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

April 24, 1996
ST-HL-AE-5354
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 96-002
Fuel Handling Building Exhaust Air Damper Inoperable
Due to Inappropriate Design Implementation

Pursuant to 10CFR50.73, the South Texas Project submits the attached Unit 2 Licensee Event Report 96-002 regarding a Fuel Handling Building Exhaust Air Damper found inoperable due to inappropriate design implementation. This event did not have an adverse effect on the health and safety of the public.

If you should have any questions on this matter, please contact Mr. S. M. Head at (512) 972-7136 or me at (512) 972-7988.

Robert E. Masse
Plant Manager,
Unit 2

TCK/tck

Attachment: LER 96-002 (South Texas, Unit 2)

IE22
1/1

Leonard J. Callan
Regional Administrator, Region IV
U. S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

Thomas W. Alexion
Project Manager, Mail Code 13H15
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

David P. Loveless
Sr. Resident Inspector
c/o U. S. Nuclear Regulatory Comm.
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

J. C. Lanier/M. B. Lee
City of Austin
Electric Utility Department
721 Barton Springs Road
Austin, TX 78704

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

Rufus S. Scott
Associate General Counsel
Houston Lighting & Power Company
P. O. Box 61067
Houston, TX 77208

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

Dr. Joseph M. Hendrie
50 Bellport Lane
Bellport, NY 11713

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

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

J. R. Egan, Esquire
Egan & Associates, P.C.
2300 N Street, N.W.
Washington, D.C. 20037

J. W. Beck
Little Harbor Consultants, Inc.
44 Nichols Road
Cohassett, MA 02025-1166

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 7

TITLE (4)

Fuel Handling Building Exhaust Air Damper Inoperable Due to Inappropriate Design Implementation

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
03	14	96	96	-- 002 --	00	04	24	96		05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	1
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

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 - Sr. Consulting Engineer	(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
B	VG	FT	T031	NO						

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 March 21, 1996, Unit 2 was in Mode 1 at 100% power. At 1451 hours, it was determined train B of the Fuel Handling Building Emergency Exhaust Air system exceeded the Allowed Outage Time, resulting in a failure to meet Technical Specification requirements. Previously, on March 16, 1996, train B of the Fuel Handling Building Emergency Exhaust Air system failed to operate in the required manner when started and was declared inoperable. The inoperability was due to the failure of a flow transmitter which prevented a control damper from operating as required. A review of historical computer data indicated the flow transmitter failed and the damper became inoperable on March 14, 1996. The cause of the transmitter failure was a design change which connected the damper loss-of-AC closure circuit to the station battery. The issues associated with the design change were due to less than adequate consideration of all design input information during the design change process. Modifications were made to the Fuel Handling Building Emergency Exhaust dampers to resolve the issue. A similar condition was discovered on train B of the Control Room Envelope Emergency Make-up system, however this condition was determined not to be reportable. Discussion of this condition, it's analysis and corrective actions are included in the text of this Licensee Event Report.

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
South Texas, Unit 2	05000 499	96	-- 002	-- 00	2 OF 7

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

DESCRIPTION OF EVENT:

On March 21, 1996 Unit 2 was in Mode 1 at 100% power. An investigation concluded that the requirements of Technical Specification 3.7.8 had not been met since 1451 hours on March 14, 1996 and therefore was reportable.

On March 16, 1996, at 2120 hours the Fuel Handling Building train B Exhaust Air system failed to operate in the automatic mode and was declared inoperable. The inoperability was due to the failure of flow transmitter FT-9507A, which prevented the flow control damper HV-9507A from operating in the automatic mode. Technical Specification 3.7.8 requires two independent exhaust filter trains and their associated dampers be operable in Modes 1, 2, 3 and 4. The LCO action statement requires that an inoperable filter train be returned to operable status within seven days or the unit must be placed in Hot Standby within the next six hours and Cold Shutdown within the following 30 hours. After being declared inoperable on March 16, 1996, at 2120 hours, the LCO Action required completion time was March 23, 1996, at 2120 hours. A review of historical computer data indicated that flow transmitter FT-9507A failed and damper HV-9507A had become inoperable on March 14, 1996, at 1451 hours. Therefore, for reportability purposes, the Allowed Outage Time expired on March 21, 1996, at 1451 hours and this event became reportable.

On March 14, 1996 a surveillance was performed in which the last step verified the operability of the Fuel Handling Building Emergency Exhaust train B damper DC closing circuit by subjecting the damper to a loss-of-AC condition. After this step was completed satisfactorily, the filter train was returned to the normal, secured condition. On March 16, 1996, during a review of the computer monitored points, it was discovered that the Fuel Handling Building Emergency Exhaust train B flow transmitter had apparently failed. The data indicated the failure occurred at 1451 hours on March 14, 1996. The Fuel Handling Building train B Emergency Exhaust system was started and subsequently declared inoperable after the damper failed to operate.

During field troubleshooting and additional surveillance testing, two additional flow transmitter failures occurred. Further trouble-shooting activities determined that voltage impulses occurred at the transmitter input terminals during the damper loss-of-AC closure function. The cause of the impulses was initially believed to be due to the starting characteristics of the motor and on March 21, 1996, the motor was replaced. When a retest was conducted after the motor replacement, the voltage impulses were still present.

On March 22, 1996, it was determined a design change installed in May of 1995, which replaced the battery mounted in the actuator with a connection to the 125 VDC station battery created higher voltages during the closure cycle and could significantly increase the size of voltage impulses. At this time it was believed the voltage impulses were causing the flow transmitter failures. Subsequent evaluation and work conducted during the trouble-shooting process found that a 125 to 24 VDC power supply would eliminate the voltage impulses.

In parallel with the preparation of a design change to install the previously tested 125 to 24 VDC power supply, an engineering evaluation concluded that credit could be taken for manually positioning the Fuel Handling Building Emergency Exhaust train B damper HV-9507A in lieu of depending on the flow transmitter to provide a signal to the automatic control system. Based on this engineering evaluation, and changes made to the necessary procedures, the Fuel Handling Building train B filter exhaust system was declared operable on March 22, 1996, at 2056 hours.

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
South Texas, Unit 2	05000 499	96	-- 002 --	00	3 OF 7

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

DESCRIPTION OF EVENT (Continued):

In an effort to provide an independent evaluation of the failure mechanism, a failed transmitter was sent to both Southwest Research and the vendor (Tavis) for evaluation. On March 26, 1996, a test report was received from Southwest Research describing the failure mechanism for the flow transmitter failure on March 14, 1996. This report confirmed that high voltages applied to the internal components was the cause of the transmitter failures. In addition, the failure analysis performed by the vendor on the flow transmitter that failed on March 19, 1996 also concluded that high voltage was the likely failure mechanism.

On March 28, 1996, the train B Control Room Envelope Heating, Ventilation and Air Conditioning system failed to operate in the automatic mode during the quarterly radiation monitor surveillance due to a flow control failure. Flow transmitter FT-9585 had failed high and the damper had fully closed in an attempt to reduce flow. It was determined that the two transmitters (FT-9507A and FT-9585) shared a common instrument power supply. Subsequent field trouble-shooting found voltage impulses created during the closure cycle of damper HV-9507A, were reaching transmitter FT-9585. Since the computer points for Control Room Envelope Heating, Ventilation and Air Conditioning HI/LO flow are normally in alarm in the secured position, an exact time of failure could not be determined for transmitter FT-9585. This condition was discovered during routine surveillance testing and corrected prior to the expiration of the Allowed Outage Time.

On March 31, 1996, a permanent design change was implemented to install the 125 to 24 VDC power supply on Fuel Handling Building damper HV-9507A, based on the previously demonstrated effectiveness of the 125 to 24 VDC power supply. After installation of the 125 to 24 VDC power supply on the Fuel Handling Building exhaust damper HV-9507A, measurements of the circuit indicated that the transient voltage impulses were no longer a concern. To preclude any potential future failures in the other trains, these modifications were installed in the remaining trains in both units by April 6, 1996.

With regards to the Control Room Envelope Heating, Ventilation and Air Conditioning system, a temporary modification was issued to deactivate the loss-of-AC closure circuit on Control Room Envelope damper HV-9585. An analysis had determined that the closure requirement was no longer necessary. These modifications were installed in the remaining trains in both units by April 4, 1996.

CAUSE OF EVENT:

The cause of the flow transmitter failures was a design change which connected the damper loss-of-AC closure circuits to the station battery. The increased operating voltage created larger transient voltage impulses which, over time, are believed to have degraded a component within the circuit. The degradation of the component allowed for the transient voltage impulses to cause the flow transmitter failure.

The issues associated with the design change implementation were due to a less than adequate consideration of all design input information. Self-assessments performed recently on the South Texas Project design process, including a review of several modifications, found that no issues existed with those designs. However, it has been determined that a more rigorous process for consideration of design inputs would enhance the preparation of design change packages. The enhancements will provide a high degree of confidence that recurrence of the issues identified in this Licensee Event Report will be prevented in the future.

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
South Texas, Unit 2	05000 499	96	-- 002 --	00	4 OF 7

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

ANALYSIS OF EVENT:

Non-compliance with Technical Specification 3.7.8 from March 14, 1996 until March 21, 1996 is reportable pursuant to 10CFR50.73 (a) (2) (i) (B). This event did not adversely impact the safe operation of the plant, the safety of plant personnel, or the health and safety of the public.

The Fuel Handling Building Emergency Exhaust filter flow control damper is an electro-hydraulically actuated damper designed to control flow through the filter train at 29000 cfm ± 10%. In addition, the damper is designed to fail closed on loss of AC supplied power. This fail closed feature is intended to close the damper to isolate flow into the non-operating train should a single failure occur causing only one train of Fuel Handling Building Exhaust Air system to be available.

Operability of Fuel Handling Building HVAC

Throughout the time HV-9507A was inoperable, the redundant Fuel Handling Building damper and filter train were operable and capable of providing the filtration of the Fuel Handling Building atmosphere, if required. In the event of an accident, the Emergency Operating Procedures are designed to ensure satisfactory operation of a single filter train.

With respect to the effect of the identified condition on past operability of the Fuel Handling Building Exhaust Air system, reviews have found that the design change which connected the 125 VDC station battery to this equipment did not have any immediate impact on the operability of the Fuel Handling Building Exhaust Air system. Immediately after the modification installation, which connected the station battery to the Fuel Handling Building Emergency Exhaust Air control circuit, post modification tests were conducted on the damper control circuits to demonstrate that the modification performed as required. The tests resulted in the circuit functioning acceptably. Since that time, surveillance testing of the damper's response to a loss of AC power have been performed monthly. These flow transmitters have not been the source of a failed surveillance test up to the time when the flow transmitter failure occurred after completion of the test on March 14, 1996.

With respect to the potential inoperability of both Fuel Handling Building Exhaust Air system trains due to the common mode effects of the 125 VDC battery transient voltages on the damper control circuits, engineering design reviews, review of the sequence of events and observation of test data indicate that the connection of the 125 VDC station battery to the damper control circuit causes the degradation of a circuit component(s). The degraded component(s) provides a path for transient voltages from relay or motor operation which affect the flow transmitter(s). The failure/degradation mechanism occurs over time as evidenced by the successful performance of the system surveillance tests for approximately one year prior to the failure of the flow transmitter. It should be noted, the DC closure circuit for the Fuel Handling Building Emergency Exhaust Air system is only activated during the loss-of-AC surveillance testing or during a loss-of-offsite power event. Therefore, the degradation of the flow transmitter due to the voltage impulses did not occur continuously, but occurred primarily during the performance of the surveillance tests. Train B of the Fuel Handling Building Emergency Exhaust Air system appears to be the first to degrade as it resulted in the first failure observed. Tests conducted on other trains of Fuel Handling Building Emergency Exhaust Air system in both South Texas Project units did not show evidence of the transmitter failure. When and if a failure does occur, it is detectable by performance of the surveillance test performed monthly. Even in the unlikely case where an undetectable circuit component degradation has occurred, the operator can take manual control in the control room to mitigate the effects of the flow transmitter failure.

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
South Texas, Unit 2	03000 499	96	-- 002	-- 00	5 OF 7

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

ANALYSIS OF EVENT (Continued):

Operability of Control Room Envelope Heating, Ventilation and Air Conditioning system

Train B of the Control Room Envelope Heating, Ventilation and Air Conditioning system was declared inoperable due to a failure of FT-9585. During this time period, redundant trains A and C of the Control Room Envelope Heating, Ventilation and Air Conditioning system with their associated dampers, fans and instrumentation were capable of providing filtration and pressurization of the Control Room Envelope, if required. In the event of an accident, the Emergency Operating Procedures are designed to verify satisfactory operation of the filter system.

With respect to the effect of the identified condition on past operability of the Control Room Envelope Heating, Ventilation and Air Conditioning systems reviews have also found that the design change which connected the station battery to this equipment did not have any immediate impact on operability. Post modification tests were also conducted immediately after the modification. Similar to the Fuel Handling Building Emergency Exhaust Air damper control circuitry, these post modification tests demonstrated the acceptability of the design modification.

The Control Room Envelope Heating, Ventilation and Air Conditioning is tested by numerous surveillance tests. The flow transmitter must be functional in these tests to provide a control system signal so that damper modulating control can occur. If the flow transmitter does not provide this signal, damper modulation would not occur, the operators would detect that deficiency and the Control Room Envelope Heating, Ventilation and Air Conditioning system would be declared inoperable. A review of all the surveillance tests conducted on the Control Room Envelope system indicates that the maximum length of time between surveillance tests that challenge the Control Room Envelope system would not exceed once per quarter. These flow transmitters have not been the source of a failed surveillance test up to the time when the flow transmitter, FT-9585, failure occurred.

The potential inoperability of all three Control Room Envelope Heating, Ventilation and Air Conditioning trains due to common mode effects of the 125 VDC battery transient voltages on the Control Room Envelope Heating, Ventilation and Air Conditioning damper control circuits has also been reviewed with results similar to those found in the Fuel Handling Building Exhaust Air system. The failure mechanisms (i.e., slow degradation of a circuit component) is the same as described previously for the Fuel Handling Building Exhaust Air system. The degraded component provides a path for the transient voltages to affect the flow transmitter. The degradation occurs over time as documented by the successful surveillance test performance for a period of one year prior to the failure described in this event. The remaining redundant trains of the Control Room Envelope Heating, Ventilation and Air Conditioning (trains A and C) did not show evidence of a transmitter failure. As discussed previously, when the transmitter failure occurs, it is detectable by the operators during performance of surveillance tests (at least once per quarter).

The damper control circuit degradation mechanism occurs over a relatively long time period. It is detectable by numerous surveillance tests performed at least once per quarter which challenge the Control Room Envelope Heating, Ventilation and Air Conditioning system trains. Because the system has not shown evidence of the mechanism, the potential for undetectable degraded failure mechanisms occurring which affect all Control Room Envelope Heating, Ventilation and Air Conditioning trains is judged to be minimal.

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
South Texas, Unit 2	05000 499	96	-- 002 --	00	6 OF 7

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

CORRECTIVE ACTIONS:

1. As an interim measure, operating procedures were revised to provide operators with the additional information necessary to respond a Fuel Handling Building filter train damper failure.

2. Design changes were implemented to install 125 to 24 VDC power connected to the loss-of-AC damper closure circuits of Fuel Handling Building filtration system for both units.

3. The Fuel Handling Building filtration system surveillance procedures (0PSP03-HF-0001 and 0PSP03-HF-0002) were optimized to identify any future failures of this type at the time of performance.

4. Temporary Modifications were completed to de-energize the loss-of-AC circuit for the Control Room Envelope Emergency Make-up dampers to minimize the susceptibility of the circuit to the transient voltage impulses.

5. A near term review process will address removal of the Control Room Envelope Emergency Make-up actuator temporary modifications.

6. Reviews have been conducted by the engineering group to assess the design modification which connected the 125 VDC station battery to the damper control circuit. The review group determined that the STP design process could be enhanced to minimize the potential for further difficulties of the type which caused this event and also recommended actions to that effect. These following significant actions are in the process of being implemented.

   - Revise the design change process procedure to clearly provide more guidance on gathering Design Inputs, documenting those inputs and using the Design Inputs to prepare a design specification. The guidance will also consider post-modification testing requirements.

     Status: In Process

   - Improve the guidance for performance and documentation of design verification

     Status: Complete

   - Provide training and develop guidelines for use by Design Engineers in establishing modification design inputs and criteria.

     Status: In Process

   - Re-emphasize management expectations of modification ownership, use of the modification team concept and the performance of modification activities.

     Status: In Process

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
South Texas, Unit 2	05000 499	96	-- 002 --	00	7 OF 7

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

ADDITIONAL INFORMATION:

There has only been one previous event reported by the South Texas Project to the Nuclear Regulatory Commission within the last three years regarding the inoperable Fuel Handling Building Emergency Exhaust Air system. Unit 1 Licensee Event Report 94-005 reported an inoperable condition due to failure of the battery backup system used for closure in the event of a loss of offsite power.