caused by a combination of two component failures: a weakened transistor in the non-1E fiber-optic start circuits and a faulty power supply that induced spikes into the fiber-optic start circuit.