Attachment 1
SAIC-91/1258

TECHNICAL EVALUATION REPORT

VIRGIL C. SUMMER

STATION BLACKOUT EVALUATION

TAC No. 68610

Science Applications International Corporation
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 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 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 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 (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 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, ventilation system, containment isolation 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.

This SBO evaluation is based on a review of the licensee's submittals dated April 17, 1989 (12), March 23, 1990 (13), and October 4, 1991 (14), and the available information in the plant Final Safety Analysis Report (FSAR) (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

3.1 Proposed Station Blackout Duration

Licensee's Submittal

The licensee, South Carolina Electric and Gas Company (SCE&G), calculated (12) a minimum acceptable station blackout duration of four hours for the V.C. Summer Station. The licensee stated that no modification are necessary to attain this proposed coping duration.

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

1. **Offsite Power Design Characteristics**

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

   a. Estimated frequency of LOOPs due to extremely severe weather (ESW) which places the plant in ESW Group "3,"

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

   c. Independence of the plant offsite power system characteristic of "I1/2," 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 group at V.C. Summer is "C." The site is equipped with two emergency diesel generators (EDGs), one of which is necessary to operate safe shutdown equipment following a LOOP.

3. **Target Emergency Diesel Generator Reliability**

The licensee stated (12) that a target EDG reliability of 0.950 was selected based on the unit average EDG reliability of greater than 0.950 for the last 100 demands, consistent with NUMARC 87-00. In a later submittal (13) the licensee committed to maintain the targeted EDG reliability.

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 estimation of the site ESW classification of "3" is consistent with that given in Table 3-2 of NUMARC 87-00. Using the data given in Table 3-3 of NUMARC 87-00, the expected frequency of LOOPs at V.C. Summer due to SW conditions is estimated to be "0.0094," or "0.0030" depending on the site having offsite power transmission lines either on one or multiple rights-of-way, respectively. These values places V.C. Summer in SW group "2" and "1," respectively. A review of the V.C. Summer FSAR, Figure 8.2-1, indicates (15) that the site could be considered to have transmission lines on multiple right-of-ways, hence SW group "1," as claimed by the licensee, is appropriate.

The licensee classified the plant independence of offsite power as "I1/2." Our review of the plant FSAR indicates (15) that:

1. All offsite power sources are connected to the plant through two electrically connected switchyards;

2. During normal plant operations, each emergency bus, (total of two), is powered from a different offsite power source through a transformer. The emergency bus 1DA is normally powered from one of the two engineered safety features (ESF) transformers, XTF4-ES and XTF6-ES, whereas the emergency bus 1DB is powered from the emergency auxiliary transformer, XTF31-ES; and

3. Upon loss of power from one offsite power source, the affected emergency bus can be powered the second offsite power source through an automatic and a manual back-up transfer.

Based on the above and the guidance provided in RG 1.155, Table 5, the site independence of offsite power can be classified as "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 power plants in the U.S., indicates that V.C. Summer did not have a grid-related LOOP up to 1984. In the absence of any contradicting information, we agree with the licensee's statement that the frequency of grid-related LOOPs is expected to be less than one per 20 years.

V.C. Summer has two Emergency AC (EAC) power sources with one required to power safe shutdown loads following a LOOP. This places the plant in EAC group "C" (RG 1.155, Table 3), as the licensee correctly identified.

In regard to the EDG target reliability, the licensee stated (12) that a target of 0.950 had been selected based on an average EDG reliability of greater than 0.950 for the last 100 demands. The licensee also provided (16) the EDG failure statistics for the last 20 and 50 demands, in accordance with the requirements of RG 1.155, which confirms that the target selection is appropriate. The licensee stated (13) that the selected EDG Target reliability will be maintained in accordance with Appendix D of NUMARC 87-00. However, it did not identify whether the plant has any formal reliability program which at minimum meets the steps given in RG 1.155, Position 1.2.

Based on an ESW group "3," an SW group "1," and an independence of offsite power group "I1/2," the offsite power design characteristic of the V. C. Summer plant is "P1." This determination, in conjunction with EAC group "C," leads to a required SBO coping duration of four hours in accordance with NUMARC 87-00, Table 3-8, as stated by the licensee (12).

3.2 Station Blackout Coping Capability

The plant coping capability 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 61,604 gallons of water are required for decay heat removal during the four hours of an SBO event. The calculation was based on Section 7.2.1 of NUMARC 87-00 using a maximum reactor thermal power of 2785 MWt (16). The minimum permissible condensate storage tank level, per Technical Specifications, provides 172,700 gallons of water, of which 160,100 gallons will be usable for the emergency feedwater (EFW) pump operation (16). This amount of condensate exceeds the required quantity for coping with a 4-hour SBO event.

Review of Licensee's Submittal

Based on a maximum reactor power of 2785 MWt a four hour SBO would require 61,604 gallons of condensate for decay heat removal, using the NUMARC methodology. In its response to questions, the licensee stated that the plant emergency operating procedure, (EOP 6.0) calls for primary system cooldown, which the operators may follow during an SBO event. The licensee added even if cooldown is initiated, the site would still have sufficient condensate to cope and recover from an SBO event (16). Our review concurs with the licensee's assessment that the minimum usable condensate is sufficient for decay heat removal and cooldown during a 4-hour SBO event.

2. Class-1E Battery Capacity

Licensee's Submittal

The original submittal (12) stated that the class-1E batteries had sufficient capacity to support a four hour SBO event, provided that load stripping was performed. The licensee later informed the NRC staff of his intention to replace the class-1E batteries (14), and installed larger class-1E batteries during the fifth refueling outage. The licensee's submittal of October 4, 1991 (14) states that the new batteries have sufficient capacity to meet the required SBO duration without having to strip any loads. The licensee in its description of the sizing calculations (16) stated that the new batteries were sized in accordance to IEEE Std-485 and included an aging factor of 1.25, a design margin of 1.10, and a temperature correction factor of 1.11 (i.e. the lowest temperature anticipated of 60°F). The battery sizing calculations are documented in Gilbert/Commonwealth calculation No. DC-832-005.

Review of Licensee's Submittal

The licensee did not provide the details of the battery sizing calculations for review. The licensee stated that the new batteries are sized larger than that is needed, i.e., each battery contains 60 cells and 58 cells were considered in the sizing calculation. The licensee added that the calculations also considered all correction factors as recommended in IEEE Std-485. Based on the licensee's statement, we agree that the batteries have sufficient capacity to support the SBO loads, pending future verification.

3. Compressed Air

Licensee's Submittal

The licensee stated (12) that air-operated valves relied upon to cope with an SBO for four hours can be operated manually. Valves requiring manual operation are identified in plant procedures.

In response to the questions raised during the review, the licensee stated (16) that local manual operation of the EFW flow control valves and the main steam power operated relief valves (PORVs) are needed during an SBO event. The licensee added that the areas where the PORVs are located will be habitable early in the SBO event. Manual operation of the PORVs is included in the "Loss of all ESF AC Power" procedure (EOP 6.0). Emergency lighting and mobile radios for communication are provided for this operation. While operating the PORVs locally is difficult because of the handwheel location, manual operation is possible, and the ability to locally operate these valves has been verified during a hot functional test.

Review of Licensee's Submittal

The emergency feedwater system and the atmospheric steam dump system were reviewed to determine their dependency on compressed air. While the emergency feedwater system operates without compressed air, decay heat removal via the PORVs can only be accomplished by manual operation of the valves due to loss of compressed air during an SBO event. The licensee stated that local manual operation of EFW flow control valves and the PORVs are possible. Therefore, we conclude that the site can cope with an SBO event. However, the licensee needs to clearly

identify the time frame when PORV operations need to be performed and ensure that the area is habitable when these actions are needed. This time frame has to be included in the EOP 6.0.

4. Effects of Loss of Ventilation

Licensee's Submittal

The licensee stated (16) that an evaluation consistent with the guidance provided in NUMARC 87-00 was performed to identify the dominant areas of concern (DACs) at V. C. Summer station. This evaluation identified three DACs which are listed in the following table, along with their associated station blackout temperature, type of heat-up analysis performed, and justification for Reasonable Assurance of Operability (RAO).

AREA	TEMPERATURE °F		ANALYSIS	RAO JUSTIFICATION
	INITIAL	FINAL		
EFW pump Room	104	144	NUMARC	equipment evaluation per NUMARC
Control Room	78*	120*	Non-NUMARC	≤ 120°F
Relay Room	78*	~119*	Non-NUMARC	< 120°F

* These values were estimated from the temperature rise Vs. time in the licensee's calculation
+ Values are for four hours.

The licensee listed dominant areas of concern in the reactor building, intermediate building, and east/west penetration access areas in its initial submittal (12), and stated that the equipment in these areas has been previously evaluated for harsh environmental conditions (16). Therefore, consistent with the Revision 1 of Appendix F to NUMARC 87-00, Section F.1.4, "Assumptions and Definitions," the equipment will be qualified for an

SBO event. The licensee also looked at the equipment located in these areas that was not previously evaluated, and concluded that the equipment operability will be assured based on the generic information given in Appendix F to NUMARC. The licensee stated that reasonable assurance of the operability of SBO response equipment in the above dominant areas of concern has been assessed using Appendix F to NUMARC 87-00 and/or the Topical Report.

Review of Licensee's Submittal

As part of the response to questions raised during our review, the licensee provided (16) a summary of details of their evaluation of the effects of a loss of ventilation in the control room, relay room, steam turbine driven emergency feedwater pump room, and other areas classified as harsh. Our findings regarding the licensee's evaluations are summarized below:

Steam Turbine Driven EFW Pump Room

Our review of the temperature rise calculation for this room, which followed the NUMARC 87-00, Appendix E method, indicates that the evaluation to be appropriate, except for the following two concerns:

1. The licensee considered only two high energy lines (steam and EFW coolant) to pass through this room. Usually, this room contains more steam lines, i.e. steam trap, and other small steam lines. The licensee needs to verify that all the potential heat sources have been considered in its evaluation.

2. The licensee used an insulation surface temperature of 50°C for both high energy lines. The licensee did not state where this temperature has been evaluated. The licensee needs to document a reference for this temperature and verify that the condition at which this temperature is evaluated is consistent with that of an SBO event.

Control Room

We reviewed the licensee-provided information for the control room heat-up and equipment operability in this room. The licensee stated (16) that control room temperature of 120 °F is based on a previously calculated control room temperature for loss of HVAC after a LOOP using a heat load of 29 kW. The licensee added that this temperature is conservative, because the heat generation from the energized equipment in the control room is 14,865 W.

Our review of the licensee's provided information and the plant FSAR indicates that the licensee's estimated heat load and the temperature rise calculation to be non-conservative. First, the plant has six 7.5 kVA class-1E inverters. If we were to assume 80% of each inverter output is used to support the equipment in the control room, then a total of ~29 kW comes directly from AC operated equipment. Without any DC operating equipment, this estimate is equal to that used in the room heat-up calculation. Second, the FSAR indicates that the control room is separated from other rooms with gypsum boards. At elevation 463 ft, where the control room is located, there are other heat sources, i.e. data display room, operation and technical support staff, which the licensee did not consider in its evaluation. Third, aside from an initial room temperature of 77 °F, which is non-conservative, we do not know what assumptions the

licensee made regarding the control room surrounding temperatures. In addition, At this elevation the FSAR Figure 1.2-17 shows a suspended ceiling. We do not know whether the heat-up calculation has considered the effect of this suspended ceiling or not.

Finally, the licensee did not commit to open the control room cabinet doors, contrary to the NUMARC guidance, and stated that except for two nuclear instrumentation consoles, all of the control room equipment is qualified for temperatures much higher than 120°F. The nuclear instrumentation consoles are qualified for 120°F for a period of 24 hours. While the licensee's approach appears to be acceptable and the equipment evaluated appears to function at temperatures in excess of 120°F, this review can not determine if all vital components were evaluated.

Based on the above, we conclude that the estimated control room heat generation rate to be low, and calculations are performed non-conservatively. The licensee can choose an initial room temperature of 77°F, however, it has to establish administrative controls to ensure that this room temperature would not be exceeded during normal plant operation.

Relay Room

Our review of the licensee's temperature rise calculation (16) for this room results in the following concerns. First, the licensee's estimate of heat loads appears to be low. The licensee has estimated that each of the 7.5 kVA inverter produces 1200 W of heat. Our estimate puts this heat loss at 2000 W. The Westinghouse 7.5 kVA has a .750 efficiency. Since the inverter rating is based on its output, then the inverter would requires 8 kW to produce 7.5 kVA at 0.8 power factor. Therefore, the heat loss would be 2000 W (8000 X 0.25). There are six class 1E inverters for a

total heat generation rate of 12 kW, whereas the licensee's estimate puts these at 7.2 kW. This change increases the licensee's estimated relay room heat load (33,410 W) by 14.40%. Second, the relay room, like the control room, is surrounded by other rooms separated with gypsum boards. It is not clear what assumptions regarding the surrounding room temperatures have been considered in the heat-up analysis. Therefore, we cannot concur with the licensee's conclusion that the room temperature is < 120°F after four hours.

5. **Containment Isolation**

Licensee's Submittal

The licensee stated (14) that the plant list of containment isolation valves was reviewed to verify that containment isolation valves that must be operated under SBO conditions can be positioned, with indication, independent of the unit's preferred and blacked-out class-1E AC power supplies. No modifications or procedure changes were necessary to ensure containment integrity under SBO conditions.

Review of Licensee's Submittal

The list of containment isolation valves in the FSAR and that provided by the licensee's response to questions (14) were reviewed to determine the capability of the licensee to establish containment isolation under SBO conditions. The exclusions allowed by RG 1.155 (paragraph 3.2.7) were applied. Our review concurs with the licensee that adequate containment isolation integrity is assured during an SBO event. All penetrations are either excluded using the criteria in the RG 1.155, or excluded on the bases that they meet the intent of the guidance.

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 has been assessed for [illegible] events. The generic analyses listed in NUMARC 87-00 were used in this assessment. The expected rates of RCS inventory loss under SBO conditions do not result in core uncovery. Therefore, RCS makeup systems under SBO conditions are not required to maintain core cooling under natural circulation (including reflux boiling).

The licensee, in response to the questions, stated (14) that it used the results of a generic a analysis performed by the Westinghouse Owner's Group, WCAP-10541, "Reactor Coolant Pump Seal Performance Following a Loss of All AC Power." The licensee added (16) that this report shows that even with a seal leakage of 150 gpm/pump, the time to core uncovery is greater than four hours. This analysis is applicable to the V. C. Summer nuclear station.

Review of Licensee's Submittal

The licensee needs to have a plant specific analysis. The generic analysis is not acceptable without proper justification and documentation regarding its applicability to the plant. In the absence of any analysis from the licensee, we performed an independent RCS inventory calculation using the information available in the plant FSAR, and that provided in the licensee's submittals. During a 4-hour SBO event, the RCS is assumed to lose 88 gpm, corresponding to a 25 gpm per pump seal and a 13 gpm for the Technical Specification allowed leakage, resulting in a total loss of

21,120 gallons, or ~2823ft^3. In addition, RCS level will be lost due to primary system cooldown and water volume shrinkage. The plant FSAR states that at the maximum guaranteed power the total RCS water volume is 8,850 ft^3. Even if we were to assume that the RCS will be cooled down to a saturation temperature of 420 °F, the RCS inventory will be sufficient to cover the core and maintain natural circulation to keep the core cooled. Therefore, we concur with the licensee that the core will remain covered during a 4-hour SBO event.

NOTE:

"The **25 gpm RCP seal leak rate** was agreed to between NUMARC and the staff pending resolution of Generic Issue (GI) 23. If the final resolution of GI-23 defines higher 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 analysis and actions addressing conformance to the SBO rule.

3.3 Proposed Procedures and Training

Licensee's Submittal

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

a. Severe Weather:
EPP-015, "Natural Emergency (Earthquake, Tornado)"

b. AC Power Restoration:
EOP-6.0, "Loss of All AC Power"
EOP-6.1, "Loss of All AC Power Recovery Without SI Required"
EOP-6.2, "Loss of All AC Power Recovery With SI Required"

The licensee further stated (12) that the following SBO response plant procedures have been reviewed and procedure changes will be implemented:

a. SBO response per NUMARC 87-00, Section 4.2.1

b. Procedure changes associated with modifications required after assessing coping capability per NUMARC 87-00, Section 7.

Review of Licensee's Submittal

We neither received nor reviewed the affected procedures. These procedures are plant-specific actions concerning the required activities to cope with an SBO event. The licensee identified the procedures that have been reviewed as well as those that have been modified to cope with an SBO event. 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 (12) that there are no plant modifications required to attain the proposed coping duration of four hours.

Review of Licensee's Submittal

This review identified no modifications that appear to be necessary to cope with a four hour SBO. However, our review identifies several concerns, see section 3.2, which may require modification(s) for their resolutions.

3.5 Quality Assurance and Technical Specifications

Quality Assurance

The licensee did not address the conformance of the plant's SBO equipment to the guidance of the RG 1.155, Appendix A.

Technical Specifications

The licensee did not address the impact on the Technical Specifications of the requirements of the SBO rule, nor were any Technical Specification changes identified by this review as being needed.

4.0 CONCLUSIONS

Based on our review of the licensee's submittals and the related supporting documents, we find that V.C. Summer's submittal conforms to the requirements of the SBO rule and the guidance of R.G. 1.155 with the following exceptions:

1. **Emergency Diesel Generator (EDG) Reliability Program**

   The licensee needs to ensure that the plant has a formal EDG reliability program that conforms to the guidance given in RG 1.155, Regulatory Position 1.2.

2. **Compressed Air**

   The licensee needs to clearly identify the time frame when PORV operations are needed and ensure the habitability of that area for the operation of the valves. This time frame has to be included in proceedure EOP 6.0. In addition, the licensee needs to simulate the SBO scenario, identify the manual actions and equipment needed to support the operation of the EFWs and PORVs, and train the operators accordingly.

3. **Loss of Ventilation**

a. Control Room

We conclude that the estimated control room heat generation rate to be low, and calculations are performed non-conservatively. The licensee can choose an initial room temperature of 77 °F, however, it has to establish administrative controls to ensure that this room temperature would not be

exceeded during normal plant operation. In addition, the licensee needs to ensure the operability of all vital components located in the control room.

b. Relay Room

The licensee's estimated relay room heat load (33,410 W) is 14.40% low by our calculations. Also, It is not clear what assumptions regarding the surrounding room temperatures have been considered in the heat-up analysis. Therefore, we cannot concur with the licensee's conclusion that the room temperature is < 120°F after four hours.

c. Steam Turbine Driven EFW Pump Room

Our review of the temperature rise calculation for this room, which followed the NUMARC 87-00, Appendix E method, indicates that the evaluation to be appropriate, except for the following two concerns:

1. The licensee considered only two high energy lines (steam and EFW coolant) to pass through this room. Usually, this room contains more steam lines, i.e. steam trap, and other small steam lines. The licensee needs to verify that all the potential heat sources have been considered in its evaluation.

2. The licensee used an insulation surface temperature of 50°C for both high energy lines. The licensee did not state where this temperature has been evaluated. The licensee needs to document a reference for this temperature and verify that the condition at which this temperature is evaluated is consistent with that of an SBO event.

4. **Proposed Modifications**

The licensee stated that there are no plant modifications required to attain the proposed coping duration of four hours. This review identified no modifications that appear to be necessary to cope with a four hour SBO. However, our review identifies several concerns, see section above, which may require modification(s) for their resolutions.

5. **Quality Assurance and Technical Specifications**

The licensee did not address the conformance of the plant's SBO equipment to the guidance of the RG 1.155, Appendix A.

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)," October 7, 1988.

10. Thadani, A.C., letter with attachment to A. Marion of NUMARC, "Publicly Noticed Meeting, December 27, 1989," dated January 3, 1990 (confirming "NUMARC 87-00 Supplemental Questions/Answers," December 27, 1987).

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

12. Letter from O.S. Bradham (SCE&G) to Document Control Desk, U.S. Nuclear Regulatory Commission, "Station Blackout," dated April 17, 1989.

13. Letter from O.S. Bradham (SCE&G) to Document Control Desk, U.S. Nuclear Regulatory Commission, "Supplemental Station Blackout Submittal," dated March 23, 1990.

14. Letter from J. L. Skolds (SCE&G) to Document Control Desk, U.S. Nuclear Regulatory Commission, "Response to Questions Concerning Station Blackout," dated October 4, 1991.

15. Virgil C. Summer Nuclear Station Final Safety Analysis Report.

16. Attachments to Reference 14 "Response to Questions Concerning Station Blackout," dated October 4, 1991.