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Report Nos.: 50-424/93-28 and 50-425/93-28

Licensee: Georgia Power Company
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Docket Nos.: 50-424 and 50-425 License Nos.: NPF-68 and NPF-81

Facility Name: Vogtle 1 and 2

Inspection Conducted: December 6 - 10, 1993

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EXECUTIVE SUMMARY

This was the second Station Blackout Inspection conducted by the Region II staff. The team used Temporary Instruction 2515/120 "Inspection of Implementation of Station Blackout Rule Multi-Plant Action Item A-22". This inspection was to verify the adequacy of the licensee's programs, procedures, training, equipment and systems, and supporting documentation for implementation of Station Blackout (SBO) Rule, 10 CFR Part 50.63.

In the areas inspected no violations or deviations were identified.

The team concluded that the licensee was implementing the SER recommendations and addressing the concerns.

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The coping duration analysis determined that Vogtle was required to cope with an SBO for 4-hours. The team determined that the analysis used to make this determination was performed in accordance with the guidelines established in NUMARC 87-00. The documentation to support this determination provided an adequate basis for the coping duration. The team concluded that the SBO systems were adequate to cope with a SBO of a 4-hour duration.

The conclusions with regard to battery systems were that they had the capacity to meet the SBO design criteria. During the review of electrical calculations several items were identified that could effect battery margin; inverter load current measurements did not consider instrument accuracies and load fluctuations, use of correct inverter efficiencies, some actual rated loads exceeded values used in calculations and review of battery performance curves at the end of the duty cycle indicated the voltage to be slightly less than the calculated voltage. The cumulative effect of these items, in the team's judgement, was that at worst some minor load shedding may be required during the 4-hour coping duration.

The team identified a few instances where a memorandum of a telephone conversation with a vendor was used to document design basis information rather than by the use of formal correspondence. The team considered this a weakness when this information is used as design input information in calculations.

The SBO procedures provided operators with adequate instruction to operate SBO equipment during an SBO event and the operators were knowledgeable of the procedures. Procedural steps for the determination of SBO conditions were adequate. Procedural controls to maintain Reactor Coolant System inventory and the supply of auxiliary feedwater supply were adequate to prevent the core from being uncovered during the 4-hour coping period. The team concluded that emergency lighting and communications equipment were adequate to successfully operate SBO equipment and to coordinate emergency operating procedure activities during a SBO event. The team concluded that the Atmospheric Relief Valves (ARV) were accessible to plant operators and temperatures in the vicinity would not prevent local operation of the valves during an SBO event. The licensee's SBO training which included simulator training was adequate.

The team concluded that the heat-up calculations were performed properly to provide assurance of SBO equipment operability. The SBO procedures had sufficient provisions to mitigate the consequences of the loss of ventilation during an SBO event.

Adequate containment integrity was assured during an SBO of 4-hour duration.

The team concluded that the Emergency Diesel Generator (EDG) reliability program was functioning consistent with the guidance of Regulatory Guide (RG) 1.155, section 1.2.

The Severe Weather Checklist was adequate and met the intent of guidance in NUMARC 87-00. However, the Transmission System grid restoration plan did not meet the intent of RG 1.155.

Reviews of the Design Change Packages (DCP) developed to implement SBO requirements concluded that the changes were properly reviewed, safety evaluations were adequate and that functional testing requirements were performed and that the changes were installed.

The team concluded that the quality assurance program currently implemented for the SBO equipment meets the requirements of RG 1.155 Appendix A.

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1.0 Inspection Background/Objective

In 1988, the NRC issued the Station Blackout Rule, 10 CFR Part 50.63, Loss of All Alternating Current Power. Guidance on acceptable methods for meeting the requirements of the rule were established in NRC Regulatory Guide (RG) 1.155, Station Blackout. Concurrent with the development of the regulatory guide the Nuclear Management and Resource Council (NUMARC) developed guidelines and procedures for assessing Station Blackout coping capability and duration. This was documented in NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors.

This inspection was the second SBO inspection conducted in Region II. The inspection was conducted using Temporary Instruction 2515/120, Inspection of Implementation of Station Blackout Rule Multi-Plant Action Item A-22.

The licensee provided the NRC with Vogtle's response to the Station Blackout (SBO) Rule in a letter dated April 12, 1989. A supplemental response to this letter was provided on March 28, 1990. A response was also provided dated June 7, 1991 to respond to questions raised in an NRC letter dated May 10, 1991. The NRC issued a Safety Evaluation Report (SER) of Vogtle's response to the SBO Rule on February 20,1992. This SER was issued, subject to satisfactory resolution of certain items. These items involved verification of 1) Class 1E battery capacity adequacy, 2) the effects of loss of ventilation, and 3) containment isolation. It also indicated that our review of the licensee proposed hardware and procedural modifications were not complete. There were recommendations identified in the SER and it was requested that the licensee review these items and respond based on this review. The licensee responded to the SER, on March 26, 1992, and provided their evaluation and actions to the SER.

The Supplemental Safety Evaluation (SSE) was issued on June 16, 1992. The SSE indicated that the licensee per Section 2.2.2 should document the basis and justification for the initial temperature assumed in the heat-up analysis for the control room complex, and that administrative procedures and controls would be established to maintain temperatures consistent with these initial temperatures.

2.0 Safety Evaluation Report Recommendations

Each of the recommendations in the NRC Safety Evaluations for SBO were addressed during this inspection to verify that they had been implemented according to the licensee's commitment. Results of this inspection effort are as follows:

Recommendation: The licensee should address the following four concerns related to battery sizing calculations:

Concern: The licensee should verify that the electrolyte temperature of 70°F used in the battery capacity calculations is in fact the lowest anticipated temperature during normal plant operations as recommended in NUMARC 87-00.

Implementation: The team confirmed that the battery rooms are maintained at 75°F by a thermostatically controlled Heating Ventilation and Air Conditioning (HVAC) system. The HVAC system is a non-Class 1E system. The Electrical Distribution System Functional Inspection team reviewed the HVAC design for safety-related equipment spaces to ensure that ambient conditions were maintained within equipment design requirements. NRC Report No. 50-424,425/93-11 section 3.5 states: "Overall, the design documentation verified that HVAC design was adequate to maintain conditions within the equipment specifications." Therefore, the HVAC system is designed to maintain at least 70°F in the battery rooms when the lowest experienced outside temperature of 9°F is assumed.

Should the HVAC system fail, the operators perform surveillance rounds which would identify temperature problems in the battery rooms. Procedure 11887-1, Rev. 22, calls for recording the battery room temperature daily, and the data sheets specify an acceptance minimum temperature criterion of 70°F. The licensee stated that the battery room temperatures are recorded during the night shift using a calibrated temperature indicator. The team verified that should the recorded temperature be below 70°F appropriate corrective actions would be initiated. These corrective actions would include attempts to repair the HVAC equipment and measuring the electrolyte temperature of all battery cells using Procedure No. 28912-C, Rev. 14, 92 Day Battery and Charger Inspection and Maintenance Check, which was also the procedure for implementing Technical Specifications (TS) 4.8.2.1.b (92 day battery surveillance). If the average of all cells electrolyte temperature is below 70°F, a limiting condition for operation action statement would be entered.

In summary, the 70°F electrolyte temperature assumed in the battery capacity (and voltage) calculations is justified because the HVAC system normally maintains 75°F and operator surveillance rounds cover the contingency of a failed HVAC system.

Low battery room temperature is alarmed in the main control room. The alarm is set at 60°F rather than 70°F because controller tolerances would be expected to result in spurious alarms if the set point were higher. The team requested operator round surveillance records for March 13, 1993, which was known to have been a day where temperatures were close to the lowest recorded temperature for an extended period of time. The lowest battery room temperature on that day was 71°F which confirmed the HVAC system was functioning as designed. This recommendation had been implemented.

Concern: The licensee did not consider any design margin (10 percent to 15 percent per IEEE Std. 485) in its battery capacity calculation.

Implementation: The battery sizing calculations indicated that, in terms of positive plates required, the batteries had from 5 to 43 percent margin (depending on the battery). Four of the batteries had less than 10 percent margin. However, since load additions are administratively controlled and some margin did exist to account for tolerances, inaccuracies etc., the calculated margins are acceptable and meet the intent of the IEEE standard. This recommendation had been implemented.

Concern: The inverter 1DD1I4 full load efficiency of 74.5 percent was used in the calculation. Since the load is 80 percent of the rating, the licensee should assume a lower efficiency. This recommendation applied, in general, to all inverters.

Implementation: The licensee had not completed the implementation of this recommendation. Refer to section 4.1 for details.

Concern: The no load losses of 1800 W for 25 kVA inverters 1DD1I5 and 1DD1I6 is non-conservative and should be adjusted.

Implementation: The team verified that these inverters supply power to RHR isolation valves and are de-energized (tagged-out) during normal plant operation, and therefore will be de-energized during an SBO. The team concluded that actual plant configuration makes this concern not applicable.

Recommendation: The licensee should verify that the containment temperature profile during an SBO event is bounded by that of the LOCA/High Energy Line Break temperature profile. This verification should be included with other documentation that is to be maintained by the licensee in support of the SBO submittals. This licensee should use an initial temperature for the SBO control building complex heat-up calculation no lower than that allowed by the TS or the administrative procedures.

Implementation: As documented in the SSE, the LOCA/High Energy Line Break temperature profile for Vogtle would bound the temperature profile resulting from a 4-hour SBO event. This item was resolved in the SSE. The licensee had completed the implementation of the recommendation concerning initial temperatures. Refer to discussion in section 4.4 Effects of the Loss of Ventilation.

Recommendation: The licensee needs to list the normally open ac motor-operated globe valves in the excess letdown and seal water leakoff line (X-49) in an appropriate procedure and identify the actions necessary to ensure that these valves can be fully closed during an SBO event. The valve closure needs to be confirmed by position indication (local, mechanical, remote, process information, etc.). This information should be included with the other documentation that is to be maintained by the licensee in support of the SBO submittals.

Implementation: As documented in the SSE, the excess letdown seal water leakoff line containment isolation valves are nominal 2-inch diameter valves. In accordance with RG 1.155, valves less than 3-inch nominal diameter isolation capabilities are excluded from consideration of containment isolation capabilities. This recommendation had been implemented.

Recommendation: The licensee should include a full description including the nature and objective of the required modifications in the documentation that is to be maintained by the licensee in support of the SPO submittals.

Implementation: Refer to discussion in section 7.0 Modifications. This recommendation had been implemented.

Recommendation: The licensee should verify that the SBO equipment is covered by an appropriate QA program consistent with the guidance of RG 1.155, Appendix A. Further, this verification should be documented as part of the package supporting the SBO Rule response.

Implementation: Refer to discussion in section 8.0 Station Blackout Equipment Quality Assurance Program. This recommendation had been implemented.

Recommendation: The licensee should confirm that a documented program meeting, as a minimum, the guidance of RG 1.155, position 1.2, Reliability Program for Emergency Diesel Generators (EDG), is in place or will be implemented.

Implementation: This recommendation had been implemented.The licensee's emergency power source reliability program is discussed in section 4.8 of this report.

The team concluded that the licensee was implementing the SER recommendations and addressing the concerns.

3.0 Coping Duration Analysis

The specified duration for station blackout was based on the specific factors given in RG 1.155 which relate to the probability of loosing AC power and the probable time needed to restore offsite power. The licensee's coping duration analysis was reviewed, and accepted, by NRC as discussed in the SERs.

The team reviewed Calculation NX3AD04, Determining the Minimum Acceptable Station Blackout Duration Capability, which was for Unit 1 and the corresponding calculation for Unit 2, NX3AD05. These calculations contained the documentation for determining the minimum acceptable SBO duration capability. The calculations indicated that the coping duration should be 4-hours. The team concluded that the information in these calculations was accurate and that the methodology was acceptable and in accordance with the NUMARC guidelines.

4.0 Station Blackout Systems

The evaluation of those systems and equipment used to support the SBO are discussed in the following sections.

4.1 Battery Systems

The licensee's design criteria was that each of the four vital batteries, 1AD1A, 1AD1B, 2AD1A and 2AD1B, could supply adequate voltage to the SBO loads necessary for the 4-hour coping duration without load shedding. The design basis duty cycle or load profile which included operation of circuit breakers and EDG field flashing at the end of the coping duration were reviewed.

The licensee's analysis of the battery systems consisted of four calculations: X3CF02 "Battery Sizing for Class 1E Battery Systems", X3CK08-A "Class 1E DC Power Cable Sizing", X3CK03-A "Maximum Control Cable Lengths", and X3CK03-B "Control Cable Sizing Details". These calculations utilized combined system models intended to envelope both LOCA/LOOP and SBO design criteria. Battery sizing was done according to IEEE-485 guidelines. The power cable sizing calculation, performed with the aid of a computer code, determined worst case voltages at power buses, motors, inverters and major control panels. The methodology for control cable sizing was to determine a maximum allowable circuit length for various types of devices then compare these lengths to the actual cable length. Calculation X3CK03-A "Maximum Control Cable Lengths" was very difficult to review because the text was marked out and notes added in numerous places causing the document to be very cluttered.

Reviews of the battery sizing calculation indicated that, in terms of positive plates required, there was at least a 5 percent design margin in each battery. The calculation properly considered aging factor, temperature correction factor and input currents requirements for constant KW loads such as inverters at the lowest voltage values. The battery voltage calculations also contained some conservatism with regard to terminal voltage and current levels.

The team reviewed the methodology for the analysis. Calculation of the battery terminal voltage profile from the battery performance curves was reviewed in detail. The team verified that all potential loads were considered in the analysis. Consistency of input data between the sizing and voltage calculations was verified. The team requested verification of design input data for selected loads and detailed voltage calculation for selected circuits.

The team concluded that the installed batteries could meet the SBO design basis criteria. However, the team determined that the following items could impact the design margin of the batteries:

- For all the inverters, loading was based on field measurement of AC current taken during various modes of operation. Safety factors of 1.02 to 1.05 were applied to the measured values. However, the team concluded that a safety factor of about 1.1 should have been considered in lieu of the ones used to conservatively account for ammeter accuracy and load fluctuations.

- The efficiency assigned to certain inverters in the calculations was not related to the actual load. In general, the efficiency of inverters varies with load, and as load decreases, efficiency decreases. Inverters 1AD1I11, 1BD1I12, 2AD1I11 and 2AD1I12 were assumed to have an efficiency of 84 percent, but the factory test report indicated an efficiency of 82 percent at 100 percent of rated load. Since the load had been determined to be 60 percent of rated on these inverters, an efficiency substantially less than 84 percent should have been used in the calculations. The efficiency assigned to inverters 1DD1I4 and 2DD1I4 in the calculation was 67 percent but the loading was determined to be 64 percent of rated. If the correct efficiencies had been used, the battery loading could have been higher.

- Of the two "smaller" loads for which the team requested verification of design input data, the actual loads were determined to be greater than that used in the calculation. The load on circuit 2AD11-08, which is the power supply to the miscellaneous systems equipment panel, should be 8.6 A rather than 3 A. The load on circuit 2AD11-14, which powers isolation relays for the 13.8 kV switchgear should be 0.23 A rather than 0.1 A.

- The team's review of the battery performance curves indicated that end of duty cycle voltage was about 0.5 V less than calculated.

In addition, the efficiency assigned to certain inverters in X3CK08-A calculation was questionable because source design input documents were not available. Also, there was uncertainty as to whether resistances used in the battery voltage calculation were adjusted for the ambient temperatures that would exist during an SBO event.

The team noted that the generator field flashing circuit voltage had not been calculated. However, it was calculated during the inspection. The team reviewed this calculation and supporting documentation and concluded that the circuit met the design basis. The licensee indicated that they would incorporate this supplementary calculation into Calculation X3CK08-A, Class 1E DC Power Cable Sizing.

The team identified a few instances where a memorandum of a telephone conversation with a vendor was used to document design basis information rather than by the use of formal correspondence. The team considered this a weakness when this information is used as design input information in calculations.

The conclusions with regard to battery systems were that they had the capacity to meet the SBO design criteria. The cumulative effect of the items identified in the calculations, in the team's judgement, was that at worst some minor load shedding may be required during the 4-hour coping duration.

4.2 Auxiliary Feedwater and Steam Relief

The team reviewed emergency operating procedure 19100-C, ECA-0.0 Loss Of All AC Power, Revision 13 which included instructions for remote, manual operation of the auxiliary feedwater (AFW) flow control valves and for local, manual operation of the steam generator atmospheric relief valves (ARVs) from their hydraulic hand-pump stations. Plant operators were trained on the manual operation of these valves during their requalification training. The team also verified that adequate communication and emergency lighting equipment were available to facilitate the operation of these valves during an SBO event.

The team reviewed the heat-up calculations X4C1500S23, Miscellaneous Plant Area SBO Ambient Temperature Analysis, Rev. 2, and DC-1007, Environment - Interdiscipline, Revision 9, to determine if the main steam isolation valve (MSIV) areas were accessible and habitable during an SBO event. The hydraulic hand-pump stations for the ARVs are located in the MSIV areas and would be manned for local, manual operations. The calculated peak temperature in the MSIV rooms was 126°F. The ARVs would be operated on an intermittent basis and operators would not be continuously stationed in these areas during an SBO event.

The team concluded that the ARVs were accessible to plant operators and temperatures in the vicinity would not prevent local operation of the valves during an SBO event. The team determined that the SBO procedures and training were adequate to provide the operators with guidance for operating the AFW and steam relief systems for decay heat removal during an SBO event.

4.3 Condensate Inventory

The team reviewed calculation X4C1302V50, Condensate Storage Tank Capacity - SBO, Rev. 1, to determine if Vogtle had adequate condensate for decay heat removal during an SBO of 4-hour coping duration. The calculation was performed in accordance with the guidance provided in NUMARC 87-00, Section 7.2.1. The calculation concluded that a minimum storage capacity of 203,000 gallons of water was required to meet the SBO 4-hour coping duration. The Unit 1 and 2 TS, section 3.7.1.3, indicates that required condensate storage tanks (CST) water volume be at least 340,000 gallons of water. Thus, the TS minimum CST volume was greater than the volume required for dealing with an SBO of 4-hour coping duration. The team concluded that there was adequate auxiliary feedwater supply for dealing with an SBO event.

At Vogtle there are two CSTs for each unit. During normal operation, the turbine-driven auxiliary feedwater pump (TDAFWP) is aligned to one of the two CSTs on each unit. Upon reaching a low CST level (less than 15%), the SBO operating procedure provided guidance to locally switch to the alternate CST.

The team concluded that adequate condensate inventory would be available to cope with an SBO event of a 4-hour duration.

4.4 Effects Of The Loss Of Ventilation

The team reviewed the heat-up calculations to ensure that they were performed in accordance with the NUMARC 87-00 guidance. All the calculated peak area temperatures were less than the temperature limits described in the NUMARC 87-00 for the operability of SBO equipment.

In calculating the peak temperatures in some areas (rooms B47, B48, B52, B55, B61, B76 and B63 in Unit 1, and B26, B29, B31, B36, B04, B18 and B30 in Unit 2), the licensee took credit for opening doors to the rooms. The doors were required to be opened because initial analyses for the rooms housing the Westinghouse inverters indicated that, as closed environments, the ambient temperature may be as high as 137 °F. The team verified that emergency operating procedure 19100-C, ECA-0.0 Loss Of All AC Power, Revision 13, Step 14 had provisions that required opening of the previously mentioned doors within 30 minutes after the onset of an SBO event.

The team verified that during normal operations the TS Section 3/4.7.10, Area Temperature Monitoring, and REA 92-VAA042, Area Temperature Monitoring Program Evaluation, provided procedures or controls to maintain area temperatures consistent with the initial temperatures used in the SBO area heat-up analysis.

The team concluded that the heat-up calculations were performed properly to provide assurance of SBO equipment operability, and the that MSIV areas would be accessible and habitable. In addition, the team determined that the SBO procedures had sufficient provisions to mitigate the consequences of the loss of ventilation during an SBO event.

4.5 Containment Isolation

The team reviewed the exclusion process which the licensee used for identifying containment isolation valves (CIV) not required to be controlled during an SBO event. The team reviewed FSAR Table 6.2.1.1, which listed all CIV and other licensee documentation addressing CIVs. The licensee's exclusion process identified the CIVs which did not conform with the five criteria described in NUMARC 87-00. However, the licensee did exempt a number of CIVs for consideration as isolation valves of concern. The team found that the licensee's justifications with regard to the exclusion of these CIVs was consistent with and met the intent of RG 1.155. The team concluded that adequate containment integrity was assured during an SBO of 4-hour duration.

4.6 Compressed Air

The compressed air system at Vogtle was neither available nor required for mitigation of an SBO event. The air operated valves which are required for SBO, fail in the safe position upon loss of air pressure. The team concluded that the compressed air system was not required for the mitigation of an SBO event.

4.7 Reactor Coolant Inventory

The team verified by review of calculation X4C1201V02, Reactor Coolant System Inventory - Station Blackout Analysis, Revision 0, that the reactor coolant inventory was adequate to ensure that the reactor core would not uncover during the SBO 4-hour coping duration. The licensee utilized Westinghouse generic analysis WCAP-10541,"Westinghouse Owners Group Report Reactor Coolant Pump Seal Performance Following A Loss Of All AC Power", Revision 2 as the basis for evaluating the amount of Reactor Coolant System (RCS) inventory required to cope with an SBO event. The purpose of the calculation was to verify the basis (specifically, for assumed reactor coolant leakage rates that were indicated in the Westinghouse analysis) used for evaluating Vogtle's ability to maintain adequate RCS inventory during an SBO of 4-hour coping duration.

The calculation concluded a total reactor coolant leakage of 112 GPM. Based upon 100 GPM (25 GPM per seal) leakage, 10 GPM TS identified leakage, 1 GPM TS unidentified leakage, and 1 GPM primary-to-secondary leakage. The calculation also determined that the core uncovery time was 12.06 hours, and that the loss of natural circulation would not occur after initiation of an SBO event for 13.5 hours.

The licensee installed high-temperature o-rings to replace RCP seals as recommended by Westinghouse to ensure that the maximum seal leakage would not exceed 25 GPM. All RCP seals were replaced with high-temperature o-rings per plant maintenance work orders.

The team concluded that the calculated time durations for both core uncovery and loss of natural circulation exceeded the required coping duration of 4-hours and were acceptable. The team concluded that the calculation utilized acceptable assumptions, and was technically sound. The team concluded that based on the RCS leak rate assumption, the core would not be uncovered during an SBO of 4-hour coping duration.

4.8 EDG Reliability Program

The team reviewed the EDG reliability program to verify that the EDG reliability data was being trended and that the program was consistent with the guidance of RG 1.155, section 1.2.

The team noted that the EDG target reliability consistent with the plant category and coping duration selection was included in the EDG reliability program. The Diesel Start Log, Procedure 55038-C, Revision 4, dated March 29, 1993, monitored each start and load run of the EDG and trended the reliability. Failure rates were trended. The senior project engineer responsible for the EDG's, kept track of the number of valid failures in the last 100, 50, and 20 valid demands (on a per EDG and per unit basis) and would inform the Unit Shift Supervisor to adjust the EDG test frequency in accordance with the TS. Each EDG start and load-run demand was being evaluated and characterized using the Industry-wide Plant Performance Indicator Program (PPIP) methodology. The team noted that the program was adequate in identifying responsibilities for the major program elements. Management oversight programs were adequate to ensure that reliability levels were achieved and that the reliability program was functioning properly.

The current EDG reliability data is as follows:

EDG	DEMANDS	START FAILURES	LOAD/RUN FAILURES	RELIABILITY EDG	RELIABILITY UNIT
	20	0	0	1.0	
1A	50	1	0	0.98	
	100	1	3	0.96	
	20	0	0	1.0	1.0
1B	50	0	0	1.0	0.99
	100	0	1	0.99	0.975
	20	0	0	1.0	
2A	50	0	0	1.0	
	100	0	0	1.0	
	20	0	0	1.0	1.0
2B	50	0	0	1.0	1.0
	100	1	0	0.99	0.995

The EDG's have a target reliability of 0.95 on a per unit basis. The team concluded that the EDG reliability program was functioning consistent with the guidance of RG 1.155, section 1.2.

4.9 Emergency Lighting and Communications

The team reviewed the emergency lighting and communication equipment to assure that they were adequate and available to support operations personnel during an SBO event.

Emergency lighting was provided at specific locations where manual operation of plant equipment were required during an SBO event. Emergency lighting for the control room was provided backup power from the unaffected unit during an SBO event (refer to paragraph 7.0).

The team performed a walkdown inspection of selected Unit 1 and Unit 2 areas where local operation of SBO equipment was required, to assure that the SBO equipment could be operated with the existing emergency lighting. No problems were identified.

The licensee took credit for sound powered communications which would be available with the control room from remote areas in the plant where communication would be necessary during an SBO. During a walkdown inspection of Unit 1 and Unit 2 the team verified that adequate sound powered communications were available in areas where operations personnel would have to perform manual actions for coping with an SBO event.

The team concluded that the emergency lighting and communications equipment were adequate to successfully operate SBO equipment and coordinate emergency operating procedure activities during an SBO event.

4.10 Heat Tracing

NUMARC 87-00 section 4.3.1 (13) requires that the licensee consider the loss of heat tracing effects for equipment required to cope with an SBO. The licensee evaluated the loss of heat tracing for the CST level instrumentation and determined that the residual heat from the heat tracing prior to the SBO would prevent these insulated lines from freezing during the coping duration. Additionally, the minimum available CST inventory was much greater than the inventory required for the coping duration, hence, the CST level indication was not essential for decay heat removal. Similarly, the loss of heat tracing to the AFW flow transmitter sensing lines would not cause that indication to be lost.

The licensee had not previously evaluated the impact of the loss of heat tracing systems except as noted above. The team noticed that much of the SBO equipment was heat traced. During the inspection period, the licensee performed an evaluation and determined that the systems (reactor coolant, main steam, auxiliary feed water, condensate storage) required for core cooling and decay heat removal during SBO coping did not rely on heat tracing to perform their functions.

The team reviewed the licensee's evaluation and concluded that loss of heat tracing would not impact equipments' ability to cope with an SBO event.

5.0 Station Blackout Procedures

The procedures for dealing with an SBO were reviewed to determine if they were adequate for coping during the 4-hour duration. The recovery procedures were also reviewed.

5.1 Emergency Response Procedures

The team reviewed the emergency operating procedures and the licensee performed a walk through of the procedure on the plants simulator with selected members of the team. Procedures that required local operator actions during an SBO event were also reviewed. This review process included plant walkdowns. The purpose was to verify that the procedures provided adequate instructions to mitigate an SBO and that they were consistent with NUMARC 87-00 section 4.2 guidelines.

The main procedure for dealing with an SBO event was emergency operating procedure ECA-0.0 "Loss of All AC Power" Rev. 13. This procedure provided the actions to respond to a loss of all AC power. The procedure was complete and well developed. The operators were familiar with the procedure and knowledgeable of the steps. Attachments to the procedure included a list of all unnecessary battery loads that could be shed, a list of containment isolation valves whose closure would be verified, and a list of containment ventilation isolation dampers and valves whose closure would be verified. The procedure directed the operators to depressurize the RCS at a rapid rate (within the capacity of the Turbine Driven Auxiliary Feed Water Pump) to minimize RCS inventory loss. Instructions were adequate to perform these steps in a controlled manner. The procedure provided adequate instruction to the operators to prevent overheating of electrical equipment in the Control Building due to the loss of ventilation.

Abnormal operating procedure 18038-1 "Operation from Remote Shutdown Panels" Rev. 17 that provided the actions for local operation of the steam generator atmospheric relief valves was reviewed. The procedure provided adequate guidance for maintaining steam generator pressure.

The procedures developed to respond to an SBO event and for coping for the 4-hour duration were adequate and the operators were familiar and knowledgeable of the procedures.

5.2 Severe Weather Procedures

Per the licensee's coping analysis, the site is in extremely severe weather group 2, as defined in RG 1.155, Table 8. Group 2 sites are expected to have storms with winds exceeding 125 mph less than once in a thousand years.

The licensee's procedure 11889-C, Severe Weather Checklist, provided instructions for the identification and elimination of potential missiles from the site. The procedure also included reviewing the adequacy of site staff to support operations and repair activities; and expediting the restoration of important systems or components to service. The procedure also called for maximizing CST inventory.

The team concluded that the Severe Weather Checklist was adequate and met the intent of guidance in NUMARC 87-00.

5.3 Recovery Procedures

The licensee's submittal stated that Transmission System's grid restoration procedures would be updated and that new blackstart and restoration of power procedures would be generated. The submittal stated that these procedures would be in place by November 6, 1992. The team found that the subject procedures had been issued by the stated date, but that the basic recovery plan had substantial weaknesses.

The recovery plan contained two alternatives for power restoration. One alternative was to blackstart gas turbines at Plant Wilson which is approximately one mile from the plant switchyard. There is a direct 230 kV connection between Plant Wilson and the switchyard. The weakness with this is that a diesel generator at Plant Wilson is used to power the gas turbine cranking motors, and the generator and motors are separated by a relatively large amount of electrical impedance. Due to this, the cranking motors do not have adequate starting voltage. During a test, the turbines started, but the cranking motors burned up. Therefore, Plant Wilson was not regarded as a reliable recovery source of power.

The second alternative described in the recovery plan was to start at least one unit at the Harllee Branch steam electric plant. Harllee Branch is about 100 miles from the site and power would flow over a 230 kV line which passes through two substations enroute. The unit cannot be started with only onsite power supplies. The team was told that the starting power would be the Wallace Dam hydroelectric power plant which is about 25 miles from Harllee Branch. Wallace Dam has six units for a total capacity of 321 kW. The station is continuously manned, and they have a blackstart procedure.

The weakness with this alternate was the time factor. It would take about 45 minutes to blackstart a hydro unit, and 4-hours minimum after outside power was available to put a Harllee Branch unit on line if the boilers had cooled down. Therefore, this power restoration plan could be expected to take longer than the SBO coping duration time of 4-hours.

The team concluded that the Transmission System grid restoration plan did not meet the intent of RG 1.155. The licensee indicated that they would reconsider this approach to recovery of AC power.

6.0 SBO Training

As required by RG 1.155, the licensee was providing training which should ensure that operators could carry out all actions necessary to cope with an SBO event for at least 4-hours and to restore normal long-term core cooling/decay heat removal once AC power was restored. This training had been in place since initial plant startup. They provide initial training for new employees and continuing (or requalification) training for each licensed operator. It consists of classroom instruction, local equipment operation demonstrations and simulator exercises. The training focuses on the SBO emergency procedure and the reasons underlying each step in the procedure.

The team reviewed the lesson plans, handouts and training materials; and concluded they were thorough and complete. The duration and frequency of the training and testing was adequate. Course completion attendance records indicated that approximately 120 licensed operators received requalification training on the SBO procedure since May 20, 1993. This number included all licensed operators at the site.

With regard to restoration of offsite power after a blackout and actions required by the Transmission System operators, the licensee presented a memorandum from system operations dated January 30, 1989. The memorandum stated that each system operator and supervisor was familiar with the recovery procedure and that training was provided. Based on this memorandum, the team concluded that the intent of RG 1.155 was met with regard to training.

7.0 Modifications

Following an SBO event ambient room temperature would increase. The licensee investigated the possibility of spurious breaker tripping due to a temperature increase, which could cause a shift in the breaker trip characteristics. Several circuit breakers in Units 1 and 2 were identified that could potentially trip due to the increased ambient temperature conditions during an SBO. The following Design Change Packages (DCP) were developed to correct this problem.

DCP No. 90-V2N0142 was issued September 4, 1990 for Unit 2 to replace the circuits breakers identified that could spuriously trip. The following breakers were replaced; 30 A breakers 2AY1A-05 and 2BY1B-05 and 20 A breakers 2CY1A-05 and 2DY1B-05, in the vital 120 V Distribution Panels 2-1807-Q3-VI1, VI2, VI3 and VI4 were replaced with 35 A and 30 A breakers respectively. Similarly 15 A breakers 2AD12-03, 2AD12-08 and 1AD12-03 in the 125 VDC Distribution Panels 2-1806-Q3-DA2 and DB2 were replaced with 20 A breakers.

DCP No. 90-V1N0141 was issued July 18, 1991 for Unit 1 to replace the circuit breakers similar to those identified above. The following breaker were replaced; 30 A breakers 1AY1A-05, 1BY1B-05 and 20 A breakers 1CY1A-05 and 1DY1B-05, in the vital 120 V Distribution Panel 1-1807-Q3-VI1, VI2, VI3 and VI4 were replaced with 35 A and 30 A breakers respectively. Similarly 15 A breakers 1AD12-08 and 1BD12-03 in the 125 V - DC Distribution Panels 1-1806-Q3-DA2 and DB2 were replaced with 20 A breakers.

To provide adequate emergency lighting for the control room and other locations DCRs 91-V1N0140 for Unit 1 and 91-V2N0141 for Unit 2 were issued. These DCRs provided for the installation of additional emergency lights at specific locations where valve manipulations during an SBO may occur. The control room was provided with backup power from the other unit (which would be EDG backed) for emergency lighting during an SBO event.

A transfer switch was added in each unit to provide power to the control room lights from the other unit during an SBO. The transfer switch allows the control room lighting to be powered from either unit, and also provides charging to the control room lighting battery backup. This switch will reduce the time that lighting in the control room will be provided by the battery backup system. During an SBO event lighting in the control room is reduced because the lighting would be powered via a battery backup system.

These transfer switches ensured that EDG backed power will be available to the control room lighting after the 90 minute battery backup capacity becomes exhausted. The design maintains the present lighting scheme which included approximately half of the lights on Train A backed power and the other half on Train B. The design ensured that the loss of one train would not place the control room completely on battery lighting and would maintain the normal control room lighting level during the event. The transfer switch will be used to transfer the different groups of lights that are supplied from their units Train A power supply to the other units Train A power supply. The lighting panel (on the other unit) feeding the transfer switches are fed from isolation devices that provide adequate isolation between the safety related electrical power trains.

The team reviewed the DCPs and determined that the changes were properly reviewed, safety evaluations were adequate and that functional testing requirements were performed. Further, following field verification of actual installed equipment it was concluded that the DCPs were properly implemented.

8.0 Station Blackout Equipment Quality Assurance Program

The team reviewed the quality assurance program applied to the SBO equipment to verify that it met the requirements outlined in RG 1.155 Appendix A.

There were four DCPs issued to address SBO, as discussed in Section 7. The DCPs that were developed and implemented for the SBO requirements were prepared per procedure 50006-C, "Preparation of Design Change Request". This process is the one used for safety related changes. The changes included two non-safety related changes but were processed under the safety-related method. The existing test program for testing safety-related equipment was the same one used to functionally test these changes.

An audit performed by the site Safety Audit and Engineering Review of Vogtle Electric Generating Plant- Units 1 and 2 Station Blackout Requirements was also reviewed. The audit was complete and adequately detailed to determine the acceptability of the Quality Assurance program for SBO equipment.

The team concluded that the quality assurance program currently implemented for the SBO equipment meets the requirements of RG 1.155 Appendix A.

9.0 Exit Meeting

The inspection scope and findings were summarized on December 10, 1993, with those persons indicated in Appendix A. The team leader described the areas inspected and discussed in detail the inspection results. Dissenting comments were not received from the licensee. Proprietary information is not contained in this report.

Appendix A

Persons Contacted

Licensee Employees

*J. Beasley, General Manager, Vogtle
*G. Brauer, Engineer, Bechtel
*W. Burmeister, Manager, Engineering Support
*S. Chesnut, Manager, Technical Support
*C. Christiansen, Supervisor, Safety Audit and Engineering Review
*R. Dorman, Plant Training and Emergency Preparedness Manager
*S. Driver, Training Supervisor
*W. Gabbard, Nuclear Specialist, Technical Support
*J. Gasser, Unit 1 Superintendent
*M. Griffis, Plant Modification Manager
*P. Hendrickson, Materials Engineering Supervisor
*K. Holmes, Operations Manager
*S. Kitchens, Assistant General Manager
*R. Moye, Plant Engineering Supervisor
*A. Parton, Chemical Superintendent
*S. Phillips, Maintenance Superintendent
*M. Sliuka, Senior Technical Specialist
*A. Streetman, Senior Engineer, Nuclear Engineering and Licensing
*J. Swartzwelder, Outage and Planning Manager
*F. Thompson, Engineering Group Supervisor
*T. Webb, Engineer, Technical Support

Other licensee employees contacted during this inspection included engineers, operators, technicians and administrative personnel.

Other Personnel

*T. Mozingo, Site Representative, Oglethorpe Power Corporation
*M. Core, Electrical/Instrument and Control Engineering Supervisor, Omaha Public Power Distribution, Ft. Calhoun
*J. Lortz, Senior Associate, Devonrue, Limited

NRC Personnel

*B. Bonser, Senior Resident Inspector
*D. Starkey, Resident Inspector

*Attended exit interview

Appendix B

Acronyms and Abbreviations

A	Amperes
AC	Alternating Current
AFW	Auxiliary Feedwater
ARV	Atmospheric Relief Valve
CFR	Code of Federal Regulations
CIV	Containment Isolation Valve
CST	Condensate Storage Tank
DAC	Dominant Area of Concern
DC	Direct Current
DCP	Design Change Package
EDG	Emergency Diesel Generator
FSAR	Final Safety Analysis Report
HVAC	Heating Ventilation and Air Conditioning
KV	Kilovolts
KVA	Kilo-volt Amperes
KVAR	Kilo-volt Amperes Reactive
KW	Kilowatts
IEEE	Institute of Electrical and Electronics Engineers
LOCA	Loss of Coolant Accident
LOOP	Loss of Offsite Power
NUMARC	Nuclear Management Resources Council
MSIV	Main Steam Isolation Valve
PPIP	Plant Performance Indicator Program
QA	Quality Assurance
RCS	Reactor Coolant System
RG	Regulatory Guide
RCS	Reactor Coolant System
SBO	Station Blackout
SER	Safety Evaluation Report
SSE	Supplemental Safety Evaluation
TS	Technical Specifications
TDAFW	Turbine Driven Auxiliary Feedwater
W	Watts