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Rick J. King
Director
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May 29, 1996

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

Subject: River Bend Station - Unit 1
Docket No. 50-458
License No. NPF-47
Licensee Event Report 50-458/96-010-00

File Nos.: G9.5, G9.25.1.3

RBG-42945
RBF1-96-0215

Gentlemen:

In accordance with 10CFR50.73, enclosed is Licensee Event Report 50-458/96-010-00. This is an interim report, the root cause and corrective action plan is expected August 30, 1996.

Sincerely,

A handwritten signature in cursive script, appearing to read "Rick J. King".

RJK/BMB/kvm
enclosure

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9606040100 960529
PDR ADOCK 05000458
S PDR

Handwritten initials, possibly "JL" or "JK", followed by a vertical line.

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

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

INPO Records Center
700 Galleria Parkway
Atlanta, GA 30339-3064

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

NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION (4-95)					APPROVED BY OMB NO. 3150-0104 EXPIRES 04/30/98 <small>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.</small>						
LICENSEE EVENT REPORT (LER) (See reverse for required number of digits/characters for each block)											
FACILITY NAME (1) River Bend Station					DOCKET NUMBER (2) 05000-458			PAGE (3) 1 of 5			
TITLE (4) Reactor Safety Limit Minimum Critical Power Ratio calculation found non-conservative											
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	
04	29	96	96	-- 010 --	00	05	29	96	N/A	05000	
									FACILITY NAME	DOCKET NUMBER	
									N/A	05000	
OPERATING MODE (9)		1		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
POWER LEVEL (10)		100.0		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)		OTHER	
				20.2203(a)(2)(iii)		50.36(c)(1)		<input checked="" type="checkbox"/> 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 D. N. Lorring, Supervisor - Licensing								TELEPHONE NUMBER (Include Area Code) 504-381-4157			
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)											
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDOS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDOS		
SUPPLEMENTAL REPORT EXPECTED (14)								EXPECTED SUBMISSION DATE (15)			
<input checked="" type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE).								MONTH DAY YEAR 08 30 96			
<input type="checkbox"/> NO											
ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)											
<p>On April 29, 1996, with the plant at 100 percent power (Mode 1), it was determined that the RBS Cycle 7 Reactor Safety Limit Minimum Critical Power Ratio (SLMCPR) value given in the Technical Specifications was non-conservative. This condition was determined to apply to RBS and has existed since the beginning of the current fuel cycle. If a limiting transient occurred, the plant could have been operated in a condition with insufficient margin to the required operating thermal limits and may have exceeded the SLMCPR. This analytical condition is conservatively being reported pursuant to 10 CFR 50.73 (a)(2)(v) as a condition that alone could have prevented the fulfillment of a safety function.</p> <p>The root causes associated with this event are currently under investigation by General Electric (GE). The results of this and RBS's own investigation will be included in a supplement to this report. Corrective actions taken to date ensure safe operation of the plant for the remaining portion of this fuel cycle.</p> <p>The revised reactor SLMCPR and associated Operating Limit Minimum Critical Power Ratio (OLMCPR) thermal limits have not been violated during Cycle 7 operation. An engineering evaluation concluded that this event had little safety significance.</p>											

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REPORTED CONDITION

On April 29, 1996, with the plant at 100 percent power (Mode 1), it was determined the Reactor Safety Limit Minimum Critical Power Ratio (SLMCPR) value given in the Technical Specifications was non-conservative. This condition was determined to apply to RBS and has existed since the beginning of the current fuel cycle. If a limiting transient occurred, the plant could have been operated in a condition with insufficient margin to the required operating thermal limits and may have exceeded the SLMCPR. This analytical condition is conservatively being reported pursuant to 10 CFR 50.73 (a)(2)(v) as a condition that alone could have prevented the fulfillment of a safety function.

BACKGROUND

As discussed in the BASES of Technical Specification 3.2.2, MCPR is a ratio of the fuel assembly power that would result in the onset of boiling transition to the actual fuel assembly power. The MCPR Safety Limit (SLMCPR) is set so the fuel rods avoid boiling transition if this limit is not violated. The operating limit MCPR (OLMCPR) is established to ensure that no fuel damage results during anticipated operational occurrences (AOOs). The core would have to be operating at the OLMCPR when the limiting transient event occurs to approach the SLMCPR. Reactor operations are such that the MCPR is greater than the OLMCPR.

INVESTIGATION

During the core design work for another BWR, Grand Gulf Nuclear Station, a plant and cycle specific calculation was performed by General Electric (GE) for the SLMCPR. The SLMCPR value calculated was in excess of the GE11 fuel generic value of 1.07. Because the other BWR and RBS are BWR/6 designs and operated by the same company, RBS personnel were alerted to the cycle specific value exceeding the generic value. At that time, GE believed that the concern with the generic SLMCPR value was solely a plant specific problem related to a transition cycle. At the request of RBS personnel, a study was undertaken by GE to determine the RBS Cycle 7 specific SLMCPR. GE11 fuel was introduced during the January, 1996, RBS refueling outage (RF) 6.

Initial, draft results from the study were provided to RBS on March 25, 1996, indicating that the RBS Cycle 7 specific SLMCPR should be 1.05 at the beginning of cycle (BOC), 1.08 at the point in the cycle of peak hot excess reactivity, about 9 months into Cycle 7, and 1.08 at the end of cycle. A condition report was issued on March 25, 1996, to communicate the potential problem with the SLMCPR. In response to the potential problem, RBS implemented a change to the core monitoring software (3D-MONICORE) adding 0.02 to the operating limit minimum critical power ratio (OLMCPR) as a conservative measure. This change of 0.02 was conservative by 0.01 to the draft result of 1.08 for SLMCPR at the point of peak hot excess reactivity ($1.08 - 1.07 = 0.01$).

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GE verified their calculation on April 16, 1996. The verified results indicated that the SLMCPR for RBS Cycle 7 should be 1.10 at the point of peak hot excess reactivity. In response to this verified information, RBS implemented a further penalty of 0.03 to the OLMCPR for all power and flow conditions, relative to the Core Operating Limits Report (COLR). Additionally, the rated OLMCPR for GE11 fuel was further penalized by implementing an additional increase of 0.01 that would not ordinarily have been implemented until approximately March/April 1997. The NRC was verbally notified of this condition as an informational report because at that time there was no impact on current safe operation.

On April 17, 1996, an industry/GE meeting was held with the NRC to discuss this issue. The actions proposed at this meeting included; GE development of the necessary changes to update the COLR which will be used to preserve the margin to SLMCPR and submittal of Licensing Topical Reports with the final resolution.

Based on additional information received from GE, RBS determined on April 29, 1996, that the BOC SLMCPR was non-conservative and should be increased from 1.07 to 1.08. RBS Technical Specification 2.1.1.2 states that with core flow $\geq 10\%$ and steam dome pressure ≥ 785 psig the SLMCPR for two recirculation loop operation is 1.07 (same as the GE11 generic SLMCPR). Therefore, as a result of the RBS Cycle 7 specific SLMCPR calculation, the existing Technical Specification and generic SLMCPR are non-conservative. This also applies to the SLMCPR for single loop operation (ref. Technical Specification 2.1.1.2).

On May 13, 1996, additional (draft) information from GE indicated this problem may also affect OLMCPR during off-rated conditions by the ratio of 1.10/1.07. Since the latest action taken by RBS was to add 0.03 to the OLMCPR at all power and flow conditions, an administrative limit of 0.950 on the ratio of MCPR/OLMCPR, Maximum Fraction of the Limiting CPR (MFLCPR), was put in place. This limit encompasses the adder of 0.03 implemented previously, and conservatively bounds plant operation for all power and flow conditions.

ROOT CAUSE

GE is investigating the cause of this condition. Therefore, GE will lead in the identification of the root cause and corrective actions associated with this event. The root cause and corrective action is expected from GE by July 31, 1996. RBS will review GE's findings and determine the need for additional corrective actions. A supplement report, including the similarity review, will be issued no later than August 30, 1996.

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INITIAL CORRECTIVE ACTIONS

On March 26, 1996, RBS implemented a 0.02 penalty to the OLMCPR for all power and flow conditions and all fuel types in the core monitoring system. This penalty of 0.02 was conservative by 0.01 to the unverified SLMCPR value of 1.08.

RBS issued a Nuclear Network entry regarding the problem with the RBS SLMCPR calculations on April 11, 1996.

Verified information was received from GE on April 16, 1996. The core monitoring system was modified to increase the OLMCPR for all power and flow conditions and all fuel types by 0.03 (1.10-1.07).

Additionally, the rated OLMCPR for GE11 fuel was increased by another 0.01 to account for the increase in the rated GE11 limit at approximately March/April 1997. Upon determining the BOC SLMCPR was non-conservative and reportable, no additional corrective actions were necessary because the previously implemented penalty bounded the BOC non-conservative increase of 0.01 (1.08-1.07).

On May 13, 1996, additional (draft) information from GE indicated the impact of the error in SLMCPR may be greater than the 0.03 adder to the OLMCPR during off-rated conditions. Actions taken at that time included administratively limiting MFLCPR to ≤ 0.950 , which conservatively bounds operation at all power and flow conditions.

With the current corrective actions enveloping the entire fuel cycle, the operation of RBS will continue to support the assumptions in the safety analysis. Therefore, no further corrective actions are necessary to ensure the continued safe operation of RBS.

FINAL CORRECTIVE ACTIONS

GE has issued a 10CFR21 notification on this condition and RBS has implemented the necessary actions to protect the fuel. In addition, at RBS request, GE is developing the root cause and corrective action plan. Upon receiving this information RBS will conclude its internal root cause evaluation and determine what, if any, additional corrective actions will be necessary. Technical Specification and/or COLR changes will also be made as needed. Any changes made to the OLMCPR curves shown in the COLR will be implemented in the core monitoring system by RBS.

SAFETY ASSESSMENT

As discussed in the BASES of Technical Specification 3.2.2, MCPR is a ratio of the fuel assembly power that would result in the onset of boiling transition to the actual fuel assembly power. The MCPR Safety

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Limit (SL) is set such that 99.9% of the fuel rods avoid boiling transition if the limit is not violated (refer to the BASES for SL 2.1.1.2). The operating limit MCPR is established to ensure that no fuel damage results during anticipated operational occurrences (AOOs). Although fuel damage does not necessarily occur if a fuel rod actually experiences boiling transition, the critical power at which boiling transition is calculated to occur has been adopted as a fuel design criterion. Reactor operations are such that the MCPR is much greater than the OLMCPR.

Operation with a non-conservative SLMCPR may lead to a condition in which the SLMCPR is challenged. However, as stated previously, the core would have to be operating at the OLMCPR when the limiting transient event occurs. Compliance with the OLMCPR is monitored via the ratio of the OLMCPR to the MCPR (MFLCPR). A ratio of ≤ 1.00 indicates that the MCPR is greater than the OLMCPR. This limit ensures that the SLMCPR would be preserved.

A minimum MFLCPR ratio to incorporate the new information may be described such that the SLMCPR would be preserved by taking the current minimum OLMCPR from the COLR report and dividing by the sum of the OLMCPR value and the SLMCPR deficit, (i.e. $1.22 \div (1.22+0.03) = 0.976$). Alternatively, a limit based on the latest draft information from GE can be defined as the ratio of the current Technical Specification SLMCPR to the new SLMCPR (i.e., $1.07/1.10 = 0.972$).

The maximum ratio for Cycle 7 prior to modifying the core monitoring system and setting the administrative controls was 0.88, indicating that the SLMCPR was never in danger of being challenged since the beginning of cycle 7. Therefore, the non-conservative value of SLMCPR contained in the Technical Specifications has not been a safety concern as compared with Cycle 7 operation to date.

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