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June 22, 2005

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

Subject: Licensee Event Report 50-458 / 04-005-01
River Bend Station – Unit 1
Docket No. 50-458
License No. NPF-47

File Nos. G9.5, G9.25.1.3

RBG-46448
RBF1-05-0096

Ladies and Gentlemen:

In accordance with 10CFR50.73, enclosed is the subject Licensee Event Report. This report is a supplement to LER 50-458/04-005-00 submitted on February 8, 2005. This document contains no commitments.

Sincerely,

David N. Lorfing
Manager – Licensing

DNL/dhw
Enclosure

IE22

cc: U. S. Nuclear Regulatory Commission
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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)

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4. TITLE

Unplanned Automatic Scram Due to Loss of Non-vital 120 Volt Instrument Bus

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
12	10	2004	2004	- 005 -	01	06	22	2005	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)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☒ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

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
X	EE	INVT	(see text)	YES					

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 December 10, 2004, at 1:17 p.m. CST, an automatic reactor scram occurred while the plant was operating at 100 percent power. The scram was the indirect result of the failure of a 120 volt AC uninterruptible power supply (UPS) on a non-safety related instrument bus. The UPS failed due to a shorted capacitor on an internal circuit board. The loss of the instrument bus resulted in the downshift of the reactor recirculation pumps to slow speed and the lockup of the main feedwater regulating valves. The decrease in coolant flow caused a flow-biased simulated thermal power signal to be sensed in the average power range monitoring system, which actuated the reactor protection system (RPS). The reactor core isolation cooling (RCIC) system was manually started in response to the failure of the feedwater regulating system. RCIC subsequently shut down as designed due to a high reactor water level signal. While it was idle, an alarm actuated indicating the presence of water in the RCIC turbine exhaust drain trap. A conservative decision was made to leave RCIC out of service and to start the high pressure core spray (HPCS) system as needed for reactor water level control. The reactor scram occurred as designed, and reactor water level was maintained above the low-low alarm setpoint. This event is being reported in accordance with 10CFR50.73(a)(2)(IV)(A) as a condition that resulted in the actuation of the RPS, RCIC, and HPCS systems. This event was of minimal safety significance.

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REPORTED CONDITION

On December 10, 2004, at 1:17 p.m. CST, an automatic reactor scram occurred while the plant was operating at 100 percent power. The scram was the indirect result of the failure of a 120 volt AC uninterruptible power supply (**INVT**) on a non-safety related instrument bus. The loss of the instrument bus resulted in the downshift of the reactor recirculation pumps to slow speed and the lockup of the main feedwater regulating valves. The decrease in coolant flow caused a flow-biased simulated thermal power signal to be sensed in the average power range monitoring system, which actuated the reactor protection system (RPS). The reactor core isolation cooling (RCIC) system was manually started in response to the failure of the feedwater regulating system. RCIC subsequently shut down as designed due to a high reactor water level signal. While it was idle, an alarm indicating the presence of water in the RCIC turbine exhaust drain trap actuated. A conservative decision was made to leave RCIC out of service and to start the high pressure core spray (HPCS) system as needed for reactor water level control.

This event is being reported in accordance with 10CFR50.73(a)(2)(IV)(A) as a condition that resulted in the actuation of the RPS, RCIC, and HPCS systems. There were no safety systems out of service at the beginning of the event.

INVESTIGATION AND IMMEDIATE CORRECTIVE ACTIONS

Troubleshooting of the UPS discovered a failed circuit board. This caused the shutdown of the UPS and loss of power to the instrument bus supplying logic circuits in the reactor recirculation system and power for the feedwater control system. The loss of the instrument power supply caused the reactor recirculation pumps to shift to slow speed, and caused the main feedwater regulating valves to lock up at the position corresponding to full reactor power, as well. Both of these are expected responses for this malfunction.

When the RCIC system was manually started, it operated for 11 seconds and then the turbine steam supply valve closed as designed due to a high reactor water level signal. While RCIC was idle, an alarm actuated to indicate the presence of water in the RCIC turbine exhaust line drain trap. This was conservatively assessed by the operators as a condition that could potentially cause damage to the turbine if it was restarted. Subsequent evaluations have determined that the RCIC system could have been restarted with the alarm

actuated. No damage would have occurred, and the system would have performed its design function.

The instrument bus was shifted to an alternate power source by placing the UPS in the "manual bypass" mode. The feedwater regulating system was restored to service at approximately 4:57 p.m. on the same day, and the HPCS system was returned to its standby configuration.

The five reactor water level instrument (**LI**) ranges include narrow range, wide range, and upset range indicators. The individual channels may be monitored on the Emergency Response Information System (ERIS) computer, as well as on recorders installed in the operator's control panels. The maximum reading on the narrow and wide range control panel recorders is 60 inches, however due to input signal and programming configuration the digital readout on the recorders can indicate levels above the 60 inch maximum. The maximum indication on the upset range recorder is 180 inches. The ERIS graphic displays have a greater scale, but in the training simulator, the narrow and wide range levels are clamped at 60 inches maximum. The wide range recorders in the simulator indicate "Over Range" when level is above 60 inches. Following the scram, the control room ERIS graphic displays for the narrow and wide range instruments increased to 88 inches and 144 inches, respectively, and the wide range recorder digital readout increased to 141 inches. These indications correspond to water levels which are above the reference leg taps on the reactor vessel, such that the readings could not be considered valid. The operators were confused by these level indications as they were not consistent with responses seen in the simulator for similar events. The upset range indication did not function properly following the scram, as it is powered by the instrument bus that was de-energized by the UPS failure.

CAUSAL ANALYSIS

The logic power for controlling the static switch is fed through a single filter, creating a single-point vulnerability. Failure at this point caused a loss of UPS output. The UPS is an Elgar Model UPS-503-1-102. The failure of the UPS was caused by the short circuit of a tantalum capacitor (**CAP**) on the static switch silicon-controlled rectifier (**SCR**) drive board. Elgar UPS's are original to the plant and were manufactured in the early 1980's. Most circuit boards in the UPS's have not been replaced. Static switch SCR drive boards have not failed historically at River Bend. A review of external operating experience found no evidence to suggest that SCR drive boards are a significant problem. The

failure is apparently a random phenomenon, and not related to age, environment, or preventative maintenance. Data reviewed thus far indicates that tantalum capacitors are not susceptible to age related failures. Most failures are random in nature, and no clear pattern has been established to predict failure. Since the problem is random, no common mode failure mechanism exists in the other UPS's installed in the plant.

The cause of the RCIC turbine exhaust trap high water level alarm has been attributed to the specific operational cycle that occurred in this event. The discharge line contains vacuum breakers (**VACB**) to preclude siphoning water from the suppression pool. In this event, the short duration of RCIC operation caused the maximum vacuum to develop. The vacuum breakers do not have sufficient flow area to compensate for this scenario. Water was siphoned up the exhaust line from the pool, and was sensed in the drain traps.

CORRECTIVE ACTIONS TO PREVENT RECURRENCE

The failed circuit board in the UPS was replaced, and the UPS was restored to operation. During troubleshooting and maintenance, the instrument bus had been shifted to a separate UPS where it remains. While the malfunction that caused this event does not represent a common-mode failure mechanism, as a conservative measure, plans are being developed to replace the static switch SCR drive board in the other Elgar UPS applications. This will be tracked in the station corrective action program.

The RCIC system was determined to be capable of performing its design function despite the presence of water in the turbine exhaust line. A documented evaluation of this condition has been completed. Plans are being developed to install a nozzle check valve in the RCIC turbine exhaust line. This action is being tracked in the station corrective action program.

Regarding the difference between the responses of the reactor water level indicators in the plant compared to the simulator, a modification has been installed in the simulator to eliminate this disparity.

Engineering design work has been initiated to improve the robustness of both the UPSs and their supplied loads. Detailed single-point vulnerability reviews will be conducted on the UPSs. Methods for hardening the circuits supplied by the UPSs will be examined. Both of these actions are being be tracked in the station corrective action program.

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PREVIOUS OCCURRENCE EVALUATION

A review of reportable events over the last three years found no occurrence of a similar event.

SAFETY SIGNIFICANCE

This event is bounded by analyzed transient for a decrease in reactor recirculation flow in the RBS Updated Safety Analysis Report. As detailed above, the RCIC system was capable at all times of performing its design function. Thus, this event was of minimal safety significance.

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