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January 18, 1996

U.S. Nuclear Regulatory Commission
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Washington, D.C. 20555

Subject: River Bend Station - Unit 1
Docket No. 50-458
License No. NPF-47
Licensee Event Report 50-458/95-012-00
File Nos. G9.5, G9.25.1.3

RBG-42343
RBF1-96-0014

Gentlemen:

In accordance with 10CFR50.73, enclosed is the subject report.

Sincerely,

James J. Fisicaro

JJF/MKB
enclosure

IE22
1/1

cc: U. S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
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700 Galleria Parkway
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Louisiana Department of Environmental Quality
Radiation Protection Division
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Baton Rouge, LA 70884-2135
ATTN: Administrator

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 (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
River Bend Station	05000-458	1 OF 5

TITLE (4)
MANUAL SCRAM DUE TO RECIRCULATION PUMP TRANSIENT

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
									NA	NA
12	19	95	95	-- 012 --	00	1	18	96	NA	DOCKET NUMBER

OPERATING MODE (9)	1
POWER LEVEL (10)	85

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

20.2201(b)	20.2203(a)(2)(v)	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)	X 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)
David Lorfing-Supervisor, Licensing	(504) 381-4157

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	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 December 19, 1995 with the reactor at approximately 85 percent power, one recirculation pump tripped followed shortly by the downshift of the other pump. The resulting core flow appeared to place the plant in an unanalyzed power-to-flow condition. To avoid possible instabilities, the reactor was manually scrammed.

A Significant Event Response Team (SERT) was established to investigate this event. The investigation determined that both of the recirculation pumps functioned as designed in response to a cavitation interlock signal. The root cause of this event has been determined to be a spurious actuation of this cavitation interlock. The most likely cause of the spurious actuation was determined to be a loose connection in the trip instrumentation circuitry. Contributing conditions involved the reduction of the setpoint margin due to a planned reduction of reactor pressure, the end-of-cycle coastdown and the as-found instrument drift.

Immediate corrective action was taken to recalibrate the instruments. The loose connection found during RF6 has been repaired. On-line monitoring of this interlock is being established. In addition, an evaluation is being conducted to investigate the deletion or bypassing of this trip function. No evidence of a power oscillation or power level excursion was detected. The operators acted safely and conservatively by manually scramming the reactor. All safety systems functioned as designed and this event is not considered safety significant.

REPORTED CONDITION:

On December 19, 1995 with the reactor at approximately 85 percent power, the "B" reactor recirculation pump (*AD-P*) tripped. About twenty-two seconds later, the "A" reactor recirculation pump downshifted to slow speed. The loss of one recirculation pump followed by the downshift of the other pump appeared to place the plant in an unanalyzed power-to-flow condition. While no evidence of a power oscillation or power level excursion was detected, the operators acted safely and conservatively by manually scramming the reactor. This event is reported pursuant to 10CFR50.73(a)(2)(iv) to document this manual actuation of engineered safety features.

INVESTIGATION:

The "B" reactor recirculation pump tripped at 08:40:38. About twenty-two seconds later, the "A" reactor recirculation pump downshifted to slow speed. The loss of one recirculation pump followed by the downshift of the other pump appeared to place the plant in an unanalyzed power-to-flow condition. The actual core flow conditions for this scenario resulted in erroneous flow information being indicated in the control room. During this event, with one recirculation pump being tripped and the other pump in slow speed, the total core flow indication provided to the operator was skewed such that the indicated total flow was less than the actual core flow. By design, the logic for the core flow summer assumes that the flow sensed in an inactive loop (recirculation pump tripped) is in the reverse direction and therefore subtracts the inactive loop flow from the active loop flow to arrive at a total core flow. For a condition with the operating pump in fast speed, this logic appropriately models the actual core flow conditions; however, for this event with the operating pump in slow speed, the flow in the inactive loop was not reversed. This was due to the fact that the flow in the active loop did not overcome the natural circulation in the inactive loop. Although forward flow was maintained in the inactive loop, the summing logic subtracted it from the operating loop flow and resulted in indicated core flow being lower than actual core flow. To avoid possible instabilities, the reactor was manually scrammed in approximately six minutes.

A Significant Event Response Team (SERT) was established to determine the cause of the reactor recirculation pump transient. This investigation determined that both of the recirculation pumps functioned as designed in response to a cavitation interlock (*IEL*) signal. Specifically, the team determined that the recirculation pump cavitation interlock circuitry (independent circuitry for each pump) sensed an inadequate differential temperature between the reactor steam dome and the recirculation pump suction. The temperature difference between the steam dome and recirculation pump suction line is used as an indication of net positive suction head. As a result of the delta-T cavitation interlock being met initially for the "B" pump and subsequently for the "A" pump, the control logic caused the "B" pump to trip to off (per its design with the opposite pump in fast speed) and the "A" pump to transfer to slow speed (per its design with the opposite pump not running.)

By design, a reactor recirculation pump downshift should occur if one or more of the following conditions exist: 1) feedwater flow less than 25%, 2) difference between the reactor steam dome temperature and recirculation temperature less than or equal to 8.6°F, 3) reactor water level 3, or 4) end of cycle recirculation pump trip. Each of the downshift signals, except the delta-T trip, provide simultaneous downshift signals to both recirculation pumps. Since the pumps did not trip simultaneously, it was concluded that the trips were initiated by the steam dome temperature to recirculation temperature differential logic circuitry. A review of the initial and subsequent plant and system conditions supported this conclusion.

After the completion of the immediate corrective actions (i.e., recalibration of the trip instruments) the plant was restarted. During this short run before the start of Refueling Outage (RF) 6, the "B" recirculation pump spuriously tripped again on January 2, 1996, due to the actuation of the delta-T cavitation interlock. This event did not result in the subsequent downshiting of the "A" pump or the scramming of the plant as occurred during the December 19, 1995 event.

Extensive troubleshooting of this circuitry was conducted during RF 6. This troubleshooting did identify one cable in the "B" pump's suction temperature input to the delta-T circuitry that was not terminated tightly and had damaged insulation. Agitation of this cable while monitoring the cable's electrical resistance did result in about a two ohm change that was sufficient to exceed the interlock setpoint.

No recent similar events have been reported at River Bend; however, Industry Operating Experience information identified two recent similar events at Perry and Clinton.

The Perry event (LER 50-440/93-015) occurred at 100 percent power and involved both recirculation pumps downshifting to slow speed at the same time due to instrument failure in the delta-T cavitation protection interlock. The Clinton event (LER 50-461/95-005) also occurred at 100 percent power and involved both recirculation pumps downshifting to slow speed at the same time due to a delta-T cavitation interlock instrument failure. Operators at both plants manually scrammed their reactors due to thermal hydraulic instability concerns.

River Bend is not susceptible to the sequence of events as described in the above industry LERs. A modification, implemented at River Bend before the above industry events occurred, separated the downshift logic circuitry of the recirculation pumps such that a single recirculation loop steam dome to recirculation suction differential temperature interlock signal would not downshift both pumps.

ROOT CAUSE EVALUATION

The root cause for the initial recirculation pump transient is the spurious actuation of the delta-T cavitation interlock. The most likely cause for this spurious actuation is fluctuations in the electrical resistance of the instrumentation circuitry due a slightly loose connection. Contributing causes involve the reduction of the setpoint margin due to a planned reduction of the reactor pressure, the end of cycle coastdown and the as-found instrument drift. The reactor pressure had been reduced in an effort to curb an upward trend in the unidentified drywell leakage rate.

The loss of the "B" pump created a pressure transient which, in conjunction with the existing plant conditions, resulted in a delta-T cavitation interlock downshift of the "A" pump.

The ability of the operator to accurately assess the true power to flow condition was complicated due to the unique recirculation pump trip configuration and the summing logic used in the total core flow indication. However, the operators responded correctly to the indicated flow condition by inserting a manual scram.

CORRECTIVE ACTIONS

Prior to restarting the reactor, the recirculation pump cavitation interlock control loops were recalibrated to correct the differential temperature sensed between the recirculation pump suction and the reactor head. Additional monitoring of the delta-T cavitation interlock was performed during startup. This data was used to support additional troubleshooting that was planned for RF6.

Subsequently, the plant has been shut down as scheduled for RF 6. During this scheduled refueling, the circuits of this trip system were inspected and electrically tested. The cable found with the damaged insulation and slightly loose terminal connection was repaired.

Selected Emergency Response Information System (ERIS) computer points and plant process computer points are being added to provide on-line capabilities to monitor the conditions being sensed for the recirculation pump suction line and steam dome temperatures to the cavitation interlock trip unit. The plant process computer points will be used to alert the operators of low delta-T conditions.

In addition, an evaluation is being conducted to determine the need for this cavitation interlock with regard to optimizing safe operation. This evaluation will investigate the possible deletion or bypassing of this trip function under certain conditions. Pending the results of this evaluation, those actions that will serve to enhance the safe and reliable operation of River Bend will be pursued.

An evaluation to determine the appropriate corrective actions to address the core flow indication involved in this event is in progress. This evaluation will consider the need for design and/or procedural changes to provide a long-term fix.

In the near term, this event will be reviewed by the operators during their next requalification class.

SAFETY ASSESSMENT

The primary purpose of the reactor recirculation system is to provide forced circulation through the reactor core to achieve full power operation and permit variations in power level without control rod movement. Control interlocks are provided for the reactor recirculation pumps to automatically downshift from fast to slow speed or trip the pumps as appropriate. These controls are provided to prevent cavitation and mitigate the effects of various analyzed operational transients involving reactor water level and reactivity. These interlocks functioned as designed in response to the spurious delta-T signal.

While the core flow indication available to the operator at the time of this event indicated that the plant was in an unanalyzed condition, a subsequent analysis concluded that the actual plant condition during the transient placed the plant in the analyzed stability region B on the power-to-flow map (region requiring immediate exit by inserting control rods or by increasing core flow by means of opening flow control valves). No evidence of a power oscillation or power level excursion was detected. The operators acted safely and conservatively by manually scramming the reactor in a timely fashion. The plant was safely shut down and all safety systems functioned as designed. Therefore this event is not considered safety significant.

Note: Energy Industry Identification Codes are in text as (*XX*).