Entergy

Entergy Operations, Inc.
River Bend Station
5485 U.S. Highway 61N
St. Francisville, LA 70775
Tel 225 381 4157
Fax 225 635 5068
dlorfin@entergy.com

David N. Lorfing
Manager-Licensing

June 14, 2006

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

Subject: Licensee Event Report 50-458 / 06-004-00
River Bend Station – Unit 1
Docket No. 50-458
License No. NPF-47

File Nos. G9.5, G9.25.1.3

RBG-46580
RBF1-06-0100

Ladies and Gentlemen:

In accordance with 10CFR50.73, enclosed is the subject Licensee Event Report. This document contains no commitments.

Sincerely,

David N. Lorfing
Manager – Licensing

DNL/dhw
Enclosure

JE22

cc: U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011

NRC Sr. Resident Inspector
P. O. Box 1050
St. Francisville, LA 70775

INPO Records Center
E-Mail

Mr. Jim Calloway
Public Utility Commission of Texas
1701 N. Congress Ave.
Austin, TX 78711-3326

Mr. Jeff Meyers
Louisiana Department of Environmental Quality
Office of Environmental Compliance
P.O. Box 4312
Baton Rouge, LA 70821-4312

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 06/30/2007

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
River Bend Station – Unit 1	05000-458	1 of 4

4. TITLE

Automatic Reactor Scram Following Recirculation Pump Downshift Due to Failed Optical Isolator Card

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
04	15	2006	2006	- 004 -	00	06	14	2006	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE

1

10. POWER LEVEL

100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
David N. Lorfing, Manager – Licensing	225-381-4157

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	JE	OB	GE	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On April 15, 2006, at 4:15 p.m., an automatic reactor scram occurred while the plant was operating at 100% power. Prior to the scram, both reactor recirculation pumps shifted from high to slow speed due to a failed optical isolator card in the reactor protection system. With the reactor control rod pattern set for full power operation, the decrease in reactor recirculation flow caused the average power range monitors (APRM) to trip on a simulated high thermal power signal. The APRM trip signal caused the reactor scram approximately twelve seconds after the recirculation pumps downshifted. This event is being reported in accordance with 10CFR50.73(a)(2)(iv) as a valid actuation of the reactor protection system. There were no safety-related systems out of service at the time of the event. Plant systems responded to the scram as designed, and reactor pressure and water level were promptly stabilized. Both optical isolator cards in the EOC-RPT circuitry were replaced during the forced outage. A downshift of both reactor recirculation pumps while operating at full power is an event analyzed in the River Bend Updated Safety Analysis Report. As such, this event was of minimal safety significance.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
River Bend Station – Unit 1	05000-458	2006	- 004 -	00	2 OF 4

REPORTED CONDITION

On April 15, 2006, at 4:15 p.m., an automatic reactor scram occurred while the plant was operating at 100% power. Prior to the scram, both reactor recirculation pumps shifted from high to slow speed due to a failed optical isolator card (**OB**) in the reactor protection system (JC). With the reactor control rod pattern set for full power operation, the decrease in reactor recirculation flow caused the average power range monitors (APRM) to trip on a simulated high thermal power signal. The APRM trip signal caused the reactor scram approximately twelve seconds after the recirculation pumps downshifted. This event is being reported in accordance with 10CFR50.73(a)(2)(iv) as a valid actuation of the reactor protection system. There were no safety-related systems out of service at the time of the event. Plant systems responded to the scram as designed, and reactor pressure and water level were promptly stabilized.

BACKGROUND

The reactor recirculation system (AD) contains a pair of two-speed pumps in separate loops that provide driving flow inside the reactor core. The reactor protection system (RPS) contains a feature that shifts the pumps from high speed to slow speed in response to a closure signal to the main turbine stop valves. This feature is known as End-of-Cycle Recirculation Pump Trip (EOC-RPT), and acts to mitigate the severity of a main turbine trip late in the operating cycle, when all reactor control rods are fully withdrawn. Downshifting the pumps to slow speed causes a prompt decrease in reactor power, minimizing the transient in reactor steam pressure that will occur in response to the turbine trip.

The EOC-RPT circuitry is arranged in two independent channels, and contains redundant optical isolator cards (General Electric model no. 204A6188G002) that provide isolation of non-safety related circuitry from the safety-related RPS system. The EOC-RPT circuits are designed such that a signal from only one of the two channels is needed to actuate the downshift of both pumps.

CAUSAL ANALYSIS

A review of conditions immediately prior to the event confirmed that no actual plant operating parameter had initiated the EOC-RPT logic. It was determined that the failure of one of the optical isolator cards spuriously injected a trip signal into the EOC-RPT circuitry, causing the downshift of both reactor recirculation pumps

to slow speed. Analysis of the affected circuits found that the card likely failed due to an inherent design weakness in the card, which degraded the output transistor on the card to the point of spurious operation. Design documents show that optical isolators used to drive inductive loads, such as in this application, require transient protection. A review of the RPS system drawings found that insufficient transient protection existed for the EOC-RPT cards.

Industry operating experience identified the need to modify the EOC-RPT circuitry at River Bend. Actions commenced to harden the associated circuitry and prevent a similar occurrence. A modification was performed to install suppression diodes in the affected circuits in June 2005. Post-modification monitoring of the card output voltage indicated that this was not sufficient to correct the condition. Plans were then developed for further modification of the circuits to install interposing relays. The refueling outage beginning in April 2006 was identified as the next available opportunity to install these relays. The scram occurred before that action could be taken. It should be noted that the failure mode is such that the circuit would not be prevented from performing its intended function, but is capable of spurious activation.

CORRECTIVE ACTIONS TO PREVENT RECURRENCE

Both optical isolator cards in the EOC-RPT circuitry were replaced during the forced outage.

During the refueling outage that started in April 2006, the EOC-RPT circuitry was modified by the installation of suppression diodes. Interposing relays were also installed in the circuits to eliminate the induced voltage on the relay powered from the optical isolators.

All optical isolators, other than those providing alarm or computer points only, were reviewed for single point vulnerability (SPV). Eighteen optical isolator channels were identified as SPVs, including the EOC-RPT cards. Suppression diodes were added to the associated relays for other optical isolators identified as SPVs during the recent refueling outage completed in May 2006.

PREVIOUS OCCURRENCE EVALUATION

A review of reported events at River Bend Station since 2003 found no prior occurrence of this condition.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
River Bend Station – Unit 1	05000-458	2006	- 004 -	00	4 OF 4

SAFETY SIGNIFICANCE

A downshift of both reactor recirculation pumps while operating at full power is an event analyzed in the River Bend Updated Safety Analysis Report. One difference between this event and the event analyzed in the USAR is that the USAR analysis was performed prior to installation of a modification to guard against core thermal-hydraulic instabilities. This stability modification included a new simulated thermal power setpoint function which precludes entry into the portion of the reactor core power/flow map where thermal-hydraulic instabilities might occur (exclusion region). Following the downshift of the recirculation pumps, core flow decreased as expected, and the portion of the simulated thermal power setpoint function which enforces the exclusion region was exceeded, generating the reactor scram signal. Thus, the reactor scram occurred as required by design. As such, this event was of minimal safety significance.

(NOTE: Energy Industry Component Identification codes are annotated as (**XX**).)