Attachment 1
SAIC-91/1263

TECHNICAL EVALUATION REPORT

RIVER BEND STATION, UNIT 1

STATION BLACKOUT EVALUATION

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An Employee-Owned Company

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1.0 BACKGROUND

On July 21, 1988, the Nuclear Regulatory Commission (NRC) amended its regulations in 10 CFR Part 50 by adding a new section, 50.63, "Loss of All Alternating Current Power" (1). The objective of this requirement is to assure that all nuclear power plants are capable of withstanding a station blackout (SBO) and maintaining adequate reactor core cooling and appropriate containment integrity for a required duration. This requirement is based on information developed under the commission study of Unresolved Safety Issue A-44, "Station Blackout" (2-6).

The staff issued Regulatory Guide (RG) 1.155, "Station Blackout," to provide guidance for meeting the requirements of 10 CFR 50.63 (7). Concurrent with the development of this regulatory guide, the Nuclear Utility Management and Resource Council (NUMARC) developed a document entitled, "Guidelines and Technical Basis for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," NUMARC 87-00 (8). This document provides detailed guidelines and procedu[illegible] how to assess each plant's capabilities to comply with the SBO rule. The NRC staff reviewed the guidelines and analysis methodology in NUMARC 87-00 and concluded that the NUMARC document provides an acceptable guidance for addressing the 10 CFR 50.63 requirements. The application of this method results in selecting a minimum acceptable SBO duration capability from two to sixteen hours depending on the plant's characteristics and vulnerabilities to the risk from station blackout. The plant's characteristics affecting the required coping capability are: the redundancy of the onsite emergency AC power sources, the reliability of onsite emergency power sources, the frequency of loss of offsite power (LOOP), and the probable time to restore offsite power.

In order to achieve a consistent systematic response from licensees to the SBO rule and to expedite the staff review process, NUMARC developed two generic response documents. These documents were reviewed and endorsed (9) by the NRC staff for the purposes of plant specific submittals. The documents are titled:

1. "Generic Response to Station Blackout Rule for Plants Using Alternate AC Power," and

2. "Generic Response to Station Blackout Rule for Plants Using AC Independent Station Blackout Response Power."

A plant-specific submittal, using one of the above generic formats, provides only a summary of results of the analysis of the plant's station blackout coping capability. Licensees are expected to ensure that the baseline assumptions used in NUMARC 87-00 are applicable to their plants and to verify the accuracy of the stated results. Compliance with the SBO rule requirements is verified by review and evaluation of the licensee's submittal and audit review of the supporting documents as necessary. Follow up NRC inspections assure that the licensee has implemented the necessary changes as required to meet the SBO rule.

In 1989, a joint NRC/SAIC team headed by an NRC staff member performed audit reviews of the methodology and documentation that support the licensees' submittals for several plants. These audits revealed several deficiencies which were not apparent from the review of the licensees' submittals using the agreed upon generic response format. These deficiencies raised a generic question regarding the degree of licensees' conformance to the requirements of the SBO rule. To resolve this question, on January 4, 1990, NUMARC issued additional guidance as NUMARC 87-00 Supplemental Questions/Answers (10) addressing the NRC's concerns regarding the deficiencies. NUMARC requested that the licensees send their supplemental responses to the NRC addressing these concerns by March 30, 1990.

2.0 REVIEW PROCESS

The review of the licensee's submittal is focused on the following areas consistent with the positions of RG 1.155:

A. Minimum acceptable SBO duration (Section 3.1),

B. SBO coping capability (Section 3.2),

C. Procedures and training for SBO (Section 3.3),

D. Proposed modifications (Section 3.4), and

E. Quality assurance and technical specifications for SBO equipment (Section 3.5)

For the determination of the proposed minimum acceptable SBO duration, the following factors in the licensee's submittal are reviewed: a) offsite power design characteristics, b) emergency AC power system configuration, c) determination of the emergency diesel generator (EDG) reliability consistent with NSAC-108 criteria (11), and d) determination of the accepted EDG target reliability. Once these factors are known, Table 3-8 of NUMARC 87-00 or Table 2 of RG 1.155 provides a matrix for determining the required coping duration.

For the SBO coping capability, the licensee's submittal is reviewed to assess the availability, adequacy and capability of the plant systems and components needed to achieve and maintain a safe shutdown condition and recover from an SBO of acceptable duration which is determined above. The review process follows the guidelines given in RG 1.155, Section 3.2, to assure:

a. availability of sufficient condensate inventory for decay heat removal,

b. adequacy of the class-1E battery capacity to support safe shutdown,

c. availability of adequate compressed air for air-operated valves necessary for safe shutdown,

d. adequacy of the ventilation systems in the vital and/or dominant areas that include equipment necessary for safe shutdown of the plant,

e. ability to provide appropriate containmen integrity, and

f. ability of the plant to maintain adequate reactor coolant system inventory to ensure core cooling for the required coping duration.

The licensee's submittal is reviewed to verify that required procedures (i.e., revised existing and new) for coping with SBO are identified and that appropriate operator training will be provided.

The licensee's submittal for any proposed modifications to emergency AC sources, battery capacity, condensate capacity, compressed-air capacity, ventilation system, containment isolation integrity and primary coolant make-up capability is reviewed. Technical specifications and quality assurance set forth by the licensee to ensure high reliability of the equipment, specifically added or assigned to meet the requirements of the SBO rule, are assessed for their adequacy.

This SBO evaluation is based upon the review of the licensee's submittals dated April 17, 1989 (12), March 30, 1990 (13), and October 18, 1991, (14), and the information available in the plant Updated Safety Analysis Report (USAR) (15); it does not include a concurrent site audit review of the supporting documentation. Such an audit may be

warranted as an additional confirmatory action. This determination would be made and the audit would be scheduled and performed by the NRC staff at some later date.

3.0 EVALUATION

During our evaluation, several questions were raised and transmitted to the NRC, on July 26, 1991 which were in turn transmitted to the licensee. We received a detailed response (14) from the licensee dated October 18, 1991 and have reviewed and incorporated the results of that response in this report.

3.1 Proposed Station Blackout Duration

Licensee's Submittal

The licensee, Gulf State Utilities Company (GSU), calculated (12) a minimum acceptable station blackout duration of four hours for the River Bend Station (RBS). The licensee stated (14) that no modifications are required to attain this coping duration.

The plant factors used to estimate the proposed SBO duration are:

1. **Offsite Power Design Characteristics**

   The plant offsite AC power design characteristic group is "P1" based on:

   a. Estimated frequency of LOOPs due to Extremely Severe Weather (ESW) which places the plant in ESW group "1,"

   b. Estimated frequency of LOOPs due to severe weather (SW) which places the plant in SW Group "1,"

   c. The Independence of offsite power system of "I 1/2," and

d. Expected frequency of grid-related LOOPs of less than one per 20 years.

2. **Emergency AC (EAC) Power Configuration Group**

The EAC power configuration of the plant is "C." River Bend is equipped with two emergency diesel generators not credited as alternate AC power sources, one of which is necessary to operate safe-shutdown equipment following a loss of offsite power.

3. **Target Emergency Diesel Generator (EDG) Reliability**

The licensee has selected (12) a target EDG reliability of 0.95. The selection of this target reliability is based on having an average EDG reliability of greater than .94 for the last 50 demands consistent with NUMARC 87-00, Section 3.2.4.

The licensee stated in a later submittal (14) that the plants EDG reliability was calculated for the last 20, 50, and 100 demands, in accordance with NSAC-108 and that an average reliability of 0.99 was achieved. Therefore, an EDG target reliability of either 0.95 or 0.975 could be selected. The licensee added that the plant has an EDG reliability program that complies with the five elements of RG 1.155, Regulatory Position 1.2.

Review of Licensee's Submittal

Factors which affect the estimation of the SBO coping duration are: the estimated frequency of LOOPs due to ESW and SW conditions, the independence of the offsite power system grouping, the expected frequency of grid-related LOOPs, the classification of EAC, and the selection of EDG target reliability.

The licensee's estimate of the frequency of ESW conditions differs substantially from the NUMARC 87-00 estimation. In NUMARC 87-00 the site is classified an ESW group "4," while the licensee considers the site to be in ESW group "1." The licensee has provided an analysis of its ESW frequency calculation (14) in response to a request for information. However the licensee's calculations are not consistent with the ESW frequency results obtained when using information contained in the plant USAR (15). The site is located 70 miles inland and therefore considered to be a hurricane exposed plant. According to the USAR, Section 2.3.2, the site is expected to see a fastest-mile wind speed of 100 mph with a return period of 100 years. The USAR also gives a return period of 2, 10, 25 and 50 years for fastest-mile wind speeds of 50, 65, 70, and 90 mph respectively. We plotted the fastest-mile wind speed against return period and fit a curve through the data points. Our results show that a wind speed of 125 mph, or greater, will occur at the site with a return period of 150 years, or a frequency of 0.0065 per year. This estimate is almost identical to the estimated frequency given in NUMARC 87-00, Table 3.2, both of which place the site in ESW group "4."

We agree with the licensee's estimated frequency of LOOPs caused by SW conditions which places the plant in SW group "1." The classification is consistent with the information provided in NUMARC 87-00, Tables 3-3 and 3-4.

The licensee stated that the independence of the plant off-site power system grouping is "I 1/2." A review of the plant USAR indicates:

1. All off-site power sources are connected to the plant through a single switchyard;

2. During normal power operation, each 4.16 kV essential bus is powered from 230 kV offsite power sources through a preferred station service transformer;

3. Upon loss of power from one of the preferred station service transformers the affected emergency bus can be powered from the other transformer through a manual transfer.

Based on these and the criteria stated in Table 5 of RG 1.155, the plant independence of offsite power system group is "I2," which is consistent with the licensee's classification.

With regard to expected frequency of grid-related LOOPs at the site, we can not confirm the stated results. The available information in NUREG/CR-3992 (3) which gives a compendium of information on the loss of offsite power at nuclear power plants in the U.S., only covers these incident through the calendar year 1984. River Bend power station did not enter commercial operation until 1986. In the absence of any contradictory information, we agree with the licensee's statement.

River Bend has two EDGs of which one is necessary to safely shutdown the plant. Therefore, the licensee correctly classified the EAC configuration as "C."

The licensee selected (12) a target EDG reliability of 0.95 and added (14) that this selection was based upon the last 20, 50, and 100 demands. The EDG reliability which the licensee selected and committed to maintain (12) is in conformance with both RG 1.155 and NUMARC 87-00. In response to a request for additional information, the licensee provided a description of the plants EDG reliability program showing compliance to the five elements of RG 1.155, Position 1.2.

Based on an ESW group "4," an SW group "1," and an independence of offsite power group "I1/2," the offsite power design characteristic of River Bend is "P2." With this determination, in conjunction with an EAC group "C" classification and a target EDG reliability of 0.95, the required SBO coping duration is eight hours. For maintaining a 4-hour SBO coping duration, the licensee needs to commit to a target EDG

reliability of 0.975. Selection of an EDG target reliability OF 0.95 requires a re-submission of the SBO coping analysis for review.

3.2 Station Blackout Coping Capability

Although, our evaluation using the licensee's commitment shows the plant needs to cope for eight hours, we reviewed the plant coping capability for four hours based on the consideration that the licensee will choose an EDG target reliability of 0.975. Therefore, the plant coping capability with an SBO event for the required duration of four hours is assessed with the following results:

1. **Condensate Inventory for Decay-Heat Removal**

Licensee's Submittal

The licensee stated (14) that the Technical Specification minimum condensate volume of 125,000 gallons of water was adequate for an SBO coping duration of 5.7 hours, and that the assumptions used in calculating the minimum condensate inventory were consistent with NUMARC 87-00. The licensee used an RCS leak rate of 18 gpm per recirculation pump plus the maximum allowed Technical Specification leakage of 25 gpm.

Review of Licensee's Submittal

Based on our knowledge of similar design of Mark III BWRs, during an SBO the plant needs to be depressurized, otherwise the suppression pool temperature will exceed its limit. Using the expression provided in NUMARC-87-00, Section 7.1.1, we have estimated that the water required for removing decay heat during the four hour SBO would be 64,000 gallons. This estimate is based on 102% of a maximum licensed core thermal rating of 2887

MWt. In addition, the condensate storage tank inventory has to account for a leak rate of 61 gpm (18 gpm per recirculation pump and a technical specifications leak rate of 25 gpm), and to account for the shrinkage due to depressurization and cool-down. We estimated that 31,000 gallons were needed to remove the sensible heat, 14,600 gallons for leakage, and 12,400 gallons for shrinkage. This gives a total necessary condensate inventory of 122,000 gallons. Therefore, we concur with the licensee that the site has sufficient condensate to cope with an SBO for four hours.

2. Class-1E Battery Capacity

Licensee's Submittal

The licensee stated (12) that the battery capacity calculations for class-1E batteries were performed in accordance with NUMARC-87-00 guidance, using the lowest expected electrolyte temperature. The licensee added that load stripping is not required to maintain SBO loads for the required 4-hour coping duration. The licensee performed a room heat-up calculation (14) which shows the minimum battery room temperature to be 70°F. The licensee's battery capacity calculations conservatively assume a minimum electrolyte temperature of 60°F.

Review of Licensee's Submittal

According to the plant USAR (15) Section 8.3.2.1.3, each class-1E battery is sized in conformance with principles set out in IEEE Std-308 and IEEE Std-485. Battery capacities for Division I and II are 2100 AH each. The class-1E batteries have the ability to supply all design basis accident (DBA) loads and all other loads not automatically tripped on a LOCA signal for four hours. The batteries have sufficient capacity remaining at four hours to perform the

switching operations necessary to restore normal AC and DC power with the charger inoperable.

The licensee's battery capacity calculations (14) were performed for a 4-hour duty cycle LOCA load with a 5% design margin, 25% aging factor, and an 11% temperature correction factor. Since the LOCA loads should bound the SBO loads, we consider the class-1E battery capacity to be adequate to support a 4-hour SBO coping duration. However, our review of the submittal (14) shows RCIC loads in the first and last minutes of the load profiles. The licensee needs to ensure that these loads are consistent with expected RCIC input during an SBO event since any change in RCIC operation will directly impact the loading calculations. In addition, we were unable to verify some details of the calculations because of the number of revisions, deletions, and the quality of the photocopies submitted. The licensee needs to ensure that the final load profiles are consistent the expected loads.

3. Compressed Air

Licensee's Submittal

The licensee stated (12) that the air-operated valves needed to cope with an SBO for four hours can either be operated manually or have sufficient back-up sources independent of the unit's preferred and class-1E power supplies, and that these valves are identified in plant procedures. The licensee added (13) that as part of safety system functional inspection (SSFI) on the instrument air system, back-up air cylinders are needed for the operation of the air operated valves to meet the requirements of Generic Letter (GL) 88-14. The licensee stated (14), in response to a request for information, that the Safety Relief Valves (SRVs) are the only air-operated valves that are required to be operated (cycled) during a station blackout. The SRVs are

provided with air accumulators which have sufficient capacity to ensure that the RPV can be depressurized and remain depressurized during the four hour SBO coping duration. The licensee added that plant procedure AOP-0050 provides a caution which directs the operator to control RPV pressure with continuous SRV opening if the air supply to the SRVs is lost. The procedure directs the operator to provide bottled compressed air or nitrogen to recharge the SRV accumulators if additional air is required.

Review of Licensee's Submittal

We consider that these back-up air cylinders identified by licensee are either installed or in the process of being installed in order to support the operation of the needed valves. Considering the fact that the Safety Relief Valves are the only air-operated valves required for an SBO event, we concluded that the plant has a sufficient source of compressed air.

4. **Effects of Loss of Ventilation**

Licensee's Submittal

The licensee initially stated (12) the control room temperature limit of 120°F required by NUMARC 87-00 section 2.7.1 can not be maintained at the plant because this temperature limit is based on maintaining the control room equipment at 120°F with the panel doors open, which is equivalent to an ambient air temperature of 104°F. The licensee added that additional measures, such as using the installed smoke removal fans or other suitable alternatives will be needed to maintain the control room temperature below 104°F in order to maintain the temperature of the equipment below 120°F. The licensee assessed the operability of station blackout response equipment in the RCIC and HPCS rooms using plant specific equipment qualification

data, and has reasonable assurance that operability limits will not be exceeded.

The licensee provided room heat-up calculations (14) for loss of ventilation as requested. Enclosed compartments were analyzed to determine dominant areas of concern (DACs) during an SBO event. The following DACs and associated SBO temperatures were identified:

Dominant Area of Concern	Temperatures (°F)	
	Initial	Final
RCIC pump and turbine room	122	146
HPCS pump room	122	156
Main Control Room	78	119
Battery Room 1A	68*/104	70*/129
Battery Room 1B	68*/104	70*/129
Standby switchgear room 1A	104	105
Standby switchgear room 1B	104	105
Standby equipment room 1A	104	113
Standby equipment room 1B	104	113

* Battery Room minimum temperatures.

Each area was analyzed for heat-up following loss of ventilation. The battery rooms were analyzed for potential cooldown to assure that the assumptions for minimum electrolyte temperature remains valid.

The licensee did not analyze the temperature effects in the main steam tunnel, stating that plant procedure AOP-0050, "Immediate Operator Actions," requires the operators to bypass the RCIC leak detection system isolation in the event of an SBO.

Review of Licensee's Submittal

The licensee's loss of ventilation heat-up calculations were reviewed with the following results:

Auxiliary Building

The licensee concluded that all equipment and components in the Auxiliary Building remain below established operability limits. The maximum temperature calculated for the RCIC equipment room for the four hour coping duration is 146 °F. The maximum temperature of the HPCS room was calculated to be 155.75 °F.

The licensee used a subcompartment analysis computer program to perform the calculations but did not provide information on the qualification, applicability, benchmarking, configuration management, verification, or validation of the program. The licensee needs to provide this information, plus the justification for the selection of nodes and time step sizes for different time increments used in the model. This comment applies to all of the computer programs used to analyze room heat-up.

An initial relative humidity (RH) of 100% was assumed for all zones. This assumption is non-conservative for maximizing SBO temperature response. The licensee should re-calculate the response using 0% relative humidity or provide evidence that these zones will always be at 100% RH. Also, the licensee needs to explain why some zones show an expected temperature response during the first hour followed by a slower asymptotic rise to eight hours while others show a constant rise throughout the eight hour period.

Control Room

The licensee calculated a maximum control room temperature of 119 °F assuming that the control room panel doors are open, and ceiling tiles have been removed. The calculation uses a heat load of 43 kW which includes personnel heat loads and is consistent with the current control room load. It is not clear, in the submittal (14), if the removal of ceiling tiles is a control room modification, or an operator action required during the first 30 minutes of an SBO event. The removal of these tiles needs to be addressed by the licensee as a control room modification or an SBO action covered by an appropriate procedure.

The licensee's calculations for control room heat-up makes use of assumptions that are non-conservative and need to be justified. Among those assumptions are:

- o The initial control room temperature of 78°F is non-conservative unless the licensee has administrative controls that ensure that this temperature will not be exceeded during plant operation. Note that the heat-up calculations for Standby DC Equipment Rooms A and B, and Switchgear Rooms A and B, specify that the control room is initially at 104°F, the Technical Specification limit.

- o The assumed outside air temperature of 96°F is not consistent with the outside air temperature of 110°F used in other room heat-up calculations.

- o There is no justification given for the 90% control room free air volume below the suspended ceiling.

The licensee used the same code for the control room analysis and the auxiliary building analysis and needs to provide the information mentioned in the auxiliary building section above.

Battery Rooms

The licensee provided (14) calculations for heat-up of the battery rooms which show a minimum temperature of 70 °F, and a maximum temperature of 129°F at the end of the SBO event. The calculations use a value for the thermal conductivity of concrete which is conservative for deriving the minimum battery room temperatures. However, this value is non-conservative for calculating the maximum battery room temperatures. The licensee needs to provide information on the computer code used for the calculations (see comments above).

Since the licensee used a temperature of 60 °F in calculating adequate battery capacity, 70 °F is an acceptable minimum temperature for the battery rooms.

Standby Switchgear Rooms A and B

The licensee needs to justify the use of a non-conservative value for the thermal conductivity of concrete (0.87). The licensee should verify that the ENSA calculation (14) has been reviewed as requested, also an explanation of the cyclical behavior of the temperatures in these rooms should be provided.

Standby DC Equipment Rooms A and B

The licensee needs to justify the use of a non-conservative value for the thermal conductivity of concrete.

Containment Heat-up

Information on the computer code used to perform the heat-up calculation, as mentioned in the auxiliary building section above, should be provided.

5. Containment Isolation

Licensee's Submittal

The licensee stated (12) that the plant list of containment isolation valves (CIVs) was reviewed and it was determined that all of the valves which must be capable of being closed or operated (cycled) under SBO conditions can be positioned with indication independent of the unit's preferred and class-1E power supplies. The licensee also stated that modifications and procedure change are required to ensure that appropriate containment integrity can be provided under SBO conditions. This change of procedure consists of a revision to AOP-0003, "Automatic Isolation," to include additional guidance on closing isolation valves which do not meet the NUMARC 87-00 exclusion criteria during a station blackout. In performing this modification the licensee used NUMARC 87-00, Section 7.2.5. The evaluation was conducted considering locked closed valves and normally closed valves in the same category. The CIVs were reviewed again (13) considering the guidance provided in NUMARC 87-00, "Supplemental Questions/Answers" (10). The licensee concluded that its previously stated position (12) remains unchanged.

The licensee submitted additional information (14) in response to a request and proposed additional CIV exclusion criteria to those outlined in NUMARC 87-00 and summarized several examples for valve exclusions:

a. Water Seal

The licensee stated that the ECCS Pumps in BWR plants normally have the capability of providing condensate from the suppression pool and that the suction inlets for these systems are submerged below the water level in the suppression pool. The water in the pipe provides a barrier from the containment atmosphere and is credited for containment isolation purposes in a number of BWRs. Example valves meeting this justification are the core spray suction valves which are AC motor-operated and closed during normal operation. The suction inlet to this system is below the minimum water level in the suppression pool so that condensate is always available. Therefore, these valves may be excluded from consideration.

b. Valves Required for Response to Station Blackout

The licensee stated that a number of CIVs are important components of station blackout response systems. In many cases, these valves need to be open for the plant to cope with a station blackout. However, NUMARC 87-00, Section 7.2.5, Step 2 indicates that these valves must have the capability to be operated independent of the class-1E and offsite AC power supplies. For example, RCIC suction is taken from the suppression pool through a normally closed DC motor-operated isolation valve, which opens on RCIC initiation. Thus, manual closure would not be necessary if sufficient battery capacity exists to close this valve at any time during the transient. Since DC closure capability is provided, this valve may be excluded from consideration.

c. **Valves Closed for Normal Operation Through Interlocks**

A large number of containment isolation valves must be closed for reactor operation. In many cases, the closure of these valves is ensured through interlocks that do not permit the penetration to be open under operating conditions. This category includes CIVs that isolate low pressure systems from high pressure reactor vessel piping. As an example, the inboard and outboard low pressure core spray (LPCS) injection valves for a BWR are ac motor-operated. Although one CIV may be open during normal operation, interlocks do not permit the second CIV to open unless the reactor pressure is less than 550 psig. Since the reactor operating pressure is 1025 psig, the valves isolating this penetration can therefore be excluded from consideration.

Based on above arguments, the licensee applied the following four exclusion criteria to the plant's CIV's in addition to the NUMARC criteria:

1) At least one valve is DC powered;
2) At least one valve is normally closed, AC powered falling as is;
3) Valve(s) are normally open, AC powered, failing as is, and failure position is acceptable during SBO; and
4) Spare penetration, assumed capped.

Review of Licensee's Submittal

The additional provisions for excluding valves meet the intent of 1.155 guide. Staff considers these criteria acceptable, provided that the licensee:

- o Ensure that the suction inlets for water seal excluded CIVs remain submerged below the minimum Technical Specification level of the suppression pool at all times during normal operation.

- o Ensure that the loads required to power the DC CIVs are factored into class-1E SBO battery capacity calculations.

In addition, CIVs that are normally closed are considered to meet the intent of SBO requirements if they are closed during normal operation per procedure and are only opened for surveillance during Modes 5 and 6 (i.e. cold shutdown and/or refueling). Otherwise the licensee needs to list the CIVs in an appropriate procedure and identify the actions necessary to ensure that the valves are fully closed, if needed, upon loss of AC power. The valve closure needs to be confirmed by position indication (local, mechanical, remote, process information, etc.).

The licensee has identified (14) eight CIVs that can not be excluded and therefore require manual closure capability under SBO conditions:

	Inboard	Outboard
RWCU Return to FW	G33-F040	G33-F039
RWCU Pump Suction	G33-F001	G33-F004
RWCU Pump Discharge	G33-F053	G33-F054
Fuel Pool Purification Suction	SFC-MOV139	SFC-MOV121

We have reviewed the plant USAR (15), Table 6.2-40, and find these valves meet the requirements of NUMARC 87-00, Section 7.2.5. All of the inboard (inside containment) valves are DC powered. The licensee needs to verify that these CIVs are DC powered. If the valves are not DC powered, the licensee needs to list the valves identified above in an appropriate procedure

and identify the actions necessary to ensure that these valves are fully closed, if needed, upon loss of AC power. The valve closure needs to be confirmed by position indication (local, mechanical, remote, process information, etc.).

In addition, we find that the following penetration CIVs meet the requirements or the intent of NUMARC 87-00 and RG 1.155:

- o RHR pump suction CIVs - All valves are normally open and fail as is. The "A" loop CIV is interlocked with reactor pressure and water sealed provided that the minimum suppression pool level is administratively maintained above the suction inlet, meets the intent of the requirement. The "B" and "C" loops are DC powered and meet the requirement.

- o LPCS pump suction CIV meets the intent. The valve is normally open and fails as is. Penetration integrity is maintained through interlocks with reactor pressure, and water sealed provided the provisions mentioned above are met.

Our review of the licensee's submittals and the plant USAR (15) did not identify any CIVs not meeting the NUMARC exclusion criteria or the intent of the containment isolation requirements of RG 1.155.

NOTE: There is an inconsistency in the USAR between Table 6.2-40 and the information given in Figures 5.4-12 a, b, and c, concerning penetrations #Z21A, Z21B, and Z21C. The figure identifies valves FO39A, B, and C, the table designates these valves as FO37A and B. There is no valve FO37C in the table. The table is also missing other valves that appear in the figures.

6. Reactor Coolant Inventory

Licensee's Submittal

The licensee stated (12) that the ability to maintain adequate reactor coolant system (RCS) inventory to ensure that the core is cooled during a four hour station blackout has been assessed using a plant-specific analysis. The licensee added that the expected rates of reactor coolant inventory loss under SBO conditions does not result in uncovery of the core in a station blackout of four hours. The licensee updated its analysis (13) to include additional leakage and concluded that make-up systems, in addition to those currently available under SBO conditions are not required to maintain core cooling.

Review of Licensee Submittal

Reactor coolant make-up is necessary to remove decay heat, cooldown the primary system, and replenish the RCS inventory losses due to the 61-gpm leak rate (18 gpm per recirculation pump per NUMARC 87-00 guideline and 25 gpm for the technical specifications maximum allowable leakage).

The RCIC pump has the capability to inject CST water to the reactor at the rate of 600 gpm. In addition, the HPCS pump will also be available as a back-up. The combination of these two pumps is sufficient to compensate for the assumed leak rate in addition to the injection rate necessary to remove decay heat and to keep the core covered and cooled for the duration of the SBO event. Therefore, we concur with the licensee's statement that no additional make-up system is necessary to keep the core covered and cooled during a 4-hour SBO event.

Note:

The 18-gpm recirculation pump seal leak rate was agreed to between NUMARC and the NRC staff pending resolution of Generic Issue (GI) 23. If the final resolution of GI-23 defines higher recirculation pump seal leak rates than assumed for the RCS inventory evaluation, the licensee needs to be aware of the potential impact of this resolution on its analyses and actions addressing conformance to the SBO rule.

3.3 Proposed Procedures and Training

Licensee's Submittal

The licensee stated (12) that the following plant procedures have been reviewed per guidelines in NUMARC 87-00, Section 4:

1. Station blackout response guidelines,
2. AC power restoration, and
3. Severe weather.

The licensee stated that these procedures have been reviewed and the changes necessary to meet NUMARC 87-00 guidelines will be implemented.

Review of Licensee's Submittal

We neither received nor reviewed the affected SBO procedures. We consider these procedures as plant specific actions concerning the required activities to cope with an SBO. It is the licensee's responsibility to revise and implement these procedures, as needed, to mitigate an SBO event and to assure that these procedures are complete and correct, and that the associated training needs are carried out accordingly.

3.4 Proposed Modifications

Licensee's Submittal

The licensee stated (14) that no modifications to the facility will be required to cope with a 4-hour SBO event. The licensee considers the installation of back-up air cylinders a modification to meet Generic Letter 88-14.

Review of Licensee Submittal

We believe that the addition of back-up air cylinders is beneficial to the plant as it provides additional reserve air for air-operated valves.

The licensee has mentioned the removal of ceiling tiles to achieve an adequate control room SBO temperature on loss of ventilation but has not stated whether this will be a permanent modification, or a station blackout operator action covered by an appropriate SBO procedure.

Because the plant is in ESW group "4," the licensee needs to commit to a EDG target reliability of 0.975. If the licensee chooses to retain its EDG target reliability at 0.95 then an eight hour coping period is required and plant modifications may be necessary, and the licensee must re-submit a coping analysis for review.

3.5 Quality Assurance and Technical Specifications

Licensee's Submittal

The licensee stated (14) that no modifications to the facility will be required to cope with a four hour SBO and that existing plant components, currently subject to 10 CFR 50 Appendix B QA requirement., will be utilized to mitigate the SBO event.

Review of Licensee Submittal

We concur with the licensee's statement, provided that no modifications are made to the plant. However, the licensee needs to have a list of SBO equipment including mitigating systems, and instrumentation and controls, with a proper cross reference to the qualified QA program in its supplementing documentation.

4.0 CONCLUSIONS

Based on our review of the licensee's submittals, and the information available in the USAR for the River Bend Plant, we find the submittal conforms with the requirements of the SBO rule and the guidance of RG 1.155 with the following exceptions:

1. **Proposed Station Blackout Duration**

   The licensee proposed an SBO coping duration of four hours, based on ESW group "1," and a proposed EDG target reliability of 0.95. Our review indicate that the River Bend site is in ESW group "4," requiring an EDG target reliability of 0.975 f . a minimum coping duration of four hours. For maintaining a 4-hour SBO coping duration, the licensee needs to commit to a target EDG reliability of 0.975. Selection of an EDG target reliability of 0.95 requires a re-submission of the SBO coping analysis for review.

2. **Class-1E Battery Capacity**

   The licensee needs to ensure that RCIC loads are consistent with expected load profile inputs during an SBO event since any change in RCIC operation will directly impact the loading ca' 'ations and alter the battery capacity.

3. **Tects of Loss of Ventilation**

   r review indicates several concerns with regards to the initial conditions, modeling assumptions, and computer codes used in the licensee's temperature rise calculations, as discussed in Section 3.2. The licensee needs to provide additional information and/or technical justification for each concern before we can verify the accuracy of the reported results. If adequate justification is not provided, the licensee may need to re-analyze the temperature response

for the rooms identified as SBO dominant areas of concern. In addition, the control room heat-up calculation assumes the removal of ceiling tiles to achieve a limiting final temperature of 119°F. The licensee needs to state whether the removal of ceiling tiles is a control room modification, or an operator action required during the first 30 minutes of an SBO event. If the removal of ceiling tiles is an operator action, then it needs to be included in an appropriate SBO procedure.

4. Proposed Modifications

a. The licensee stated (14) that no modifications to the facility will be required to cope with a 4-hour SBO event. However, the licensee has mentioned the removal of ceiling tiles to achieve an adequate control room SBO temperature on loss of ventilation, but has not stated whether this will be a permanent modification or a station blackout operator action covered by an appropriate SBO procedure.

b. Because the plant is in ESW group "4," the licensee needs to commit to a EDG target reliability of 0.975. If the licensee chooses to retain its EDG target reliability at 0.95 then an eight hour coping period is required and plant modifications may be necessary. In addition, the licensee must re-submit a coping analysis for review.

5. Quality Assurance and Technical Specifications

The licensee needs to have a list of SBO equipment including mitigating systems, and instrumentation and controls, with a proper cross reference to a qualified QA program in its supplementing documentation.

5.0 REFERENCES

1. The Office of Federal Register, "Code of Federal Regulations Title 10 Part 50.63," 10 CFR 50.63, January 1, 1989.

2. U.S. Nuclear Regulatory Commission, "Evaluation of Station Blackout Accidents at Nuclear Power Plants - Technical Findings Related to Unresolved Safety Issue A-44," NUREG-1032, Baranowsky, P.W., June 1988.

3. U.S. Nuclear Regulatory Commission, "Collection and Evaluation of Complete and Partial Losses of Offsite Power at Nuclear Power Plants," NUREG/CR-3992, February 1985.

4. U.S. Nuclear Regulatory Commission, "Reliability of Emergency AC Power System at Nuclear Power Plants," NUREG/CR-2989, July 1983.

5. U.S. Nuclear Regulatory Commission, "Emergency Diesel Generator Operating Experience, 1981-1983," NUREG/CR-4347, December 1985.

6. U.S. Nuclear Regulatory Commission, "Station Blackout Accident Analyses (Part of NRC Task Action Plan A-44)," NUREG/CR-3226, May 1983.

7. U.S. Nuclear Regulatory Commission Office of Nuclear Regulatory Research, "Regulatory Guide 1.155 Station Blackout," August 1988.

8. Nuclear Management and Resources Council, Inc., "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," NUMARC 87-00, November 1987.

9. Thadani, A. C., Letter to W. H. Rasin of NUMARC, "Approval of NUMARC Documents on Station Blackout (TAC-40577)," dated October 7, 1988.

10. Thadani, A. C., letter to A. Marion of NUMARC, "Publicly-Noticed Meeting December 27, 1989," dated January 3, 1990, (Confirming "NUMARC 87-00 Supplemental Questions/Answers," December 27, 1989).

11. Nuclear Safety Analysis Center, "The Reliability of Emergency Diesel Generators at U.S. Nuclear Power Plants," NSAC-108, Wyckoff, H., September 1986.

12. Deddens J. C., letter to NRC Document Control Desk, "River Bend Station -Unit 1, Docket No. 50-458," dated April 17, 1989.

13. Deddens J. C., letter to NRC Document Control Desk, "River Bend Station -Unit 1, Docket No. 50-458," dated March 30, 1990.

14. Deddens J. C., letter to NRC Document Control Desk, "River Bend Station -Unit 1, Docket No. 50-458," dated October 18, 1991.

15. River Bend Station Updated Safety Analysis Report.