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

February 20, 1992

ST-HL-AE-3999
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 92-001 Regarding a
Reactor Trip Due to a Dropped Control Rod

Pursuant to 10CFR50.73, Houston Lighting & Power (HL&P) submits the attached Licensee Event Report 92-001 regarding a reactor trip due to a dropped control rod. This event did not have adverse impact on the health and safety of the public.

If you should have any questions on this matter, please contact Mr. C. A. Ayala at (512) 972-8628 or me at (512) 972-7205.

William J. Jump
Manager,
Nuclear Licensing

JMP/mg

Attachment: LER 92-001 (South Texas, Unit 2)

LER\92034001.U2

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cc:

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Revised 10/11/91

L4/NRC/

NRC FORM 366 (6-89) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES 4/30/92
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
South Texas, Unit 2	0 5 0 0 0 4 9 9	1 OF 0 6

TITLE (4)

Reactor Trip Due to a Dropped Control Rod

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 NAMES	DOCKET NUMBER(S)
0 1	2 2	9 2	9 2	0 0 1	0 0	0 2	2 0	9 2		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	1 0 0	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 (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		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	TELEPHONE NUMBER
	AREA CODE
Charles Ayala - Supervising Licensing Engineer	5 1 2 9 7 2 - 8 6 2 8

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	A A	S T C	W 1 2 0	YES							

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 fifteen single-space typewritten lines) (16)

On January 22, 1992, Unit 2 was in Mode 1 at 100% power. At 0909 hours, Unit 2 experienced a reactor trip due to power range high neutron flux negative rate. The plant was brought to a stable condition in Mode 3 with no unexpected post-trip transients. The cause of the power range high neutron flux negative rate trip was dropping of control rod H-6 into the reactor core. The control rod dropped when the blocking diode and its associated stationary gripper coil's power circuit failed open, resulting in an interruption of current to the stationary gripper coil. The cause of the diode failure remains unknown. The faulty diode was replaced, along with all other blocking diodes sharing the faulty diode's manufacturer's date code. HL&P has sent the faulty diode and the other selected diodes to an independent laboratory for analysis. HL&P will evaluate the results of the analysis and initiate further corrective actions as needed. Additionally HL&P, in cooperation with Westinghouse, will perform testing to determine if the blocking diodes can be eliminated from the present rod control system design.

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DESCRIPTION OF EVENT:

On January 22, 1992, Unit 2 was in Mode 1 at 100% power. At 0909 hours, Unit 2 experienced a reactor trip due to power range high neutron flux negative rate. The turbine tripped subsequent to the reactor trip. As expected, an auxiliary feedwater actuation was initiated due to low steam generator water level. A feedwater isolation actuation occurred due to low reactor coolant system average temperature. All safety systems functioned as required except: 1) steam generator 2A bulk water sample Outside Containment Isolation Valve (OCIV) (SB-FV-4189A) failed to close automatically on the auxiliary feedwater actuation signal and 2) pressurizer backup heater 2A failed to energize automatically on demand from the pressurizer pressure master controller. The redundant steam generator 2A water sampling isolation valve SB-FV-4189, located upstream of SB-FV-4189A did close automatically to isolate the sampling line and operators energized pressurizer backup heater 2A using manual controls.

The negative rate reactor trip was caused when control rod H-6 dropped into the reactor core. The control rod dropped when the blocking diode and its stationary gripper coil's power circuit failed open, interrupting power to the control rod's stationary gripper coil.

The diode that failed is designated as CR1. It was mounted on the heat sink assembly A22 in the rod control system's power cabinet 2AC. The diode was a type 1N1206RA diode manufactured by NAE, Inc. A review of the maintenance history for the rod control system's power cabinets revealed four prior cases of blocking diode failure. One case which resulted in a similar reactor trip on October 13, 1989 (Reference Unit 2 LER 89-026). The other three failures were discovered at different times while attempting to withdraw control rods. These diodes were subsequently replaced. The corrective actions prescribed in LER 89-026 were replacement of diode (CR2) and inspection of abnormal characteristics of blocking diodes in the gripper coil circuits in Unit 1 and Unit 2.

DESCRIPTION OF EVENT: (CONT'D)

The inspections performed included visual inspections of the blocking diodes' soldered connections and electrical characteristic checks of the diodes' operating parameters. The checks revealed that several of the diodes had unsatisfactory soldered connections (i.e. cracked solder joints) and that several of the diodes did not meet their rated peak reverse voltage parameter of 600 V. As a result, diodes not meeting their rated peak reverse voltage parameter were replaced and unsatisfactory solder joints were repaired. One of the soldered connections that was cracked and repaired was the connection on diode CR1 on heat sink assembly A22 in Unit 2 power cabinet 2AC (this is the blocking diode that failed open on January 22, 1992). Operating performance of the blocking diode CR1 for the past two years (December 1989 through January 1992), indicates that maintenance activities did not adversely affect the blocking diode.

Thermography data, from thermographic surveys of operating temperatures of the blocking diodes in the Unit 1 and Unit 2 rod control systems' power cabinets, indicates that the average operating temperature of the diodes is 33.5°C. The blocking diode that failed open during this event ranged in measured temperature from 25.4°C to 48.6°C during previous thermographic surveys. Westinghouse stated that variations in temperature for diodes of the same batch can be attributed to differences in physical make-up that are reflected as variations in electrical characteristics. Westinghouse also indicated that these temperatures are within the low-normal operating range and therefore, are not a concern. The design specification for this type of diode has an operating temperature rating up to 150°C.

Maintenance troubleshooting of the Unit 2 rod control system's blocking diodes indicated that diode CR1 and the diode which has exhibited the highest operating temperature to date (CR3 on heat sink A24 in power cabinet 2AC) shared common manufacturer's date codes. For this reason, faulty diode CR1, diode CR3, and blocking diodes in the power cabinets 1AC, 2AC, 1BD, 2BD, and SCDE marked with this same date code were replaced. The electrical characteristics of the replacement diodes were checked using a curve tracer to verify satisfactory diode performance before and after installation. After the completion of work activities, the rod control system tested satisfactorily and was declared operable.

DESCRIPTION OF EVENT: (CON.)

Westinghouse indicated that the blocking diodes are a design carry-over from the design of the DC-Contactor rod control system that preceded the present solid state design. In theory, it may be possible to remove the diodes with no impact to hold-in times of the control rod drive mechanism grippers due to energy stored in the gripper coils and released when the magnetic field collapses.

As stated earlier, the steam generator 2A bulk sample OCIV SB-FV-4189A failed to close upon the auxiliary feedwater actuation signal, a review of the circumstances associated with this event indicates that FV-4189, which is just upstream of FV-4189A, did close and that FV-4189A closed 50 minutes after the trip without operator action. Problems with closure of these type solenoid valves have been experienced previously at STP and were attributed conditions where little or no differential pressure exists across the valve. Since FV-4189A is downstream of FV-4189, a closure of FV-4189, would remove differential pressure from FV-4189A not allowing it to close. During the trip, the design function of containment isolation was accomplished by the closure of FV-4189 by itself. On January 24, 1992, while draining steam generator 2D for maintenance, an expected auxiliary feedwater actuation occurred during which FV-4189A closed per design when it was previously in the open position. If FV-4189 were to fail to close, FV-4189A would function to isolate the sampling line to meet single failure criteria as evidenced by its satisfactory closure during the auxiliary feedwater isolation on January 24, 1992.

An investigation was conducted to determine why the pressurizer backup heater 2A failed to energize automatically. Troubleshooting revealed no problems. The automatic energization circuit adequately energized upon testing. Inspection of the pressurizer heater feeder breaker revealed no discrepancies.

CAUSE OF EVENT:

The power range high neutron flux negative rate trip on the Unit 2 reactor was due to the dropping of control rod H-6 into the reactor core. The control rod dropped when the blocking diode in its associated stationary gripper coil's power circuit failed open, resulting in an interruption of current to the stationary gripper coil. The exact cause of the diode failure is unknown.

As previously stated, the steam generator 2A bulk water sample isolation valve SB-FV-4189A failed to close automatically upon demand by the auxiliary feedwater actuation which followed the reactor trip. This condition is known to occur when there is little or no differential pressure across FV-4189A. Since the upstream valve FV-4189 went closed, with FV-4189A being slightly slower to close, the differential pressure across FV-4189A was removed. The design function of the containment isolation was maintained by the closure of FV-4189 by itself.

Additionally, pressurizer backup heater 2A failed to energize automatically as required when pressurizer pressure decreased following the reactor trip. No problems were identified during troubleshooting and the heaters were verified operable.

ANALYSIS OF EVENT:

This event is reportable pursuant to 10CFR50.73(a)(2)(iv). The reactor tripped as designed and, aside from SB-FV-4189A and pressurizer backup heater 2A, the remaining safety equipment operated as expected. No unexpected post-trip transients occurred and there was no safety injection actuation. There were no adverse radiological or safety consequences as a result of this event.

CORRECTIVE ACTIONS:

1. The faulty diode CR1 was replaced, along with other blocking diodes sharing the faulty diode's manufacturer's date code.

2. Troubleshooting of pressurizer backup heater 2A identified no problems.

CORRECTIVE ACTIONS: (CONT'D)

3. To determine the cause of the diode failure, HL&P has sent the failed diode and other selected diodes sharing the same date code to an independent laboratory for analysis. HL&P will evaluate the results of the analysis and initiate further corrective actions, if necessary.

4. HL&P, in cooperation with Westinghouse, will pursue efforts to perform testing to determine if the blocking diodes can be eliminated from the present rod control system design. If the testing reveals that the blocking diodes can be eliminated without adverse impact to the rod control system's function, the experienced failure mode can be eliminated. This evaluation will be completed by end of the next refueling outage on Unit 1.

5. HL&P has submitted a Technical Specification change to the NRC for approval to delete the negative flux rate trip. (Reference: HL&P Letter ST-HL-AE-3750, dated April 15, 1991)

ADDITIONAL INFORMATION:

The failed component was a type 1N1206RA diode manufactured by NAE, Inc.

A similar event was reported under LER 89-026 regarding a Unit 2 reactor trip due to a dropped control rod.

A review of the NPRDS database revealed that a similar event occurred at Vogtle Electric Generating Plant, Unit 2 on October 11, 1989. Documentation of this event is provided in Vogtle's LER 89-027.