GULF STATES UTILITIES COMPANY

RIVER BEND STATION POST OFFICE BOX 220 ST. FRANCISVILLE, LOUISIANA 70775

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U.S. Nuclear Regulatory Commission
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Gentlemen:

River Bend Station - Unit 1
Docket No. 50-458

Gulf States Utilities Company (GSU) hereby files an application to amend the River Bend Station - Unit 1 Technical Specifications, Appendix A to Facility Operating License NPF-47, pursuant to 10CFR50.90. This application is filed to revise the Technical Specification (TS) Surveillance Requirements for TS 4.5.1, Emergency Core Cooling Systems (ECCS) - Operating to correct minor non-conservative calculational errors discovered during a self-initialized SSFI. This change will also provide consistency in the calculational method of ECCS pump operability limits.

Attachment 1 to this letter provides the justification for this proposed revision to the Technical Specifications as shown in Attachment 3. Attachment 2 furnishes the no significant hazards consideration discusssion.

If you have any questions or comments, please contact Mr. Leif L. Dietrich of my staff at (504) 381-4866.

Sincerely,

W. H. Odell
Manager - Oversight
River Bend Nuclear Group

LAE/LLD/WJS

Attachments

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

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

Mr. Edward T. Baker
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

Mr. Glenn Miller
Radiation Protection Division
Louisiana Department of Environmental Quality
P.O. Box 14690
Baton Rouge, LA 70898

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

STATE OF LOUISIANA)

PARISH OF WEST FELICIANA)

Docket No. 50-458

In the Matter of)

GULF STATES UTILITIES COMPANY)

(River Bend Station - Unit 1)

AFFIDAVIT

W. H. Odell, being duly sworn, states that he is a Manager-Oversight for Gulf States Utilities Company; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission the documents attached hereto; and that all such documents are true and correct to the best of his knowledge, information and belief.

W. H. Odell

Subscribed and sworn to before me, a Notary Public in and for the State and Parish above named, this 22nd day of December, 1992. My Commission expires with Life.

Claudia F. Hurst
Claudia F. Hurst
Notary Public in and for
West Feliciana Parish, Louisiana

ATTACHMENT 1

GULF STATES UTILITIES COMPANY
RIVER BEND STATION
DOCKET 50-458/LICENSE NO. NPF-47

EMERGENCY CORE COOLING SYSTEMS-OPERATING
(91-09)

DOCUMENT INVOLVED: Technical Specifications

ITEM: Surveillance Requirement 4.5.1.b.2

Surveillance Requirement 4.5.1.b.3

REASON FOR REQUEST:

During the performance of a GSU sponsored Safety System Functional Inspection (SSFI) of the high pressure core spray (HPCS) system, an inconsistency between Technical Specification Surveillance Requirement (TSSR) 4.5.1.b.3 and the Bases for Technical Specification (TS) 3/4.5.1 Emergency Core Cooling Systems - Operating was identified. Specifically, TSSR 4.5.1.b.3 requires verifying that the HPCS pump develops a flow of at least 5010 gpm with a pump differential pressure (dp) greater than or equal to 399 psid. The Bases for TS 3/4.5.1 and the HPCS design requirements state that the HPCS is designed to deliver greater than or equal to 467/1400/5010 gpm at a reactor to suction source dp (reactor dp) of 1177/1147/200 psid respectively.

During the SSFI, the assessment team substituted the TSSR pump dp of 399 psid the flow rate of 5010 gpm and the calculated system resistance into the equations developed in Stone and Webster calculation PN-289 (HPCS system heads, flow rates and orifices' Δ P) and calculated the reactor dp. The calculated reactor dp of 150 psid was less than the required reactor dp of 200 psid specified in the HPCS design documents and the Bases for TS 3/4.5.1.

As a result of the concerns identified by the assessment team, GSU Design Engineering generated calculation G13.18.4.0*16-0 entitled HPCS Flow vs. Reactor Pressure. The purpose of this calculation was to determine whether the 399 psid operational limit specified in TSSR 4.5.1.b.3 is correct and, if not, to determine the correct operational limit to ensure that the HPCS pump will meet it's design basis. This calculation differed from PN-289 in that the system resistances used were the actual resistances measured during the performance of the HPCS preoperational test (1-PT-203) rather than calculated system resistances. Based upon the results of calculation G13.18.4.0*16-0, it was concluded that the pump dp operability limit of 399 psid is not sufficient to ensure that the HPCS pump can deliver 5010 gpm with a reactor dp of 200 psid. The operability limit for the HPCS pump should be 415 psid.

Based upon the results of G13.18.4.0*16-0 and the potential safety significance of the improperly specified operability limit, GSU Design Engineering also performed a similar evaluation on the operability limits for the low pressure core spray (LPCS) and residual heat removal (RHR) pumps. GSU calculations G13.18.4.0*17-0 and G13.18.4.0*18-0 RHR Flow vs Reactor Pressure and LPCS Flow vs Reactor Pressure, respectively, were generated. As with the HPCS calculation, actual system resistance as measured in the RHR (1-PT-204) and LPCS (1-PT-205) preoperational tests were used. Based upon these calculations, it was concluded that 1). The LPCS pump dp specified in TSSR 4.5.1.b.1 is correct and 2). the RHR pump dp specified in TSSR 4.5.1.b.2 should be increased from 100 psid to 102 psid.

After concluding that the operability limits specified for the HPCS and RHR pumps were incorrect and calculating the new operability limit, GSU reviewed the data from all previous surveillance on the HPCS and RHR pumps to ensure that the pumps had been operable when required. Based upon this review, it was concluded that these pumps were operable at all required times.

DISCUSSION:

The emergency core cooling systems (ECCS) is designed to provide protection against postulated loss-of-coolant accidents (LOCA) caused by ruptures in primary system piping. The functional requirements (for example, coolant delivery rates) are such that the system performance under all LOCA conditions postulated in the design satisfies the requirements of Paragraph 50.46, "Acceptance Criteria for Emergency Core Cooling System for Light Water Cooled Nuclear Power Reactors" of 10CFR50. The most important of these requirements is that the post-LOCA peak cladding temperature (PCT) is limited to 2200°F. Additionally, the ECCS is designed to meet the following requirements:

1. Protection is provided for any primary system line break up to and including the double ended rupture (DER) of the largest line.

2. Two independent cooling methods (flooding and spraying) are provided to cool the core.

3. One high pressure cooling system is provided which is capable of maintaining water level above the top of the core and preventing automatic depressurization system (ADS) actuation for breaks of lines less than 1 in nominal diameter.

4. No operator action is required until 10 min after an accident to allow for operator assessment and decision.

5. The ECCS is designed to satisfy all criteria specified in Section 6.3 of the USAR for any normal mode of reactor operation.

6. A sufficient water source and the necessary piping, pumps and other hardware are provided so that the containment and reactor core can be flooded for possible core heat removal following a LOCA.

Each system of the ECCS including flow rate and sensing networks is capable of being tested during shutdown. All active components are capable of being tested during plant operation, including logic required to automatically initiate component action.

The ECCS is designed to provide makeup water to the reactor vessel over the full range of operating pressures. HPCS is required to provide 467 gpm at a reactor dp of 1177 psid, 1400 gpm at a reactor dp of 1147 psid and 5010 gpm at a reactor dp of [illegible]. The LPCS system is required to provide a minimum of 5010 gpm to the reactor with a reactor dp of 119 psid. Each of the three RHR pumps are required to provide a minimum of 5050 gpm to the reactor with a reactor dp of 24 psid.

In order to ensure that each ECCS pump can deliver its required flow rate at the required reactor dp, TSSR 4.5.1.b provides the operability limits on pump flow and pump dp. This TS requires that each:

1. LPCS pump develops a flow of at least 5010 gpm with a pump differential pressure greater than or equal to 281 psid.

2. LPCI pump develops a flow of at least 5050 gpm with a pump differential pressure greater than or equal to 100 psid.

3. HPCS pump develops a flow of at least 5010 gpm with a pump differential pressure greater than or equal to 399 psid.

These surveillances are performed quarterly by running the HPCS pump in the CST to CST test mode and the LPCS and RHR pumps in the suppression pool to suppression pool test mode. Test valves in the test return lines are throttled to obtain a flow rate approximately 5% higher than the minimum flow rate in the TSSR. Pump differential pressure is measured at the above flow rate and verified to be greater than the TSSR minimum pump dp.

During performance of the HPCS SSFI, the assessment team questioned the basis of the 399 psid required of the HPCS pump. Using the calculated system resistances from the HPCS design calculation, the design pressure drop through the HPCS discharge orifice, the required flow rate and pump dp from the TSSR, the assessment team calculated the reactor dp to be 150 psid. The design specification for the system and the HPCS process diagram require the HPCS pump to deliver the design flow rate of 5010 gpm to the reactor at a reactor dp of 200 psid. Based on the calculation performed, it was concluded that the pump dp specified in the TSSR would not ensure operability of the pump.

GSU Design Engineering repeated the calculations of the assessment team, however, rather than using the calculated resistances, system resistances measured during the performance of the HPCS preoperational test were used. Based upon the GSU calculation and actual system resistances, it was determined that with a pump dp of 399 psid, the HPCS would deliver 5010 gpm to the reactor with a reactor dp of ≈184 psid, which is less than the design reactor dp of 200 psid. Thus, GSU Design Engineering's conclusions agreed with the conclusion reached by the assessment team. Design Engineering has calculated the pump dp required to ensure pump operability to be 415 psid.

A brief discussion of the methodology used in performing this calculation follows:

All of the ECCS pumps are centrifugal pumps. A centrifugal pump is a constant differential head device, that is, for a given flow rate and, assuming no pump degradation, the pump will deliver the flow at a constant differential head (i.e., discharge head in ft - suction head in ft = constant). The only thing that affects pump dh is pump degradation (assuming sufficient NPSH and proper voltage). Actual pump dh is not affected by fluid temperature. Pump dp, on the other hand is affected by temperature. Pump dp is calculated as follows:

$$dp = (\text{fluid density})\ dh/144.$$

Since the fluid density increases as temperature decreases, the dp equivalent to a specific dh increases with decreasing temperature. Thus for a given dh, the corresponding dp is higher at lower temperatures.

The TSSRs for the ECCS pumps require that the pump dp be measured at the required flow rate. Since dp is variable dependant on temperature, and since it was not possible to know in advance the temperature at which testing is performed, the required dp was calculated as follows:

1. Bernoulli's equation was applied to the suction and discharge sides of the system and solved for pump dh.

2. Actual system resistances as measured in the preoperational test were used rather than calculated values.

3. Condensate storage tank and suppression pool levels were assumed to be at or below the minimum expected levels under accident conditions.

4. Reactor water levels were assumed to be at the level 2 initiation point.

5. HPCS was assumed to deliver 5010 gpm with a reactor dp of 200 psid.

6. Required dh was calculated for two cases - suction from the CST and suction from the suppression pool.

For the case of suction from the CST, the CST temperature was assumed to be at the minimum expected temperature of 40°F. The required dh was calculated to be 956.4 ft. which is equivalent to 414.6 psid. In this case, 40° F was assumed to be the CST temperature during an accident and the CST temperature during testing. Since the dp corresponding to 956.4 ft decreases as CST temperature increases, a measured dp greater than 414.6 ensures that the pump is operable under all CST temperature conditions.

For the case of suction from the suppression pool, the suppression pool temperature was assumed to be the maximum expected suppression pool temperature (185°F). The required pump dh was calculated to be 957.5 ft under these conditions which is equivalent to a pump dp of 401.7 psid. The HPCS pump surveillance is not performed with the suppression pool at 185°F. Since testing is normally performed CST to CST and since the minimum expected CST temperature is lower than the minimum expected suppression pool temperature, the pump dp was calculated assuming a CST test at 40°F. 957.5 ft is equivalent to 414.9 psid at a CST temperature of 40°F.

When calculating the required pump dh from the suppression pool, the suppression pool temperature was assumed to be 185°F. The HPCS process diagram requires the HPCS deliver design flow with a suppression pool temperature of 170°F. Assuming 185°F adds some conservatism to the calculation because a higher pump dh is required at 185°F than at 170°F.

After verifying that the existing TSSR pump dp of 399 psid was incorrect and determining that the correct pump dp is 415 psid, Design Engineering reviewed the results of all previous performances of the HPCS pump surveillance to ensure that the pump has been operable when required.

A review of the data from the past performances of the STP concluded that the HPCS pump has always been operable when required.

Based upon the evaluation performed on HPCS, GSU Design Engineering performed a similar review on the LPCS and LPCI pumps. Calculations G13.18.4.0*18 Rev. 1 (LPCS) and G13.18.4.0*17 Rev. 0 (LPCI) were performed for these pumps using the same methodology discussed above for the HPCS pump. It was concluded that: 1.) The operation limit of 281 psid specified for the LPCS pump is correct and 2.) The operational limit of 100 psid specified for the LPCI pumps is incorrect. The correct operational limit for the LPCI pumps is 102 psid.

These conclusions were based upon calculating the required pump dh at a suppression pool temperature of 170°F per the system process diagrams. Since the LPCI surveillance requirement was incorrect, the calculation of a new operability limit was required. This new limit was calculated assuming a suppression pool temperature of 185°F for conservatism.

Although the existing operability limit for LPCS was acceptable using a suppression pool temperature of 170°F, it was decided that a new operability limit for the LPCS system based upon a suppression pool temperature of 185°F should be calculated. Calculating this new limit served two purposes. First the new limit will add conservatism and secondly, the new limit will provide consistency between the bases for the operability limit for all ECCS pumps. The LPCS operability limit assuming 185° F in the suppression pool was established at 282 psid (an increase of 1 psid).

REVISED TECHNICAL SPECIFICATIONS

GSU proposes that Technical Specification Surveillance Requirement 4.5.1.b be revised to incorporate the adjusted operability limits as shown in Attachment 3.

SCHEDULE FOR ATTAINING COMPLIANCE

River Bend Station is currently in compliance with the requested revision. Since the requested revision is more conservative than the existing requirements, Surveillance Test Procedure (STP's) revisions have been completed. This is acceptable because the pump differential pressures required by the proposed change are greater than the current requirements.

NOTIFICATION OF STATE PERSONNEL:

A copy of this amendment request has been provided to the State of Louisiana, Department of Environmental Quality - Nuclear Energy Division.

ENVIRONMENTAL IMPACT APPRAISAL:

GSU has reviewed the proposed license amendment against the criteria of 10CFR51.22 for environmental considerations. The proposed changes to the technical specifications do not involve any significant hazards considerations, increase the types and amounts of effluents that may be released offsite, nor significantly increase individual or cumulative occupational radiation exposures. Based on the foregoing, GSU concludes that the proposed change meets the criteria given in 10CFR51.22(c) (9) for a categorical exclusion from the requirement for an Environmental Impact Statement.

ATTACHMENT 2

NO SIGNIFICANT HAZARDS CONSIDERATION

In accordance with the requirements of 10CFR50.92 the following discussions are provided in support of the determination that no significant hazards are created or increased by the change proposed in the submittal.

1. The proposed change would not significantly increase the probability or consequences of an accident because:

   Each of the ECCS systems and subsystems are designed to provide cooling water to the reactor vessel following various transient and accident conditions. The performance of the ECCS was determined through application of the 10CFR50 Appendix K evaluation models and then showing conformance to the acceptance criteria of 10CFR50.46.

   The ECCS performance is evaluated for the entire spectrum of break sizes for postulated LOCAs. The accidents, as listed in USAR Chapter 15, for which ECCS operation is required are:

15.2.8	Feedwater line break
15.6.4	Steam system piping break outside containment
15.6.5	Loss-of-coolant accidents (inside containment)

   The applicable ECCS performance acceptance criteria from 10CFR50.46 are as follows:

   a. Criterion 1, Peak Cladding Temperature - "The calculated maximum fuel element cladding temperature shall not exceed 2200°F".

   b. Criterion 2, Maximum Cladding Oxidation - "The calculated total local oxidation of the cladding shall nowhere exceed 0.17 times the total cladding thickness before oxidation".

   c. Criterion 3, Maximum Hydrogen Generation - "The calculated total amount of hydrogen generated from the chemical reaction of the cladding with water or steam shall not exceed 0.01 times the hypothetical amount that would be generated if all the metal in the cladding cylinder surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react."

   d. Criterion 4, Coolable Geometry - "Calculated changes in core geometry shall be such that the core remains amenable to cooling".

e. Criterion 5, Long-Term Cooling - "After any calculated successful initial operation of the ECCS, the calculated core temperature shall be maintained at an acceptably low value and decay heat shall be removed for the extended period of time required by the long-lived radioactivity remaining in the core".

The design of the various ECCS systems is such that the ECCS network will ensure that the above acceptance criteria are met for the various postulated transients and accidents of Chapter 15 of the USAR.

The technical specification surveillance requirements are specified to ensure that the various ECCS pumps are able to deliver the minimum required flows at the required reactor to suction source differential pressures as assumed in the ECCS performance analysis.

The proposed change to the technical specification surveillance requirements will ensure that the ECCS pumps can deliver the required flows at design conditions and, thus, there is no increase in the possibility or consequences of a previously evaluated accident.

2. The proposed change would not create the possibility of a new or different kind of accident from any previously evaluated because:

The proposed change to the technical specification surveillance requirement will ensure that the ECCS pumps are able to meet their existing design bases. There are no physical modifications required as a result of this requested change. The proposed operability limits are more conservative than existing limits.

Based upon the above discussion, the proposed change will not create the possibility of a new or different kind of accident from any previously evaluated.

3. The proposed change would not involve a significant reduction in the margin of safety because:

The proposed changes to the surveillance requirements provide new operability limits calculated to ensure that the ECCS pumps meet the existing design bases for the systems as discussed in the current bases for Technical Specification 3/4.5.1, the existing USAR analyses and the system design specifications. Some additional conservatism is included in the new operability limits by assuming a higher suppression pool temperature than required by the system design specifications. Therefore, it was concluded that there is no reduction in the margin of safety created by this requested revision.