UNITED STATES
NUCLEAR REGULATORY COMMISSION
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Enclosure

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FLORIDA POWER AND LIGHT COMPANY

TURKEY POINT UNIT NOS. 3 AND 4

COMPLIANCE WITH STATION BLACKOUT RULE 10 CFR 50.63

DOCKET NOS. 50-250 AND 50-251

1.0 INTRODUCTION

On July 21, 1988, the Code of Federal Regulations, 10 CFR Part 50, was amended to include a new section 50.63, entitled "Loss of All Alternating Current Power" (Station Blackout). The station blackout (SBO) rule requires that each light-water-cooled nuclear power plant be able to withstand and recover from an SBO of a specified duration. The SBO rule also requires licensees to submit information as defined in part 50.63 and to provide a plan and schedule for conformance to the SBO rule. The SBO rule further requires that the baseline assumptions, analysis and related information be available for NRC review. Guidance for conformance to the SBO rule is provided by Regulatory Guide (RG) 1.155, Station Blackout; and NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors."

Staff review of SBO submittals may be limited to a review of the licensee's submittal and need not include a concurrent site audit review of the supporting documentation. However, a limited number of site audits reviews were performed to obtain a benchmark for licensee conformance with the documentation requirements of the SBO rule. Turkey Point was one of the plants selected by the NRC for a site audit review.

The licensee's response to the SBO rule was provided by a letter (L-89-144) from W. F. Conway to U. S. Nuclear Regulatory Commission, dated April 17, 1989. The licensee's response was reviewed by Science Applications International Corporation (SAIC) under contract to the NRC. The site audit was performed by a joint NRC/SAIC team headed by an NRC staff member on August 15-18, 1989. Following the audit, the licensee submitted supplemental information dated March 29, 1990 to address specific items raised and discussed during the audit. The licensee did not deem it necessary to respond to the NUMARC 8700 supplemental questions and answers because they claimed similar information had been provided in the March 29, 1990 submittal.

The results of the review and site audit are documented by an SAIC Technical Evaluation Report (TER) SAIC-89/1642, "Turkey Point, Units 3 And 4, Station Blackout Evaluation," dated June 11, 1990 (Attachment 1).

2.0 EVALUATION

After reviewing the licensee's submittal and the SAIC TER and in consideration of the information obtained by the NRC staff during the site audit review and the supplemental information supplied by the licensee, the staff concurs with the SAIC analysis and conclusions as identified in the SAIC TER. Based on this review, the staff findings and recommendations are summarized as follows.

2.1 Station Blackout Duration

The licensee has calculated a minimum acceptable station blackout (SBO) duration of 4 hours based on a plant AC power design characteristic group "P2", an emergency AC (EAC) Power configuration Group "A", and a target Emergency Diesel Generator (EDG) reliability of 0.95. The target EDG reliability was based on each Turkey Point EDG having a reliability greater than 0.95 over the last 100 demands. The "P2" grouping is based on an independence of offsite power classification of Group "I 1/2", a severe weather (SW) classification of Group "1" and an extremely severe weather (ESW) classification of Group "4".

For the reasons discussed in the attached SAIC TER, the staff disagrees with the licensee's determination of several of the items used to determine the required SBO duration. The staff concludes that the Turkey Point Station offsite power design characteristic group is P3* based on ESW Group 5 alone. For the ESW group 5, the offsite power design characteristic is P3* whether the offsite independence power system group is I_1, I_2 or I_3. Also, the staff classifies the EAC Power in Group "C". The required coping duration is therefore 8 hours for an EDG reliability of 0.95 (or 4 hours for an EDG reliability of 0.975).

Although the licensee does not agree with the staff's assessment of the required coping duration, they have indicated informally that they can adequately cope with an 8-hour SBO since the AAC source will have adequate capacity to power the necessary loads.

Recommendation: The licensee should formally confirm that the plant can adequately cope with an 8-hour SBO, considering such factors as condensate inventory, battery capacity, ventilation, reactor coolant inventory and containment isolation.

2.2 Alternate AC (AAC) Power Source

The licensee has proposed an AAC power source to operate systems necessary for SBO coping duration and recovery therefrom.

2.2.1 General Staff Position on AAC Power Sources

The definition in 10 CFR 50.2, RG 1.155 and NUMARC 87-00 defines AAC power source in terms of four attributes: (1) connections to the offsite or the onsite AC power systems, (2) minimum potential for common cause failure with offsite power

or the onsite emergency AC power sources, (3) timely availability, and (4) required capacity and reliability. More specifically, in regard to the fourth attribute, the SBO rule reads as follows:

> "(4) Has sufficient capacity and reliability for operation of all systems required for coping with station blackout and for the time required to bring and maintain the plant in safe shutdown (non-design basis accident)."

In view of the variety of types, capacities and capabilities of power sources proposed as AAC sources by various licensees, the staff has characterized proposed AAC power sources as being either optimum, fully capable or minimally capable. This characterization, which relates only to the capacity attribute cited above, was necessary in order to facilitate the staff review of licensee responses to the SBO rule. It does not invalidate or revoke any of the requirements or guidance applicable to AAC power sources.

An optimum AAC power source design is one that is capable of powering simultaneously both safety trains of normal safe shutdown systems and equipment. Such a design, following actuation of the AAC source, would provide completely redundant normal safe shutdown capability during an SBO and recovery therefrom from the main control room.

A fully capable AAC power source design is one that is capable of powering at least one complete safety train of normal safe shutdown systems and equipment. This includes decay heat removal, battery charging, HVAC (heating, ventilation and air conditioning), emergency lighting, and the associated controls and instrumentation. Thus, although redundant capability is not available, a fully capable AAC source would enable attainment of safe shutdown during an SBO and recovery therefrom from the main control room.

A minimally capable AAC power source design is one that is not capable of powering all (or any) normal safety train related safe shutdown equipment; but it is capable of powering specific equipment that, in conjunction with extensive manual operator actions both inside and outside of the control room, is critical for attaining safe shutdown during an SBO. Diesel generators provided for fire protection and proposed as AAC sources are examples of minimally capable AAC sources. With this design, operability of the main control room could not be assured unless the batteries are sized to operate for the SBO duration, or battery charging capability is pro-vided by the AAC source.

2.2.1.1 EDGs Used as AAC Power Sources

The guidance on the use of existing emergency diesel generators (EDGs) as AAC power sources is documented in the station blackout rule 10 CFR §50.63, RG 1.155, Position C.3.3.5 and NUMARC 87-00 (Section 2.3.1(3)). This guidance is further explained in NUMARC 87-00 Supplemental Questions and Answers dated December 27, 1989, under questions 3.4 and B.3. The station blackout rule states:

> "At multi-unit sites, where the combination of emergency ac power sources exceeds the minimum redundancy requirements for safe shutdown (non-DBA) of all units, the remaining emergency ac power sources may be used as alternate ac power sources provided they meet the applicable requirements."

The rule statement requires minimum redundancy. This means that in order to qualify as an AAC source, there must be an EDG available in the non-blackout (NBO) unit that is in addition to the number of EDGs required to meet the minimum EDG redundancy requirement for powering a normal safe shutdown for a loss of offsite power (LOOP) event. Thus, the EDG's in a two-unit site with two dedicated EDG's per unit would not qualify as AAC sources because the two EDGs per unit just meet the minimum redundancy requirement, i.e., there is no excess EDG.

However, there are some plants at two-unit sites which just meet minimum redundancy but where each EDG is of sufficient capacity to fully power all the normal LOOP loads of the NBO unit, and also has sufficient excess capacity for powering the required safe shutdown loads of the SBO unit. In recognition of the existence of this type of situation, the staff has interpreted the excess EDG redundancy requirement of the SBO rule to allow EDGs just meeting the minimum EDG redundancy requirements to qualify as AAC sources on the basis of excess capacity, provided the other applicable requirements for AAC sources are also met.

The NRC's basic position on the use of EDGs as AAC power sources on the basis of excess capacity is that such excess capacity should not be attained by load shedding in the NBO unit which results in a degradation of its normally available safe shutdown capability for the loss-of-offsite-power (LOOP) condition. Any actions that would add to the burden of operators that are already in a high stress environment, such as load switching or disablement of information readouts or alarms in the control room, are considered to be a degradation of normal safe shutdown capability for LOOP in the NBO unit. The staff position is therefore that the normal equipment complement should remain available with adequate EDG capacity for use should it become necessary. The NBO unit should have the capability for hot shutdown/hot standby forced cooling, cooldown and depressurization, as required. While additional events are not explicitly being postulated, it is not prudent to diminish the capability of the NBO unit to mitigate problems should they arise. It is not in the interest of safety to reduce the capability to handle various eventualities in one unit for the purpose of meeting the SBO rule in another unit. Each unit must meet the SBO rule on its own merits without reducing another unit's capability to respond to its own potential problems.

Therefore, a multi-unit site with the dedicated EDGs just meeting the minimum redundancy requirement, but not having the excess capacity defined above for qualifying as an AAC source, does not meet the SBO rule AAC source option requirements. Further measures are required such as a separate AAC source or a coping analysis which shows the plant can cope with and recover from an SBO for the required duration.

2.2.1.2 Connectability of AAC Power Sources

The basic criteria governing the connectability of an AAC power source are contained in 10 CFR 50.2 (the AAC source should be connectable to but normally not connected to the offsite or onsite emergency AC power systems), 10 CFR 50.63 (SBO should not assume a concurrent single failure or design basis accident), and in Appendix A of 10 CFR Part 50 (The single failure criterion and the independence requirements apply to the non-blackout [NBO] unit). Therefore, in a one unit site as a minimum an AAC source need only be connectable to one set

of safe shutdown equipment, regardless of whether that equipment is part of a safety train or not, or whether the AAC source is an excess redundancy EDG or an independent power source.

However, at a two (or more) unit site where the EDGs meet the AAC source excess redundancy criterion, one intertie circuit between units is acceptable provided it is separately connectable to each safety (EDG) bus in both units. This follows from the application of the above criteria and the assumptions that must be taken that an SBO can occur in either unit, and that the single failure in the non-blackout unit can be on either one of its EDGs or on its respective safety bus.

2.2.2 Proposed AAC Power Source

The Turkey Point Station is a two-unit site with two totally shared EDGs.

The licensee proposes to install two additional Class 1E EDGs (resulting in a total of four, two dedicated per unit) and additional switchgear to their existing system to improve reliability and operational flexibility. These additional facilities are not considered to be a part of the SBO modifications and are being evaluated separately from this SBO evaluation. However, a 4160V connection between safety busses 3D of unit 3 and 4D of unit 4 (see SAIC TER Figure 1 for details) will also be added to permit either one of the EDGs of the non-blacked out unit to be used as an alternate AC (AAC) source for the blacked out unit. The AAC power source would be available to power the loads within 10 minutes following the confirmation that an SBO has occurred. The licensee has committed to performing a test to demonstrate that the AAC power source can power the SBO loads within 10 minutes.

Either of the two EDGs of one unit can be connected to either of the safety busses of the other unit for SBO conditions. The capacity of one of the two smaller EDGs (2850kW 2000 hour rating) is sufficient to simultaneously power the normal loss of offsite power (LOOP) shutdown loads of the non-blacked unit and all of the desired safe shutdown loads of the blacked out unit (2758kW). However, the licensee did not identify all the HVAC loads in his submittal or during the audit review. Because of the coping duration being 8 hours instead of 4 hours, the licensee should reevaluate and confirm that the unidentified HVAC loads do not exceed 92kW or that the operability of equipment is not compromised in the NBO and SBO units during SBO conditions when certain areas may not have HVAC.

The staff assessment of the proposed AAC power source indicates that it falls into the fully capable AAC power source category cited above. Based on our evaluation and the evaluation documented in the SAIC TER, it appears that the EDG/AAC source has sufficient excess capacity and connectability to power the SBO equipment with the exception noted in Section 2.3.4.

Recommendation: The licensee should confirm that the EDG/AAC power source has sufficient excess capacity, without degrading the NBO units LOOP shutdown capability, for powering SBO loads including HVAC in the SBO unit for the 8-hour SBO duration. If excess EDG/AAC capacity is not available for the required HVAC loads, the licensee should reevaluate the heatup in affected areas and document this evaluation in the documentation supporting the SBO submittal to provide reasonable assurance of equipment operability (see Section 2.3.4).

2.3 Station Blackout Coping Capability

The characteristics of the following plant systems and components were reviewed to assure that the systems have the availability, adequacy and capability to achieve and maintain a safe shutdown and recover from an SBO for a 4-hour coping duration. Further analyses should be completed to assure the adequacy of the systems and components for an 8-hour coping duration, since the Turkey Point 3 and 4 plant has been evaluated to be an 8-hour coping duration instead of 4-hour coping duration.

2.3.1 Condensate Inventory for Decay Heat Removal

The licensee's Final Safety Analysis Report indicates that the condensate storage tank inventory of 185,000 gallons per unit (the minimum Technical Specification (TS) requirement) is adequate to keep a unit in hot standby for about 23 hours. The staff therefore concludes that there is sufficient condensate water to cope with an SBO of 8 hours.

2.3.2 Class 1E Battery Capacity

The AAC source will be available to power the battery chargers in approximately 10 minutes. Battery capacity adequacy is not considered to be a concern under these conditions and the licensee was not required to perform any additional calculations to meet the requirements of the SBO rule.

2.3.3 Compressed Air

The licensee has stated that air-operated valves needed to cope with an SBO are supported by diesel engine driven air compressors which will continue to operate during an SBO. The staff therefore concludes that there is reasonable assurance that such valves will remain operable.

2.3.4 Effects of Loss of Ventilation

The licensee did not initially perform any calculations pertaining to loss of ventilation since the AAC source will be available within approximately 10 minutes to power the necessary ventilation equipment. However, not all ventilation equipment will be powered by the AAC source during an SBO. In their supplemental response, the licensee noted that HVAC will be available, after the AAC is connected to the blacked-out unit, to provide heat removal in the areas having SBO coping equipment. However, the staff/SAIC analysis indicates that the AAC source may not have sufficient capacity above that required for the non-blacked unit to power all of the HVAC loads of the blacked out unit.

Recommendation:

The licensee should confirm that the AAC source has sufficient excess capacity to power the necessary HVAC loads. If there is insufficient excess capacity, the licensee should perform an analysis to determine the temperature rise in the affected areas during the 8-hour coping duration and provide reasonable assurance that needed systems and equipment would remain operable.

2.3.5 Containment Isolation

The licensee did not address containment isolation since the AAC source will be available to power one of the blacked-out unit safety busses within approximately 10 minutes. The licensee was not required to address containment isolation if the AAC source is available within 10 minutes. During the site audit review, the licensee stated that power would be available for the appropriate valves to maintain containment integrity.

2.3.6 Reactor Coolant Inventory

The licensee plans to use one charging pump to maintain reactor coolant inventory. The charging pump will be powered by the AAC source and has a capacity of 75 gpm, which is adequate to provide sufficient makeup for a maximum calculated leakage of 100 gpm provided that no RCS shrinkage occurs. A review of reactor coolant inventory indicates that the inventory is adequate for the net loss that would occur during the 8-hour coping duration.

2.4 Procedures and Training

The licensee has committed to the issuance of new and revised procedures, including the associated training required to implement the procedures.

The proposed procedural and training modifications were not reviewed in detail but the staff expects the licensee to maintain these procedures to ensure an appropriate response to an SBO event.

2.5 Proposed Modifications

As discussed in paragraph 2.2.2 above, the licensee is adding a 4160V crosstie between the safety busses of units 3 and 4 so that one of the two EDGs of either unit can be used as an AAC source for an SBO of the other unit. This 4160V tie will have sufficient capacity to power the shutdown loads of the blacked-out unit and will be installed underground or be within buildings such that it will not be exposed to weather-related events. Physical separation of the crosstie will conform with the separation criteria of the plant's licensing basis. The staff finds that the proposed modification serves as a part of the AAC source and meets the applicable guidelines of RG 1.155 and NUMARC 87-00, Appendix B.

2.6 Quality Assurance and Technical Specifications

The licensee has committed to incorporate equipment used to cope with an SBO and not covered by current QA programs into a QA program that meets the guidance of RG 1.155, Appendix A. The staff finds this to be acceptable.

The TS for the SBO equipment are currently being considered generically by the NRC in the context of the Technical Specification Improvement Program. However, the staff understands that the plant procedures will reflect the appropriate testing and surveillance requirements to ensure the operability of the necessary SBO equipment. If the staff later determines that TS regarding the SBO equipment are warranted, the licensee will be notified of the implementation requirements.

2.7 EDG Reliability Program

The licensee's submittal on SBO did not specifically address a commitment to implement an EDG reliability program to conform to the guidance of RG 1.155, Position 1.2. However, during the site audit review, the licensee stated that their reliability program would meet these guidelines. The staff finds this to be an acceptable commitment toward meeting the requirements of the SBO rule.

2.8 Scope of Staff Review

The Station Blackout Rule (10 CFR 50.63) requires licensees to submit a response containing specifically defined information. It also requires utilities "--- to have baseline assumptions, analyses, and related information used in their coping evaluations available for NRC review." The staff and its contractor (SAIC) did not perform a detailed review of the proposed hardware and procedural modifications which are scheduled for later implementation. However, based on our review of the licensee supporting documentation and SBO audit, we have identified the following areas for focus in any follow-up inspection or assessment that may be undertaken by the NRC to verify conformance with the SBO rule. Additional items may be added as a result of the staff review of any revised SBO response.

a. Hardware and procedural modifications,

b. SBO procedures in accordance with RG 1.155, Position 3.4, and NUMARC 87-00, Section 4,

c. Operator staffing and training to follow the identified actions in the SBO procedures,

d. EDG reliability program meets as a minimum the guidelines of RG 1.155,

e. Equipment and components required to cope with an SBO are incorporated in a QA program that meets the guidance of RG 1.155, Appendix A, and

f. Actions taken pertaining to the specific recommendations noted above in this Safety Evaluation (SE).

3.0 SUMMARY AND CONCLUSIONS

The staff has reviewed the licensee's response to the Station Blackout (SBO) Rule (10 CFR 50.63) and the Technical Evaluation Report (TER) prepared by the staff's consultant, Science Applications International Corporation (SAIC). The staff and SAIC also jointly conducted a site audit review of some of the supporting documentation for the SBO response. Based on our review of the submittal and site audit, we find the licensee's design and proposed method of dealing with an SBO to be in conformance with the SBO rule. However, additional analyses and confirmations described in the recommendations itemized in this SE need to be completed. These include calculations for the HVA required to maintain ambient temperatures sufficiently low in the areas containing equipment and systems needed

to cope with an SBO for 8 hours. The licensee should maintain these analyses in the documentation supporting the SBO submittal available for further inspection and assessment as may be undertaken by the NRC to audit conformance with the SBO Rule.

Dated: June 15, 1990

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Attachment:
SAIC TER