



**ENTERGY**

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James J. Fisicaro  
Director  
Nuclear Safety

December 27, 1995

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Mail Stop P1-37  
Washington, D.C. 20555

Subject: River Bend Station - Unit 1  
Docket No. 50-458  
License No. NPF-47  
Licensee Event Report 50-458/95-010-00  
File Nos. G9.5, G9.25.1.3

RBG-42310  
RBF1-95-0313

Gentlemen:

In accordance with River Bend Station Operating License NPF-47, Section 2.E, enclosed is the subject report.

Sincerely,

JJF/RMM/jr  
enclosure

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

NRC Sr. Resident Inspector  
P. O. Box 1051  
St. Francisville, LA 70775

INPO Records Center  
700 Galleria Parkway  
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Mr. C. R. Oberg  
Public Utility Commission of Texas  
7800 Shoal Creek Blvd., Suite 400 North  
Austin, TX 78757

Louisiana Department of Environmental Quality  
Radiation Protection Division  
P.O. Box 82135  
Baton Rouge, LA 70884-2135  
ATTN: Administrator

<b>NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION</b> (4-95)					<b>APPROVED BY OMB NO. 3150-0104</b> <b>EXPIRES 04/30/98</b> <small>ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST 500 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-8 P33) 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.</small>																															
<b>LICENSEE EVENT REPORT (LER)</b> (See reverse for required number of digits/characters for each block)																																				
<b>FACILITY NAME (1)</b> River Bend Station					<b>DOCKET NUMBER (2)</b> 05000-458			<b>PAGE (3)</b> 1 of 4																												
<b>TITLE (4)</b> Reactor Thermal Power Limit Exceeded Due to Failure to Consider Required Heat Balance Inputs																																				
<b>EVENT DATE (5)</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">MONTH</td> <td style="width: 33%;">DAY</td> <td style="width: 33%;">YEAR</td> </tr> <tr> <td>11</td> <td>30</td> <td>95</td> </tr> </table>			MONTH	DAY	YEAR	11	30	95	<b>LER NUMBER (6)</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">YEAR</td> <td style="width: 33%;">SEQUENTIAL NUMBER</td> <td style="width: 33%;">REVISION NUMBER</td> </tr> <tr> <td>95</td> <td>-- 10 --</td> <td>00</td> </tr> </table>			YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	95	-- 10 --	00	<b>REPORT DATE (7)</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">MONTH</td> <td style="width: 33%;">DAY</td> <td style="width: 33%;">YEAR</td> </tr> <tr> <td>12</td> <td>27</td> <td>95</td> </tr> </table>			MONTH	DAY	YEAR	12	27	95	<b>OTHER FACILITIES INVOLVED (8)</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">FACILITY NAME</td> <td style="width: 40%;">DOCKET NUMBER</td> </tr> <tr> <td>N/A</td> <td>05000</td> </tr> <tr> <td>FACILITY NAME</td> <td>DOCKET NUMBER</td> </tr> <tr> <td>N/A</td> <td>05000</td> </tr> </table>		FACILITY NAME	DOCKET NUMBER	N/A	05000	FACILITY NAME	DOCKET NUMBER	N/A	05000
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<b>OPERATING MODE (9)</b> 1			<b>THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)</b>																																	
<b>POWER LEVEL (10)</b> 90.0			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">20.2201(b)</td> <td style="width: 33%;">20.2203(a)(2)(v)</td> <td style="width: 33%;">50.73(a)(2)(i)</td> <td style="width: 33%;">50.73(a)(2)(viii)</td> </tr> <tr> <td>20.2203(a)(1)</td> <td>20.2203(a)(3)(i)</td> <td>50.73(a)(2)(ii)</td> <td>50.73(a)(2)(x)</td> </tr> <tr> <td>20.2203(a)(2)(i)</td> <td>20.2203(a)(3)(ii)</td> <td>50.73(a)(2)(iii)</td> <td>73.71</td> </tr> <tr> <td>20.2203(a)(2)(ii)</td> <td>20.2203(a)(4)</td> <td>50.73(a)(2)(iv)</td> <td><input checked="" type="checkbox"/> OTHER</td> </tr> <tr> <td>20.2203(a)(2)(iii)</td> <td>50.36(c)(1)</td> <td>50.73(a)(2)(v)</td> <td rowspan="2">Specify in Abstract below or in NRC Form 366A</td> </tr> <tr> <td>20.2203(a)(2)(iv)</td> <td>50.36(c)(2)</td> <td>50.73(a)(2)(vii)</td> </tr> </table>							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)	50.73(a)(2)(iv)	<input checked="" type="checkbox"/> 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)				
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<b>LICENSEE CONTACT FOR THIS LER (12)</b>																																				
<b>NAME</b> D. N. Lorfing, Supervisor - Licensing					<b>TELEPHONE NUMBER (Include Area Code)</b> 504-381-4157																															
<b>COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)</b>																																				
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDs	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDs																											
<b>SUPPLEMENTAL REPORT EXPECTED (14)</b>					<b>EXPECTED SUBMISSION DATE (15)</b>		MONTH	DAY	YEAR																											
<b>YES</b> (If yes, complete EXPECTED SUBMISSION DATE)					<b>X NO</b>																															
<b>ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)</b>																																				
<p>On November 30, 1995, with the plant at 90 percent power (Operational Condition 1) and coasting down for Refueling Outage 6, it was discovered during an industry events review that the reactor thermal power limit had been previously exceeded. The licensed thermal power limit had been exceeded by about 1.2 MWt for about 7 hours on October 11, 1995. This plant condition is reportable pursuant River Bend Station (RBS) Operating License, NPF-47, Section 2.E.</p> <p>There were two root causes associated with this event. The first was determined to be a design error in that the vendor supplied process computer (heat balance calculation) had not accurately accounted for all flow inputs into the reactor vessel from the control rod drive system. The second was less than adequate reviews of three subsequent design modifications. Two of these modifications impacted the control rod drive flow inputs to the heat balance calculation but due to inadequate reviews, the changes were not reflected in the calculation. The third recalibrated reactor water clean-up flow transmitters but did not reflect the induced flow error in the heat balance calculation.</p> <p>The licensed reactor power thermal limit was exceeded by about 1.2 MWt (0.04% rated thermal power) for approximately 7 hours. An engineering evaluation concluded that this event had little safety significance.</p>																																				

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## REPORTED CONDITION

On November 30, 1995, with the plant at 90 percent power (Operational Condition 1) and coasting down for Refueling Outage 6, it was discovered during a review of recent industry events (Nuclear Network report PS 4577) that the licensed reactor thermal power limit had been previously exceeded. This limit had been exceeded by about 1.2 MWt (0.04 % rated thermal power) for about 7 hours on October 11, 1995. This plant condition is reportable pursuant River Bend Station (RBS) Operating License, NPF-47, Section 2.E.

## INVESTIGATION

During a review of an industry event report concerning the failure to account for the reactor recirculation (RCS) pump seal flow in the reactor heat balance calculation, it was concluded that RBS was susceptible to the same error. The flow to the RCS pump seals branch upstream of the CRD system flow sensor which provides input to the plant process computer (used for heat balance calculation). As a result, the unmonitored flow was not considered in the heat balance calculation which resulted in non-conservative heat balance results.

Additional engineering reviews identified two modifications which similarly diverted CRD flow to the reactor vessel resulting in a non-conservative impact on the heat balance. These were the reactor water cleanup (WCS) system pump seal purge and reference leg back-fill system. In addition, as part of a leak detection system improvement, a modification was performed to calibrate the WCS flow sensors for cold conditions. In addition to performing leak detection functions, the suction flow sensor provides WCS flow input into the heat balance calculation (via plant process computer). As a result of this modification, the heat balance flow input was erroneously low at rated conditions.

The error attributable to the unaccounted CRD flow was calculated to be approximately 1.1 MWt (0.04 % rated thermal power) for the RCS pump seal flow and 0.7 MWt (0.02 % rated thermal power) for the WCS pump seal flow. The error attributed to the WCS flow calibration error was calculated to be about 0.4 MWt (0.01 % rated thermal power). The error associated with the reference leg back-fill flow was negligible.

Since the RCS pump seal flow error has been in existence since early plant operation, it is possible that the thermal power limit may have been exceeded prior to Cycle 6. Based on the magnitude of the error, the maximum the limit would have been exceeded during this time period would have been less than 1.0 MWt when considering conservatism in the calculation, the WCS flow error discussed in the previous paragraph, and the administrative practice of limiting thermal power to 2893.5 MWt.

The CRD system water supply to the WCS pump seals and the Reference Leg Back-fill system was installed during Refueling Outage 5 (April - July, 1994). Therefore, only the current operating cycle, Cycle 6, was affected by these modifications. An engineering evaluation concluded that the total heat balance calculation error was about 1.8 MWt for this cycle. This resulted in an eight hour thermal power average of 2895.2

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River Bend Station	05000-458	<table border="1"><tr><th data-bbox="1032 263 1094 300">YEAR</th><th data-bbox="1094 263 1252 300">SEQUENTIAL NUMBER</th><th data-bbox="1252 263 1338 300">REVISION NUMBER</th></tr></table>	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	3 of 4
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
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MWt, 1.2 MWt (0.04% rated thermal power) over the licensed limit. A review of Cycle 6 power history concluded that the limit was exceeded for 7 hours on October 11, 1995. Since the plant was in End-of-Cycle coast-down and at approximately 90% power at time of discovery, no reduction in power was necessary as a result of the identified error.

**ROOT CAUSE**

There were two root causes associated with this event. The first was determined to be a design error in that the vendor supplied process computer (heat balance calculation) had not accurately accounted for all flow inputs into the reactor vessel from the CRD system. The second was less than adequate reviews of three subsequent design modifications. Two of these modifications impacted the control rod drive flow inputs to the heat balance calculation but due to inadequate reviews, the changes were not reflected in the calculation. The third modification recalibrated WCS flow transmitters but did not reflect the induced flow error in the heat balance calculation.

A review of recent Licensee Event Reports was performed for similar events. Although there have been events reported associated with the RBS modification process, no similar events associated with the heat balance calculation were identified.

**CORRECTIVE ACTIONS**

Since all new plant designs will be implemented as modifications, there is no recommended corrective action for preventing another original design error. Consequently, the corrective actions taken below to address deficiencies in the modification process will address this condition.

As part of the RBS performance improvement initiatives the modification process has significantly changed since the development of the modifications described above. It is believed that the current process would have identified this issue and, as a result, no additional process changes were identified. These improvements included, in part, the addition of a Reactivity Impact Program Review checklist as part of the modification review process. This checklist contains questions specific to the heat balance calculation and other associated core/vessel parameters. Any questions indicating that these calculations/parameters are impacted will require a review by reactor engineering.

To correct the error caused by diversion of CRD flow to the RCS and WCS pump seals and the Reference Leg Back-fill System, the indicated CRD flow rate input to the reactor heat balance will be adjusted by adding a constant flow input to the heat balance calculation. WCS flow indication will be corrected by applying a temperature dependent correction factor to the WCS term in the calculation.

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To heighten the awareness of this issue, a heat balance study was distributed to each applicable system engineer along with a discussion of this event. The study lists each input device and shows the effects of each on the heat balance calculation.

A review of changes to plant systems and instrumentation associated with the reactor heat balance will be performed. This will include review of software change documentation of process computer points that input into the reactor heat balance.

Since several similar industry events have occurred recently, RBS will continue to monitor industry reports for any additional generic issues that may have an impact on the issues associated with this event.

**SAFETY ASSESSMENT**

The licensed reactor power thermal limit was exceeded by about 1.2 MWt (0.04 % rated thermal power) for about 7 hours. This is below the 102 % analyzed power limit and had insignificant impact on core thermal design limits. Inputs from the heat balance calculation are used in the Core Thermal Limit calculation; however, since the magnitude of the identified error was small, the impact was insignificant. As a result, this event was of little safety significance.

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