Attachment 1

SAIC-91/6652

TECHNICAL EVALUATION REPORT

SOUTH TEXAS PROJECT ELECTRICAL GENERATING STATION

STATION BLACKOUT EVALUATION

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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 procedures on 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 on-site emergency AC power sources, the reliability of on-site emergency power sources, the frequency of loss of off-site power (LOOP), and the probable time to restore off-site power.

In order to achieve a consistant 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 by the NRC staff (13) 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 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 the 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 (14) 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 3.4),

D. Proposed modifications (Section 3.3), 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) off-site 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 containment 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 is reviewed for any proposed modifications to emergency AC sources, battery capacity, condensate capacity, compressed air capacity, appropriate containment integrity and primary coolant make-up capability. 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.

The licensee's proposed use of an alternate AC power source is reviewed to determine whether it meets the criteria and guidelines of Section 3.3.5 of RG 1.155 and Appendix B of NUMARC 87-00.

This SBO evaluation is based on a review of the licensee's submittals dated April 17, 1989 (10) and March 30, 1990 (12), telephone conversations between NRC/SAIC and the licensee's staff on August 9 and 15, 1990, the licensee's response (17) to the questions raised during the telephone conversation, a follow-up telephone call to the licensee on December 13, 1990,

and the information available in the plant Updated Final Safety Analysis Report (UFSAR) (11); 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

3.1 Proposed Station Blackout Duration

Licensee's Submittal

The licensee, Houston Lighting and Power (HL&P), initially calculated (10 and 12) a minimum acceptable SBO duration of four hours for the South Texas Project Electric Generating Station (STPEGS). This determination was based on an implementation of a pre-hurricane procedure which calls for shutting down the plant if the hurricane windspeed exceeds 120 miles per hour (mph). Since the selection of the 120 mph hurricane windspeed was greater than the NUMARC 87-00 recommended windspeed of 73 mph, the staff informed the licensee during the telephone conversation on August 9, 1990, that it cannot take credit for pre-hurricane shutdown to reduce the coping duration. In its subsequent submittal (17), the licensee revised the offsite power characteristic to "P3" with a required coping duration of eight hours. The licensee stated 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 AC power design characteristic group is "P3" based on:

   a. Independence of the plant offsite power system characteristics of "I1/2,"

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

   c. Estimated frequency of LOOPs due to extremely severe weather (ESW) which places the plant in ESW group "5," and

d. Estimated frequency of LOOPs due to severe weather (SW) which places the plant in SW group "1."

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

The EAC power configuration of the plant is "C." Each unit at STPEGS is equipped with three emergency diesel generators (EDGs). Two EDGs, (EDG A and EDG B), are assigned to EAC power configuration. The third EDG, (EDG B), is assigned as an Alternate AC (AAC) power source. Only one EDG is required to operate safe shutdown equipment following a LOOP.

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

The licensee has selected a target EDG reliability of 0.975. The selection of this target reliability is based on having a unit average EDG reliability of greater than 0.94 for the last 50 demands consistent with NUMARC 87-00, Section 3.2.4.

Review of Licensee's Submittal

Factors which affect the estimation of the SBO coping duration are: the independence of the offsite power system grouping, the estimated frequency of LOOPs due to ESW and SW conditions, the expected frequency of grid-related LOOPs, the classification of EAC, and the selection of EDG target reliability. The licensee's estimate of the expected frequency of LOOPs due to ESW conditions, which places the STPEGS site in ESW group "5," is consistent with the data provided in Table 3-2 of NUMARC 87-00. Using the data provided in Table 3-3 of NUMARC 87-00, the expected frequency of LOOPs at STPEGS due to SW conditions are estimated to be 0.0037 or 0.0018 depending on the site having offsite power transmission lines on one, or multiple rights-of way, placing the site in SW group "2" or "1," respectively. A review of the STPEGS UFSAR indicates the site has transmission lines on three rights-of-way, therefore, we concur with the licensee's selection of SW group "1."

The licensee stated that the independence of the plant offsite power system grouping is "I1/2." A review of STPEGS UFSAR indicates that:

1. All offsite power sources are connected to the plant through a single switchyard;

2. During normal operation the class 1E electrical buses in each unit are powered from two independent sources of offsite power: two buses are powered from an offsite power source through the standby transformer and one bus from the main generator through the unit auxiliary transformer;

3. Upon loss of power from main generator, the connected emergency bus will be powered from the unit standby transformer through an automatic transfer; and

4. Upon loss of power from the unit standby transformer the connected buses are powered from the other unit standby transformer, or emergency transformer through manual transfer.

Based on the above and the criteria stated in Table 5 of RG 1.155, the plant independence of offsite power system group is "I2."

With regard to the 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 plants in the U.S., only covers these incidents through the calendar year 1984. The STPEGS did not begin its commercial operation until June of 1989. In the absence of any contradictory information, we agree with the licensee's statement.

Based on an independence of offsite power system grouping of "I2," grid-related LOOPs of less than one per 20 years, ESW group "5," and SW group "1," STPEGS has an offsite power design characteristic of group "P3."

The licensee stated that the EAC classification of STPEGS is "C." This is based on the determination that one EDG is required to support the safe shutdown loads following a LOOP and two-out-of-three existing EDGs (EDG A and C) are available and designated as EAC power sources. Review of the plant UFSAR, Section 8.3.1.1.4, indicates that each unit is equipped with three independent, physically separated, EDGs supplying power to three associated load groups designated as Train A, Train B, and Train C. Each EDG and load group of a particular unit is also physically separated and electrically independent from the other two EDGs and their load groups. Each train (i.e., load group) is not totally redundant, however. Two trains are necessary to mitigate the consequences of a design basis accident.

The guidance provided in NUMARC 87-00 Supplemental Questions/Answers (14), under Question 3.4, states that when determining the number of EAC power sources necessary to operate safe shutdown equipment the shutdown loads powered must be capable of maintaining the plant in a safe shutdown condition for an extended period. The licensee stated (17) that limited manual actions are needed to maintain long term cooling. Based on the information provided in Reference (17) and the plant UFSAR, it is not clear whether Train A and Train C are fully redundant and each can provide one full division of safe shutdown equipment and related instrumentation and controls to maintain the plant in a safe shutdown condition for an extended period. On the surface, it appears that only Train A can be considered to provide a quasi-division; whereas, Train C does not appear to provide one. Even if each train meets the full division requirement, the licensee's statement that only one EDG train is sufficient to operate the safe shutdown equipment following a LOOP appears to be justified for a limited time period; it is bounded by insufficient battery capability to provide the required instrumentation and controls support.

If Train A or Train C cannot provide a full division of ESF equipment and instrumentation and controls, then the licensee needs to consider that two-out-of-three EDGs are required for supporting LOOP loads and EDG B

cannot be assigned as an AAC power source. If this is the case, (i.e. two-out-of-three EDGs are needed), then the EAC classification of the plant is "D." The licensee needs to provide information supporting the conformance of the EAC classification to the guidance stated above.

The licensee stated that the 0.975 target EDG reliability is based on the demonstrated start and run reliability of EDGs for the last 20 and 50 demands. At the time of initial submittal (10), the EDGs had not accumulated 100 start demands each. The licensee provided the statistics for the 20 and 50 start demands. Based on this information, the EDGs at STPEGS experience an average reliability of 0.998 per diesel generator. Using this data, it appears that the target EDG reliability (0.975) selected by the licensee (10) to be appropriate. The licensee stated (10) that a reliability program has been implemented at STPEGS to ensure that the target EDG reliability is met. However, the information supporting the statistics of the EDG reliability is only available on site for review. An audit may be required to ensure compliance and to identify whether the STPEGS formal EDG reliability program is consistent with the guidance of the RG 1.155, Section 1.2, and NUMARC 87-00, Appendix D.

Based on the above, and pending the licensee's confirmation that Train A or Train C provides a full division of instrumentation and controls and ESF equipment, the offsite power design characteristic of the STPEGS site is "P3" with a minimum required SBO coping duration of eight hours.

3.2 Alternate AC (AAC) Power Source

Licensee's Submittal

The licensee stated that one EDG per unit, (EDG B), will be designated as the AAC power source. The AAC power source will be available within 10 minutes of the onset of an SBO event. This power source will have sufficient capacity and capability to operate systems necessary for coping with an SBO for the required duration of eight hours.

Review of Licensee's Submittal

The licensee's AAC power source is a class 1E EDG that meets or exceeds all the required criteria specified in Appendix B to NUMARC 87-00. The AAC power source has sufficient capacity to support the required loads. However, it lacks the connectability to support the control room emergency lighting, the centrifugal charging pump, and the boric acid transfer pump. The licensee stated that a positive displacement charging pump which is powered by a non-class 1E diesel generator will be used to provide reactor coolant system (RCS) make-up. During the telephone conversation on August 9, 1990, the licensee stated that the control room lighting is provided by several battery packed self contained unit during an SBO event. The adequacy of these units have been evaluated during the control room design review evaluation process. The licensee added that the boric acid transfer pump will not be needed during an eight hour coping duration.

Based on the above explanations/justifications, we concur with the licensee that the proposed AAC power source has sufficient capacity to support the SBO loads.

3.3 **Station Blackout Coping Capability**

The plant coping capability with an SBO event for the required duration of eight hours is assessed based on the following results:

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

Licensee's Submittal

The licensee stated (17) that the minimum permissible volume of water in the Auxiliary Feedwater Storage Tank (AFST) is sized to support cooldown over 14 to 21 hours including 4 hours at hot standby until residual heat removal (RHR) is initiated. The duration varies with the initiating event and single failure

considered. Therefore, STPEGS has adequate condensate available for decay heat removal during an SBO of eight hours with AAC power available.

Review of Licensee's Submittal

Using the expression given in NUMARC 87-00, Section 7.2.1, each unit would need approximately 138,000 gallons of condensate water to remove decay heat during an 8-hour SBO event. This estimate is based on a maximum licensed core thermal rating of 3876 Mwt, or 102% of 3800 MWt (Table 4.1-1 of the plant UFSAR). The licensee stated that if the positive displacement pump was not able to maintain the RCS inventory, the reactor will be depressurized/cooled down below 1600 psig where the high head safety injection (HHSI) pump can be used to replenish the RCS losses. If the licensee were to cool down the RCS below 1600 psig additional condensate would be needed. However, plant Technical Specifications requires a minimum condensate level of 525,000 gallons be available in the AFST. Therefore, we concur with the licensee that adequate condensate inventory is available to maintain the plant in a safe shutdown condition during an SBO event.

2. **Class 1E Battery Capacity**

Licensee's Submittal

The licensee stated that the STPEGS design has been reviewed to ensure that adequate battery capacity is available to support decay heat removal during the 4-hour SBO. At STPEGS each of the four class 1E vital 120 V AC channels is backed by its own class 1E battery. Calculations determined that Channel II (Train D) is adequate for an eight hour duration and Channel III (Train B) is adequate as sized for a 4-hour duration, with no load shedding. Channels I (Train A) and IV (Train C) are each adequate for a four

hour duration provided that the NSSS inverter on each channel is switched off within 30 minutes of the start of an SBO event.

The licensee stated that either channel I (Train A) or Channel IV (Train C) must be maintained to support control room display of safe shutdown plant parameters. These channels will be alternated to cover the eight-hour duration. One channel will be maintained energized during the first four hours. The other channel will be de-energized within the first 30 minutes of the blackout and re-energized less than its NSSS inverter, at approximately four hours into the event. This load shedding requirements will be incorporated into the plant procedures.

Review of Licensee's Submittal

A review of the plant UFSAR indicates that the class 1E batteries are sized to carry their connected ESF loads for two hours without power flow from the chargers in the event of loss of AC power. The plant has four class 1E batteries. The licensee stated that Battery A and Battery C can last for four hours if the NSSS inverters on these batteries are shed within 30 minutes. Battery B will be charged from the AAC power source (EDG B), and Battery D has sufficient capacity for eight hours. Since neither Battery A nor Battery C can be charged from the AAC power source and one of them is needed to support the required safe shutdown instrumentation in the control room, the licensee has proposed to alternate use of these batteries to cover the eight-hour duration. The licensee stated that switching off one NSSS inverter would not cause any undesirable ESF actuations. However, if two NSSS inverters are switched off it would generate ESF actuation signals. The licensee's proposed action requires that two of the NSSS inverters to be switched off within 30 minutes of an SBO. Therefore, operator actions are required to prevent ESF actuations. In addition, alternating the use of Battery A and C during an SBO also adds additional operator actions which are outside of the normal and

emergency training procedures. These actions make operator tasks more difficult and would exacerbate the already difficult situation. Therefore it does not appear to be consistent with the staff's position (15 and 16) that not to burden the operators excessively. Based on the discussion with the staff, the licensee needs to provide charging capability for either Battery A or C during an SBO event. Without this capability, the plant does not conform to the SBO guidance.

3. **Compressed Air**

Licensee's Submittal

The licensee stated that no air operated valves are required to cope with an SBO, and no further action is required.

Review of Licensee's Submittal

A review of the plant UFSAR indicates that the compressed air system is not required to perform any safety function. An air compressor and associated instrument air emergency cooling water pump may be put in service by using a non-class 1E balance-of-plant diesel. However, for the purposes of this review, no air is assumed to be available during an eight-hour SBO event. Following a LOOP, air-operated valves throughout the plant are designed to fail in the safe position upon loss of air. Our review concurs with the licensee's statement.

4. **Effects of Loss of Ventilation**

Licensee's Submittal

The licensee stated that an assessment has been performed to determine the steady-state temperature in dominant areas containing equipment necessary to achieve and maintain safe shutdown during an

SBO event. The licensee added that, except for the turbine-driven auxiliary feedwater (AFW) pump room, ventilation to all areas of concern is provided by the AAC power source. The calculated steady-state ambient air temperature for the turbine-driven AFW pump room during an SBO using the NUMARC 87-00 method is 132°F. The result of a transient heat-up calculation for this room after eight-hours is 124°F. During an 8-hour SBO, the control room temperature at STPEGS would reach 107°F. This is also based on the result of a transient heat-up calculation. Therefore, the control room is not a dominant area of concern.

The licensee added that testing has demonstrated the capability to maintain acceptable control room and relay room temperatures with only one train of HVAC in service. The test was conducted with two trains of control room HVAC fans in service in the make up and clean-up recirculation mode (for maximum heat load) but with only one cooler train in service. The control room temperature was found to not increase during operation of only one train of HVAC.

Reasonable assurance of the operability of SBO equipment in the turbine driven AFW pump room, (the only dominant area of concern), has been assessed using Appendix F to NUMARC 87-00. No modifications or associated procedures are required to provide reasonable assurance for equipment operability.

Review of Licensee's Submittal

Based on the licensee's statement that the AAC power source (EDG B) and its associated ESF train will support the required HVAC for the equipment operating on that train, we conclude that the plant conforms to the SBO guidance. However, the licensee needs to have a procedure for opening the cabinet doors inside the control room and relay room within 30 minutes. This is needed to maintain the temperature inside the cabinet below 120°F. The control room temperature is calculated to be 107°F, and according to the

licensee, the equipment in the control room cabinet are designed for conditions up to 120°F. If we were to assume a 15°F temperature rise inside the cabinet compared to the average bulk room temperature, the equipment inside these cabinets will experience a temperature above 120°F. Opening the cabinet doors to reduce the hot spots and potential equipment operability problems is a recommended guidance in the NUMARC 87-00 Supplemental Questions and Answers.

5. Containment Isolation

Licensee's Submittal

The licensee stated that an assessment has been performed to ensure that appropriate containment isolation can be provided during a station blackout event. The plant list of containment isolation valves has been reviewed to verify that valves which must be capable of being closed or that must be operated (cycled) under station blackout conditions can be positioned (with indication) independent of the preferred and blacked-out unit's class 1E power supplies. No plant modifications and/or procedure changes were determined to be required to ensure that appropriate containment integrity can be provided under an SBO conditions.

Review of Licensee's Submittal

Upon review of the plant containment isolation valves given in Figure 6.2.4-1 of the UFSAR, we found several valves that can not be excluded using the criteria stated in RG 1.155. These valves are normally closed motor-operated valves that fail as is upon loss of power. Since only one train of ESF buses can be powered from the AAC power source, the licensee needs to ensure that these valves are closed during an SBO event. The assurance needs to be provided by listing these CIVs in an appropriate procedure and identifying the actions required to ensure these valves are fully closed by

providing position indications (local, remote, mechanical, process information, etc.) independent of preferred and EAC power sources.

6. Reactor Coolant Inventory

Licensee's Submittal

In its recent submittal (17), the licensee stated that the AAC power source supplies power to the make-up systems necessary to maintain adequate RCS inventory to ensure that the core is cooled for the required coping duration of eight hours.

The licensee stated (17) that the maximum expected reactor coolant pump (RCP) seal leakage during an SBO would be 3 gpm per pump, based on the seal leakoff rates during normal seal injection. Charging flow directed to the reactor coolant pumps for seal water is nominally 8 gpm. Nominally 5 gpm enters the labyrinth seals and thermal barrier. The remainder of the flow, 3 gpm, is directed up the pump shaft to the number one seal leakoff and then discharged either to the suction side of the charging pumps or to the volume control tanks. During an SBO, when both centrifugal charging pumps are unavailable, RCP seal injection flow and reactor coolant boration capability can be maintained by a 35 gpm positive displacement pump powered by the non-class 1E Technical Support Center diesel generator.

Assuming a seal leakage rate of 25 gpm per pump, plus the miscellaneous technical specification leakage of 10 gpm, results in a total leakage rate of 110 gpm. With only the positive displacement pump, the plant must contend with a net outflow of 75 gpm. This case has been analyzed assuming availability of one standby diesel generator as the AAC source, so that there is continued capacity for HHSI system. In this scenario the RCS must be depressurized below 1600 psig for the HHSI pump to inject.

Assuming a net RCS leakage rate of 75 gpm, the operators have a minimum of 178 minutes before natural circulation ends. Plant procedures describe actions to be taken in the event of loss of all AC power. Activation of safety injection as described in Emergency Operating Procedures will ensure that at the end of natural circulation the reactor core will remain covered for a station blackout duration of eight hours.

Review of Licensee's Submittal

Reactor coolant make-up is necessary to replenish the RCS inventory losses due to the RCP seal leakage (25 gpm per pump), and the technical specifications maximum allowable leakage (10 gpm according to reference 17). The make-up, or the charging, system at STPEGS during an SBO is a positive displacement pump with a design flow capacity of 35 gpm. With an assumed 110 gpm RCS leak rate, and the positive displacement pump running, a net loss of 75 gpm would result. The licensee's analysis determined that with this leak rate the operators have a minimum of 178 minutes before natural circulation ends. Before this occurs, the operator will activate the safety injection system, per emergency operating procedures 1POP05-EO-EC02, which will ensure core coverage. One HHSI pump can deliver 800 gpm of borated water at 1750 psig from the Reactor Water Storage Tank (RWST). The RWST has a minimum volume of 383,500 gallons of water to be used for safety injection. With this system core coverage is assured even with cooldown and/or depressurization. However, the licensee needs to verify that the HHSI flow indication which powered from a non-class 1E power source will be available during an SBO event.

Note:

"The 25 gpm RCP seal leak rate was agreed to between NUMARC and NRC staff pending resolution of Generic Issue (GI) 23. If the final resolution of GI-23 defines higher RCP 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."

3.4 Proposed Procedures and Training

Licensee's Submittal

The licensee stated 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 listed the name(s) of the plant procedures, which fall in each of above categories, in the plant SBO submittal. The licensee stated that these procedures will be revised, if necessary, to meet NUMARC 87-00 guidelines.

Review of Licensee's Submittal

We neither received nor reviewed the affected SBO procedures. We view 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.

3.5 Proposed Modifications

Licensee's Submittal

The licensee did not propose any modifications.

Review of Licensee's Submittal

Our review indicates that the licensee needs to provide charging support for either Battery A or C to prevent alternating their use during an SBO event. This modification is necessary to conform to the staff's guidance. In addition, if Train A or Train C cannot be considered to provide a full division of instrumentation and controls the licensee may need to perform other modifications for EDG B to be classified as an AAC power source.

3.6 Quality Assurance and Technical Specifications

The licensee did not provide any information on how the plant complies with the requirement of RG 1.155, Appendices A and B.

4.0 CONCLUSIONS

Based on our review of the licensee's submittals and the information available in the UFSAR for South Texas Project Electrical Generating Station, we find that the submittal does not conform to the requirements of SBO rules for the following reasons:

1. **Emergency AC (EAC) power configuration Group**

   The licensee classified the plant as an EAC group "C." This is based on the determination that one EDG is required to support the safe shutdown loads following a LOOP and two-out-of-three existing EDGs (EDG A and C) are available and designated as EAC power sources. The guidance provided in NUMARC 87-00 Supplemental Questions/Answers (14), under Question 3.4, states that when determining the number of EAC power sources necessary to operate safe shutdown equipment the shutdown loads powered must be capable of maintaining the plant in a safe shutdown condition for an extended period. It is not clear whether Train A and Train C are fully redundant and each can provide one full division of safe shutdown equipment and related instrumentation and controls to maintain the plant in a safe shutdown condition for an extended period. On the surface, it appears that only Train A can be considered to provide a quasi-division; whereas, Train C does not appear to provide one. If Train A or Train C cannot provide a full division of safe shutdown equipment and instrumentation and controls, then the licensee needs to consider that two-out-of-three EDGs are required for supporting LOOP loads and EDG B cannot be assigned as an AAC power source. If this is the case, then the EAC classification of the plant is "D." The licensee needs to provide information supporting the conformance of the EAC classification to the guidance stated above.

2. **Class 1E Battery Capacity**

The licensee stated that either Battery A or Battery C is needed to support control room display of safe shutdown plant parameters. However, these batteries can only last for four hours provided that the NSSS inverter loads on these batteries are shed within 30 minutes. Since neither Battery C nor Battery A can be charged from the AAC power source, the licensee has proposed to alternate use of these batteries to cover the eight-hour duration. There are two problems with the proposed action:

1. The operator actions required to timely switch off both the NSSS inverter loads and one train of DC loads without causing ESF actuations would burden the operators excessively and exacerbate the already difficult situation. This does not conform to the staff's guidance that not to burden the operators excessively.

2. The switching off and on and alternating the use of a set of instrumentation and controls for meeting the SBO rule does not appear to be of a sound practice. The problem becomes more pronounce if a set of instrumentation is out of service before the accident occurs.

Therefore, the licensee needs to provide charging capability for either Battery A or C during an SBO event. Without this capability, the plant does not conform to the SBO guidance.

3. **Effects of Loss of Ventilation**

The licensee stated that the control room temperature is calculated to be 107°F during an SBO event. However, the licensee did not state whether the plant has a procedure for opening the cabinet doors inside the control room and the relay room within 30 minutes. This is needed to maintain the temperature inside the cabinet below

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.

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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.

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10. McBurnett, M. A., letter to the Document Control Desk, U.S. Nuclear Regulatory Commission, "South Texas Project Electric Generating Station

Units 1&2, Docket Nos. 50-498, STN 50-499, Response to 10 CFR 50.63, Loss of all Alternating Current Power," dated April 17, 1989.

11. South Texas Project Electric Generating Station Updated Final Safety Analysis Report.

12. McBurnett, M. A., letter to the Document Control Desk, U.S. Nuclear Regulatory Commission, "South Texas Project Electric Generating Station Units 1&2, Docket Nos. 50-498, STN 50-499, Station Blackout Implementation: Request for Supplemental SBO Submittal to NRC," dated March 30, 1990.

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

14. Ghadani, 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).

15. Tam P. S., Memorandum for, " Daily Highlight - Forthcoming Meeting with NUMARC on Station Blackout (SBO) Issues (TAC 40577)," dated April 25, 1990, (Providing a Draft "Staff Position Regarding Use of Emergency AC Power Sources (EDGs) as Alternate AC (AAC) Power Sources," dated April 24, 1990).

16. Russell, W. T., letter to W. Rasin of NUMARC, "STATION BLACKOUT," dated June 6, 1990.

17. Harrison, A. W., letter to Document Control Desk of U.S. Nuclear Regulatory Commission," South Texas Project Electric Generating Station, Units 1 and 2, Docket Nos. STN 50-498, STN 50-499, 10 CFR 50.63, Loss of All Alternating Current Power, - Response to NRC Questions," ST-HL-AE-3509, dated January 10, 1991.

120°F. If we were to assume a 15°F temperature rise inside the cabinet compared to the average bulk room temperature, the equipment inside these cabinets will experience a temperature above 120°F. Opening the cabinet doors to reduce the hot spots and potential equipment operability problems is a recommended guidance in the NUMARC 87-00 Supplemental Questions and Answers.

4. Containment Isolation

Our review of the plant CIVs indicates that there are several motor operated valves that are not locked closed and will fail as is upon loss of power and, therefore, can not be excluded by the criteria given in RG 1.155. The licensee needs to add these valves in an appropriate procedure to ensure that they are fully closed, if needed, by providing position indication (local, remote, mechanical, etc.) independent of the preferred and EAC power sources.

5. Proposed Modifications

The licensee did not propose any modifications. However, our review indicates that the licensee needs to provide charging support for either Battery A or C to prevent alternating their use during an SBO event. This modification is necessary to conform to the staff's guidance. In addition, if it cannot be justified that Train A and C each represents a full division, the licensee may need to perform other modifications for EDG B to be classified as an AAC power source.

6. Quality Assurance and Technical Specifications

The licensee's submittal does not document the conformance of the plant's SBO equipment with the guidance of RG 1.155, Appendices A and B.