UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO STATION BLACKOUT

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY, ET AL.

PERRY NUCLEAR POWER PLANT, UNIT NO. 1

DOCKET NO. 50-440

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, analyses and related information be available for NRC review. Guidance for conformance to the SBO rule is provided by (1) Regulatory Guide (RG) 1.155, Station Blackout, (2) The Nuclear Management and Resources Council (NUMARC) 87-00 , Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, and (3) NUMARC 87-00 Supplemental Questions/Answers and Major Assumptions dated December 27, 1989 (issued to the industry by NUMARC January 4, 1990).

To facilitate the NRC staff's (hereafter referred to as staff) review of licensee responses to the SBO rule, the staff endorsed two generic response formats. One response format is for use by plants proposing to use an Alternate AC (AAC) power source and the other format is for use by plants proposing an AC independent response. The generic response formats provide the staff with a summary of the results from the licensee's analysis of the plant's SBO coping capability. The licensees are expected to verify the accuracy of the results and maintain documentation that supports the stated results. Compliance to the SBO rule is verified by a review of the licensee's submittal, an audit review of the sup-

porting documentation as deemed necessary, and possible follow-up NRC inspections to ensure that the licensee has implemented the appropriate hardware and/or procedure modifications that will be required to comply with the SBO rule.

The licensee's responses to the SBO rule were provided by letters from A. Kaplan on April 17, 1989 and March 30, 1990 and M. D. Lyster on March 15, 1991 to U.S. Nuclear Regulatory Commission, Document Control Desk. Also, there was a teleconference between representatives of the licensee and the NRC Staff on February 8, 1991. The licensee's responses were reviewed by Science Applications International Corporation (SAIC) under contract to the NRC. The results of the review are documented in the SAIC Technical Evaluation Report (TER) SAIC-91/6665, "PERRY NUCLEAR POWER PLANT, STATION BLACKOUT EVALUATION," dated July 31, 1991 (Attachment 1).

2.0 EVALUATION

After reviewing the licensee's submittals and the SAIC TER the staff concurs with the SAIC analysis and conclusions as identified in the SAIC TER (refer to Attachment 1 for details). 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 "P1," an emergency AC (EAC) power configuration Group "C," and a target Emergency Diesel Generator (EDG) reliability of 0.95. The Group "C" EAC configuration is based on two EDGs not credited as AAC power supplies, with one EDG required to operate safe shutdown equipment following a loss of offsite power. The target EDG reliability was based on the Perry Nuclear Power Plant (PNPP) having an average EDG reliability greater than 0.94 over the last 50 demands. The "P1" grouping is based on an independence of offsite power classification of Group "I 1/2," a severe weather (SW) classification of Group "2" and an extremely severe weather (ESW) classification of Group "1."

The licensee selected a target EDG reliability of 0.95 based on the last 50 demands. The licensee did not furnish the values for the EDG reliability over the last 20 and 100 demands. The licensee should have an analysis showing the EDG reliability statistics for the last 20, 50, and 100 demands in its SBO submittal supporting documents.

After reviewing the available information in the licencee's submittals, RG 1.155, NUMARC 87-00 and SAIC's TER, the staff agrees with the licensee's evaluation of a 4-hour SBO coping duration.

2.2 Alternate AC (AAC) Power Source

The licensee has proposed an AAC power source to operate systems necessary for the required coping duration of 4 hours 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 define the 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 definition 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 partially 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 a SBO. Appendix R diesels proposed as an AAC source are examples of minimally capable AAC sources. With this design, operability of the main control room could not be assured unless the batteries were sized to operate for the SBO duration, or battery charging capability was provided by the AAC source.

2.2.1.1 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), and 10 CFR 50.63 (SBO should not assume a concurrent single failure or design basis

accident.) Therefore, 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.

2.2.2 Proposed AAC Power Source

The licensee has proposed to use the Division-III emergency diesel generator which provides power for the High Pressure Core Spray (HPCS) system, as an AAC power source. The licensee has stated that this power source is available within 10 minutes from the onset of an SBO event, has sufficient capacity and capability to operate systems necessary for coping with an SBO for a duration of 4 hours, and has capability to bring and maintain the plant in the hot-shutdown condition. The licensee has also stated that the AAC source meets the criteria of NUMARC 87-00, Appendix B.

The Division III EDG is capable of powering the HPCS pump and the pump supporting systems, and has minimal excess capacity which can be used for other needs. This excess capacity is only sufficient to operate motor operated valves (MOVs), one at a time, as proposed by the licensee. To accomplish this, the licensee has proposed to cross-connect two motor control centers (MCC) with a temporary cable (see Section 2.5) in order to power certain MOVs that are not powered from Division-III.

According to RG 1.155, Section 3.3.5, an AAC source, as a minimum, should be connectable to one set of safe shutdown equipment regardless of whether that equipment is part of a safety train or not. The proposed AAC source for PNPP (the Division-III EDG) is not connected to a full division (normal safety bus) for powering safe shutdown equipment. However, the staff conceptually accepts that the Division-III diesel generator could meet the minimally capable AAC source requirements and the connectability criteria of Section 2.2.1 above if a cross-connect capability were provided to one (or both) of the other full safety divisions to power the required SBO loads.

Based on the above, the staff has assessed that the proposed AAC source (the Division-III EDG) under the present configuration, or with the proposed cross-connect between MCCs, does not meet the capability and connectibility criteria of RG 1.155, and Section 2.2.1 above. Therefore, the staff would not classify the Division-III EDG as an AAC source. However, it is acceptable to use the Division-III diesel generator to assist in coping during an SBO event.

2.3 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 to recover from an SBO for a 4-hour coping duration.

2.3.1 Condensate Inventory for Decay Heat Removal

The licensee's Technical Specifications (TS) require a minimum condensate storage tank (CST) level of 150,000 gallons. Using NUMARC 87-00 calculations, the staff has determined that 81,000 gallons of water are required to remove decay heat for 4 hours. This estimate is based on 102% of a maximum licensed core thermal rating of 3579 MWt. In addition, 15,000 gallons of condensate is needed to account for reactor coolant leakage of 66 gpm (18 gpm per reactor coolant pump and a maximum allowable technical specification leakage of 30 gpm), bringing the total requirement to 96,000 gallons. This leaves approximately 54,000 gallons in the CST for cooldown and depressurization. In addition, there are 1,000,000 gallons of recyclable water available, in the suppression pool and upper pool make-up, for cool down and depressurization. The staff therefore concludes that there is sufficient condensate water to cope with and recover from an SBO of 4 hours.

2.3.2 Class 1E Battery Capacity

The licensee stated that the PNPP has four class-1E battery systems capable of supporting the design load of 2 hours. Two of the battery systems are

associated with Unit 1, one battery system each for Divisions I and II. Similarly, Unit 2 has one battery system each for its Divisions I and II. Since Unit 2 construction is incomplete, the licensee proposes to use the existing maintenance cross-tie between the Unit 1 and 2 batteries during an SBO. The cross-tie would effectively double the capacity of the Unit 1 DC system, providing the 4-hour capacity. The licensee stated that these cross-ties are routinely used in normal plant operations for maintenance. The maintenance ties connect the same divisions of Unit 1 and 2, e.g., Unit 1, Division 1 to Unit 2, Division 1. The licensee added that each division of the Unit 2 batteries will be tied to their corresponding Unit 1 division by SBO procedure early in the event before loss of capability to supply the necessary loads. The licensee stated that the battery capacity includes a design margin of 1.15, an aging factor of 1.25, and that no Unit 1 load shedding was assumed in determining the capability of the batteries to supply DC power to associated safe shutdown loads.

Based on the above, the staff concludes that there is reasonable assurance that the battery capacity is adequate for the 4-hour SBO scenario, and recovery therefrom provided that Unit 2 batteries are dedicated and always available to Unit 1.

Recommendation: The licensee should provide confirmation that the Unit 2 batteries will be dedicated and always available to Unit 1. This confirmation should be included with the other documentation supporting the SBO submittals that is to be maintained by the licensee.

2.3.3 Compressed Air

The licensee stated that no air-operated valves other than safety relief valves (SRVs) are relied upon to cope with an SBO event for 4 hours using the HPCS systems. The SRVs will operate either on spring pressure for over-pressure protection, or by manual operation using the air stored in the safety-related air system. Compressed air is also required for the operation of the automatic depressurization system (ADS) valves. Each ADS valve is equipped with an

accumulator which is capable of opening the valves and holding them open against the maximum drywell pressure of 30 psig. The accumulator capacity is sufficient to provide two actuations of each ADS valve against 70 percent of the maximum drywell pressure.

Based on the above, the staff concludes that there is reasonable assurance that sufficient compressed air would be available during a 4-hour SBO coping duration and recovery therefrom.

2.3.4 Effects of Loss of Ventilation

The licensee has performed analyses to determine the effects of loss of ventilation during an SBO event in the areas containing equipment required to cope with the SBO. The staff's evaluation of the effects of loss of ventilation in each of these areas is provided below:

2.3.4.1 Division III/HPCS Operation

Initially, the licensee stated that the HPCS switchgear room temperature will remain below 130°F, and that there is reasonable assurance of equipment operability at this temperature. In their response following the teleconference, the licensee indicated that the room temperature will be below 88°F and that there is no equipment qualification (EQ) concern since the lowest temperature concern occurs at 104°F. However, the licensee has not provided discussion for the significant change in the temperature conditions between the two submittals. Therefore, the staff has not been able to conclude that the operability of equipment in this room has been properly assessed for an SBO event.

Recommendation: The licensee should provide discussion and determine which switchgear room temperature condition is correct and include the correct value in the documentation supporting the SBO submittals. The licensee should include the basis of operability of the equipment if the room temperature goes over 104°F.

2.3.4.2 Control Room

The licensee stated that if the TS temperature limit were used for the control room initial temperature, the final temperature will be 113°F. The licensee also stated that the control room cabinet doors will be opened if the control room temperature exceeds 104°F. Based on its review, the staff concludes that the control room is not a dominant area of concern. However, the licensee needs to open cabinet doors within 30 minutes of the onset of SBO event in accordance with the guidance described in NUMARC 87-00.

Recommendation: The licensee should include in the procedure a provision to open the cabinet doors in the control room within 30 minutes of the onset of an SBO event in accordance with the NUMARC 87-00 Supplemental Questions and Answers dated January 4, 1990, independent of the temperature in the control room.

2.3.4.3 Drywell/Containment

The licensee reviewed the drywell temperature response with a 66 gpm leak rate assumed due to seal leakage of both recirculation pumps and the maximum TS leakage. The licensee confirmed that the SBO drywell conditions are conservatively bound by other LOCA conditions. Based on this we accept the licensee's statement that the temperature design limits of the drywell/containment will not be exceeded during the 4-hour SBO duration.

2.3.4.4 Main Steam Tunnel

The licensee stated that there is no equipment in the main steam tunnel which needs to be operated during an SBO event. The licensee did not mention whether this includes the containment isolation valves.

Recommendation: The licensee should verify that there are no valves in the steam tunnel which would be required to operate should containment isolation be necessary. If the licensee determines that there are some valves which must be

closed for containment isolation, then the licensee should provide in the procedures for the closure of these valves early in the SBO event before the main steam tunnel significantly heats up, or ensure that the valves will be able to be closed at the expected steam tunnel temperature.

2.3.4.5 Cable Spreading Room

The licensee stated that the reactivity control system inverters, which are located in the cable spreading room, will be turned off in accordance with SBO procedures, to reduce the heat load in the cable spreading room.

Recommendation: The licensee should establish a procedure for turning off the reactivity control system inverters early in the SBO event, such as within the 30 minutes of the onset of an SBO. This information should be included in the documentation supporting the SBO submittals that is to the maintained by the licensee.

2.3.4.6 Switchgear Room

The licensee indicated that the Division I and II switchgear rooms are large and would not have any SBO heat loads, with the exception of the MOV isolation function, if needed. However, the licensee has not performed an analysis to assess the operability of equipment in this room for an SBO event. Therefore, the staff has not been able to conclude the operability of equipment in this room during an SBO event.

Recommendation: The licensee should perform an analysis for the Division I and II switchgear rooms to confirm that there will be no appreciable temperature rise. The analysis should be documented as part of the documentation supporting the SBO rule response.

2.3.4.7 RCIC Pump Room

The licensee did not perform a heat-up calculation for the reactor core isolation cooling (RCIC) pump room during SBO. Since the HPCS system can

support the function provided by the RCIC system, the staff concludes that the failure of the RCIC system is of no concern during an SBO event.

2.3.5 Containment Isolation

The licensee stated that the plant list of containment isolation valves (CIVs) was reviewed and it was determined that all of the valves which must be capable of being closed or operated (cycled) under SBO conditions can be positioned with indication independent of the preferred and blacked-out unit's Class-1E power supplies. However, some modifications and associated procedure changes are necessary to ensure that appropriate containment integrity can be provided if needed under SBO conditions (See Section 2.5). The modifications will allow closure, with position indication, of the required inboard isolation motor operated valves (MOVs) from the control room. The licensee stated that the procedure will list the CIVs to be closed, one at a time to avoid overloading of the Division III EDG and cross-connect between the two motor control centers, and will address normally closed MOVs to ensure that they are closed. If the cross-connect between MCCs is permanently installed (see Section 2.5), the staff agrees that there is reasonable assurance that appropriate containment integrity can be maintained, if needed, under these conditions during an SBO.

2.3.6 Reactor Coolant Inventory

The licensee stated that the AAC source will power the necessary make up systems to maintain adequate reactor coolant system (RCS) inventory to ensure that the core is cooled for the required coping duration. After reviewing the supporting documentation and SAIC's TER, the staff agrees that the HPCS pump, which is powered by the Division III EDG, has sufficient capacity to maintain the core cooled and covered during an SBO event.

The reactor coolant inventory evaluation was based on the guidance provided in NUMARC 87-00 of 18 gpm per recirculation pump (RCP) seal leakage for boiling water reactors. The 18 gpm value was agreed to between NUMARC and the staff pending resolution of Generic Issue (GI) 23. If the final resolution of GI-23 defines higher RCP leakage rates than assumed for this evaluation, the licensee

should be aware of the potential impact of this resolution on its analyses and actions addressing conformance to the SBO rule.

2.4. Procedures and Training

The licensee stated the AC power restoration, severe weather, and station blackout response procedures have been reviewed and will be modified as required to meet the guidelines of NUMARC 87-00, Section 4. Also, changes as required will be implemented to the coping procedures to ensure that all the provisions of NUMARC 87-00, Section 7, are included.

The staff did not review the procedures or proposed procedure modifications. The staff expects the licensee to maintain and implement these procedures including any others that may be required to ensure an appropriate response to an SBO event. Although personnel training requirements for an SBO response were not specifically addressed by the licensee's submittal, the staff expects the licensee to implement the appropriate training to ensure an effective response to an SBO.

2.5 Proposed Modifications

The licensee proposes to run a temporary cable from the HPCS MCC EF1E-1 to MCC EF1C07. This temporary connection will allow the Division III EDG to provide the power for the valve manipulations necessary to initiate the upper-pool dump and to close CIVs, if needed, one at a time, from the control room. The licensee will also provide battery powered lighting for making the temporary connection. The licensee stated that the use of the temporary cable will be proceduralized and the cable will be stored in a designated location.

The temporary cable connection is not acceptable to the staff since it may create additional burden on operators and complications during an SBO event.

Recommendation: The licensee should make permanent connections with proper disconnect devices between the division-III EDG and the two motor control

centers (MCC EFIE-1 and MCC EFIC07), so that during an SBO the procedure to make these connections will be simpler and lesser burden on the operators.

The licensee should include a full description of the proposed modifications in the documentation to be maintained by the licensee in support of the SBO submittals.

2.6 Quality Assurance And Technical Specifications

The licensee did not specifically address Quality Assurance (QA) programs or Technical Specification (TS) for the SBO equipment. The TS for the SBO equipment are currently being considered generically by the NRC in the context of the Technical Specification Improvement Program and remains an open item at this time. However, the staff would expect 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 is warranted, the licensee will be notified of the implementation requirements.

Recommendation: The licensee should verify that the SBO equipment is covered by an appropriate QA program consistent with the guidance of RG 1.155. Confirmation that such a program is in place or will be implemented should be included as a part of the documentation supporting the SBO rule response.

2.7 EDG Reliability Program

Although the licensee is committed to maintain the target reliability, it did not specify whether the plant has any formal reliability program consistent with the guidance of RG 1.155, Section 1.2, and NUMARC 87-00, Appendix D.

Recommendation: It is the staff's position that an EDG reliability program should be developed in accordance with the guidance of RG 1.155 Section 1.2, and the November 1987 version of th NUMARC 87-00, Appendix D. Confirmation that such a progr_m is in place or will be implemented should be included in

the documentation that is to be maintained by the licensee in support of the SBO submittals.

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's supporting documentation, 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 the actions taken by the licensee in response to this SE.

a. Hardware and procedural modifications

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

c. Operator staffing and training to follow the identified actions in the 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 in the SE.

3.0 Summary and Conclusions:

The staff has reviewed the licensee's responses to the SBO rule (10 CFR 50.63) and the TER prepared by the staff's consultant, SAIC. Based on our review, some actions need to be completed as described in the recommendations itemized herein. These include confirming that the Unit 2 batteries are available to Unit 1, installing a crossite between MCCs EFIE-1 and EFIC07, resolving a discrepancy with the HPCS switchgear room temperature, confirmation that the control room cabinet doors will be opened and tne reactivity control system inverters are turned off within 30 minutes of the onset of an SBO event, verification that there are no valves which would be required to operate in the steam tunnel should containment isolation be necessary, performance of a heat-up analysis for the Division I and II switchgear rooms, verification that the SBO equipment is covered by a QA program consistent with RG 1.155, Appendix A, and implementation of an EDG reliability program in accordance with the guidance of RG 1.155, Section 1.2. The licensee should include the documentation associated with the above actions with the other documentation supporting the SBO submittal, and maintain this documentation for further inspection and assessment as may be undertaken by the NRC to further verify conformance with the SBO rule.

Based on our review of the submittals, we find the licensee's responses and proposed method of dealing with an SBO to be in conformance with the SBO rule contingent upon receipt of confirmation from the licensee within 30 days that the recommendations documented in this SE will be implemented. The schedule for implementation should also be provided in accordance with 10 CFR 50.63(c)(4).

4.0 Attachment

SAIC-91/6665, Technical Evaluation Report, Perry Nuclear Power Plant, Station Blackout Evaluation, July 31, 1991

Principal Contributor
S. K. Mitra

Date: April 23, 1992

Attachment 1

SAIC-91/6665

TECHNICAL EVALUATION REPORT
PERRY NUCLEAR POWER PLANT
STATION BLACKOUT EVALUATION

No. 68584

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 (13) by the NRC staff for the purposes of plant specific submittals. The documents are titled:

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

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

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

In 1989, a joint NRC/SAIC team headed by an NRC staff member performed audit reviews of the methodology and documentation that support the licensees' submittals for several plants. These audits revealed several deficiencies which were not apparent from the review of the licensees' submittals using the agreed upon generic response format. These deficiencies raised a generic question regarding the degree of licensees' conformance to the requirements of the SBO rule. To resolve this question, on January 4, 1990, NUMARC issued additional guidance as NUMARC 87-00 Supplemental Questions/Answers (14) addressing the NRC's concerns regarding the deficiencies. NUMARC requested that the licensees send their supplemental responses to the NRC addressing these concerns by March 30, 1990.

2.0 REVIEW PROCESS

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

A. Minimum acceptable SBO duration (Section 3.1),

B. SBO coping capability (Section 3.2),

C. Procedures and training for SBO (Section 3.4),

D. Proposed modifications (Section 3.3), and

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

For the determination of the proposed minimum acceptable SBO duration, the following factors in the licensee's submittal are reviewed: a) offsite power design characteristics, b) emergency AC power system configuration, c) determination of the emergency diesel generator (EDG) reliability consistent with NSAC-108 criteria (9), 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 for any proposed modifications to emergency AC sources, battery capacity, condensate capacity, compressed air capacity, ventilation system, containment isolation integrity and primary coolant make-up capability is reviewed. Technical specifications and quality assurance set forth by the licensee to ensure high reliability of the equipment, specifically added or assigned to meet the requirements of the SBO rule, are assessed for their adequacy.

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

This SBO evaluation is based upon the review of the licensee's submittals dated April 17, 1989 (10), and March 30, 1990 (12), a telephone conversation with the licensee on February 8, 1991, the licensee's response on March 15, 1991 (15) to questions raised during the telephone conversation and

the information available in the plant Updated Safety Analysis Report (USAR) (11); it does not include a concurrent site audit review of the supporting documentation. Such an audit may be warranted as an additional confirmatory action. This determination would be made and the audit would be scheduled and performed by the NRC staff at some later date.

3.0 EVALUATION

3.1 Proposed Station Blackout Duration

Licensee's Submittal

The licensee, Centerior Energy (formerly the Cleveland Electric Illuminating Company), calculated (10 and 12) a minimum acceptable station blackout duration of four hours for the Perry Nuclear Power Plant (PNPP) site. Although it is not clearly stated by the licensee, no modifications are required to attain this coping duration.

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

1. Offsite Power Design Characteristics

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

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

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

   c. Estimated frequency of LOOPs due to extremely severe weather (ESW) which places the plant in ESW Group "1," and

   d. Estimated frequency of LOOPs due to severe weather (SW) which places the plant in SW Group "2."

2. Emergency AC (EAC) Power Configuration Group

   The EAC power configuration of the plant is "C." Perry is equipped with two emergency diesel generators not credited as

alternate AC power sources, one of which is necessary to operate safe-shutdown equipment following a loss of offsite power.

3. Target Emergency Diesel Generator (EDG) Reliability

The licensee has selected a target EDG reliability of 0.95. The selection of this target reliability is based on having an average EDG reliability of greater than 0.94 for the last 50 demands consistent with NUMARC 87-00, Section 3.2.4.

Review of Licensee's Submittal

Factors which affect the estimation of the SBO coping duration are: the independence of the offsite power system grouping, the estimated frequency of LOOPs due to ESW and SW conditions, the expected frequency of grid-related LOOPs, the classification of EAC, and the selection of EDG target reliability. Using Table 3-2 of NUMARC 87-00, the expected frequency of LOOPs due to ESW conditions place the PNPP site in ESW Group "1."

Using Table 3-3 of NUMARC 87-00, the expected frequency of LOOPs at PNPP due to SW condition is Group "3." In its submittal, the licensee stated that its SW Group is "2." The SW grouping determination is based on the plant's offsite power lines traversing on a single right-of-way. As a result of the telephone conversation on February 8, 1991, the licensee performed a survey of power lines leaving the plant and determined (15) that the offsite power transmission lines meet the criterion of multiple rights-of-way; that is, the lines are separated by more than 1/4 mile at 1 mile from the plant. Therefore, based on this information, we agree with the licensee that PNPP is in SW Group "2."

The licensee stated that the independence of the plant offsite power system grouping is "II/2." A review of the PNPP USAR indicates that:

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

2. During normal power operation, the essential buses are powered from 345-kV offsite power through the start-up and interbus transformers;

3. Upon loss of power to either transformer, there is a manual transfer to the start-up and interbus transformers associated with the other (unfinished) unit;

4. Both sets of transformers are sized and designed to supply the required load to the essential buses.

Based on these and the criteria stated in Table 5 of RG 1.155, we conclude that the plant independence of offsite power system group is "12."

The licensee classified the EAC classification of Perry as "C." Perry has two EDGs not credited as AAC power sources, one of which is necessary to operate the safe shutdown equipment.

The licensee selected a target EDG reliability of 0.95 based upon the last 50 demands. The target EDG reliability which the licensee selected (10) and committed to maintain (12) is in conformance with both RG 1.155 and NUMARC 87-00. Although this is an acceptable criterion for choosing an EDG target reliability, the guidance in RG 1.155 requires that the EDG reliability statistics for the last 50 and 100 demands also be calculated. Without this information, it is difficult to judge how well the EDGs have performed in the past and if there should be any concern. The licensee needs to have an analysis showing the EDG reliability statistics for the last 20, 50, and 100 demands in its SBO submittal supporting documentation.

Although the licensee is committed to maintain the target EDG reliability, it did not state whether the plant has any formal reliability program consistent with the guidance of RG 1.155, Section 1.2, and NUMARC 87-00, Appendix D.

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 U.S., only covers these incidents through the calendar year 1984. Perry Nuclear Power Plant did not enter commercial operation until 1987. In the absence of any contradictory information, we agree with the licensee's statement.

Based on the above, the offsite power design characteristic of the Perry site is "P1" with a minimum required SBO coping duration of four hours.

3.2 Alternate AC (AAC) Power Source

Licensee's Submittal

The licensee proposes to use the Division-III emergency diesel generator as an AAC power source. The licensee stated that the AAC power source meets the criteria specified in Appendix B to NUMARC 87-00 and is available within 10 minutes of the onset of an SBO event. The licensee also stated (10) that the AAC power source has sufficient capacity and capability to operate systems necessary for coping with a 4-hour SBO to bring the plant to and maintain it in a hot-shutdown condition. The licensee proposes to use the Division-III EDG's excess capacity to operate several containment isolation motor-operated valves (MOVs). These MOVs will be operated one at a time to avoid overloading the Division-III EDG.

Review of Licensee's Submittal

The proposed AAC power source, the Division-III EDG, is not capable of powering a full division of shutdown equipment. The Division-III EDG is capable of powering the High Pressure Core Spray (HPCS) pump, the HPCS-pump supporting systems, and has minimal excess capacity which can be used for other needs. This excess capacity is sufficient to operate MOVs, one at a time, as proposed by the licensee. The licensee proposes to cross-connect two motor control centers (MCCs) with a temporary cable (see Proposed Modifications section) to facilitate the operation of MOVs. The licensee needs to have an established procedure for performing the cross-connection between the MCCs, and to train the operators accordingly in order to prevent any common-cause failure.

3.3 Station Blackout Coping Capability

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

1. Condensate Inventory for Decay-Heat Removal

Licensee's Submittal

The licensee stated that it determined from Section 7.2.1 of NUMARC 87-00 that less than 150,000 gallons of water are required for decay-heat removal for four hours, and that the minimum permissible condensate storage tank (CST) level per technical specifications provides 150,000 gallons of water. The licensee stated (15) that the normal level of the CST is between 250,000 and 300,000 gallons, and that redundant level alarms warn the operator if the CST level drops below 155,000 gallons available to a common suction for HPCS and RCIC. The CST low-level switches automatically transfer HPCS/RCIC suction from the CST to the suppression pool. The licensee stated (12) that the SBO

procedures will address the loss of heat tracing on the CST level sensing line.

The licensee added (10) that the suppression pool provides an additional 800,000 gallons of recyclable water as an alternate HPCS-pump supply, and that appropriate instructions will be added to procedures to align the HPCS-pump suction to the suppression pool if needed. In addition, the containment upper-pool make-up will be available with an additional 200,000 gallons. The licensee stated that plant modifications are necessary to utilize the upper-pool water. The modifications are minor in scope and consist of the temporary use of the Division-III power supply for the operation of two isolation valves and appropriate lighting for this power supply connection (see Section 3.5, Proposed Modifications).

As a result of the telephone conversation on February 8, 1991, the licensee provided (15) the following points of important decision or action regarding the condensate requirement:

a) At 90 minutes, manual depressurization is initiated per EPG guidance;

b) At 140 minutes, the CST volume is depleted and the HPCS-pump suction is transferred to the suppression pool;

c) At 173 minutes, the suppression-pool temperature reaches 180°F, and so the upper-pool dump is manually initiated;

d) At 182 minutes, the upper-pool dump is completed and the suppression-pool temperature lowers to 163°F;

At the end of the SBO event (240 minutes), the suppression-pool temperature will be 180°F, and the reactor outlet pressure will be 160 psia.

The licensee concluded that the total water sources exceed the quantity required for coping with a four-hour SBO event.

Review of Licensee's Submittal

Using the expression provided in NUMARC 87-00, we have estimated that ~81,000 gallons of condensate would be required to remove decay heat during the four-hour SBO event. This estimate is based on 102% of a maximum licensed core thermal rating of 3579 MWt. In addition, ~15,000 gallons of condensate has to be provided to account for a leak of 66 gpm (18 gpm per pump and a technical specifications leak rate of 30 gpm), bringing the total to ~96,000 gallons. Technical specifications require a minimum CST level corresponding to 150,000 gallons of water, leaving ~54,000 gallons in the CST, in addition to the 1,000,000 gallons of recyclable water available in the suppression pool and upper-pool make-up, for cooldown and depressurization. Therefore, we conclude that PNPP has a sufficient water supply for the 4-hour coping duration.

2. Class-1E Battery Capacity

Licensee's Submittal

The licensee stated that the AAC power source energizes the Division-III battery chargers and verified that the non-Division-III class-1E batteries have sufficient capacity to meet station blackout loads for four hours.

Presently, the site has four class-1E battery systems capable of supporting the design loads for two hours. Two of the systems are associated with Unit 1, one system each for Divisions I and II. Similarly, Unit 2 has one system each for its Divisions I and II. Since Unit-2 construction is not complete, the licensee proposed to use an existing maintenance cross-tie between the Unit-1 and

Unit-2 batteries. This cross-tie effectively doubles the capacity of the Unit-1 DC system, providing the 4-hour capacity.

These cross-ties are routinely used in normal plant operations for maintenance. The licensee stated that maintenance tie busses connect the same Divisions of Units 1 and 2, e.g., Unit 1, Division 1 to Unit 2, Division 1. The cross-tie application has been accepted by the NRC staff (NUREG-0887). The licensee added that the battery capacity includes a design margin of 1.15 and an aging factor of 1.25, and that no Unit 1 load shedding was assumed in determining the capability to supply DC power to associated safe shutdown loads.

The licensee also stated that the SBO procedures will specify that plant DC loads will remain on the Division/Unit batteries in use at the time of SBO initiation. The licensee added that the Unit-2 batteries will be tied to their corresponding Unit-1 Division by SBO procedure early in the event, before loss of capability to supply necessary loads.

Review of Licensee's Submittal

According to the plant USAR, Section 8.3.2.1.2.2, the Division-I and -II 125-VDC batteries are sized to supply the required loads for a minimum of two hours. The plant is equipped with an existing cross connect between the Unit-1 and Unit-2 batteries. This cross connect is used for battery maintenance. With the use of the cross-ties as described by the licensee, PNPP will have sufficient battery capacity to cope with a 4-hour SBO event without the need for recharge. However, the licensee needs to provide an assurance that the Unit-2 batteries are always available. This assurance needs to be consistent with that applied to the Unit-1 class-1E batteries. With the verification of this assurance, we consider the site to have sufficient battery capacity. This conclusion is based on the licensee's statement

and the information which appears in the plant USAR; no review of the battery calculation has been performed.

3. Compressed Air

Licensee's Submittal

The licensee stated that no air-operated valves other than the safety-relief valves (SRVs) are relied upon to cope with an SBO event for 4 hours using the HPCS systems. The SRVs will operate either on spring pressure for over-pressure protection, or by manual operation using the air stored in the safety-related air system.

Review of Licensee's Submittal

At Perry, compressed air is required for the operation of the automatic depressurization system (ADS) valves. Each ADS valve is equipped with an accumulator which is sized to be capable of opening the valves and holding them open against the maximum drywell pressure of 30 psig. The accumulator capacity is sufficient for each ADS valve to provide two actuations against 70 percent of the maximum drywell pressure. Therefore, Perry has sufficient back-up supplies of compressed air to cope with a 4-hour SBO event.

4. Effects of Loss of Ventilation

Licensee's Submittal

The licensee provided (15) the results of its heat-up calculations for the HPCS switchgear room and the control room. The results indicate that the HPCS switchgear room will be less than 88°F and the control room temperature will be 98°F. The licensee did not state whether any Heating, Ventilation, and Air Conditioning

(HVAC) systems other than the HPCS-associated equipment HVAC would be powered by the Division-III EDG.

The licensee stated that reasonable assurance of equipment operability has been assessed for the HPCS switchgear room using Appendix F of NUMARC 87-00. The licensee also stated that no modifications are necessary to cope with a 4-hour SBO event.

The licensee stated (12) that the PNPP SBO procedures will address the loss of heat tracing on the CST level sensing line and determine alternate steps, if needed, to supplement planned action.

In response to the telephone conversation on February 8, 1991, the licensee stated (15) that the areas of concern were chosen using NUMARC 87-00 for guidance, with areas necessary to support HPCS operation and to provide control room indication/control functions receiving primary attention. The licensee provided a summary of its heat-up analyses for the following areas of concern:

1) Division III/HPCS Operation

Ventilation for HPCS-associated equipment is provided by a system powered from the HPCS diesel, with the exception of some containment instrumentation and the switchgear/battery room. The licensee provided (10 and 15) two different temperatures for the HPCS switchgear room. Initially, the licensee stated (10) that the room would remain below 130°F. In its written response to the questions raised during the telephone conversation, the licensee stated (15) that the heat-up under SBO conditions would be less than 13°F, which yields a final temperature of less than 88°F, based on an assumed initial temperature of 75°F. To justify this initial temperature, the licensee stated (15) that the switchgear room is routinely checked on plant rounds and

remains at or below 75°F. The licensee also stated (15) that the final room temperature is of no equipment qualification (EQ) concern, since the lowest temperature effect on equipment in this room is MCC thermal overload switch potential actuation at 104°F. In addition, this room would have the doors opened for the MCC interconnection to allow the upper-pool dump (see Condensate Inventory section), provided further cooling form a much larger switchgear room with no SBO heat load (except MOV isolation, if needed, one valve at a time).

2) Control Room

The control room, which has a daily temperature record indicating an initial temperature below 75°F, was calculated using NUMARC methodology to increase 23°F to 98°F. The technical specification limit of 90°F results in a final temperature of 113°F. The licensee stated that the instrument cabinets, each containing DC inverters, will be opened under procedural control if temperatures exceed 104°F to provide assurance that no EQ concerns exist.

3) Drywell/Containment

As noted in NUMARC 87-00, large dry containments are well bounded by LOCA temperatures used to determine equipment-qualification envelopes. The Perry Mark III containment has over one million cubic feet of free volume, and significant temperature increases are not expected during an SBO. The licensee stated that it has reviewed drywell temperature response with a 66-gpm leak rate due to both recirculation pump seal leakage and technical specification maximum leakage, and confirmed that other accidents analyzed in the plant USAR conservatively bound the SBO drywell conditions.

4) Steam Tunnel

The steam tunnel does not contain equipment required for 4-hour coping. [Therefore no analysis was performed.]

5) Cable-Spreading Room

Redundant reactivity controls system inverters, located in the cable-spreading room, will be turned off per SBO procedures in order to essentially eliminate heat loads in this area.

Review of Licensee's Submittal

The licensee's temperature-rise calculations were neither received nor reviewed. Therefore, this review is based on the summaries provided (10 and 15) by the licensee in its submittals. As such, the review only covers the assumptions and the methods identified by the licensee, and assumes the calculated temperatures to be accurate, pending future verification.

Regarding the rooms for which the licensee provided summary information, we have the following comments:

1) Division III/HPCS Operation

Initially, the licensee stated (10) that the HPCS switchgear room will remain below 130°F, and that it had determined that there is reasonable assurance of equipment operability at this temperature. After the telephone conversation on February 8, 1991, in its response to the questions, the licensee stated (15) that, based on an initial temperature of 75°F, the room will be below 88°F and that this is not an EQ concern since the lowest temperature effect is at 104°F. This is apparently a discrepancy from the licensee's initial statement. The licensee needs to resolve this discrepancy and have the resolution documented in its SBO submittal supporting documentation.

2) Control Room

The licensee determined that, if the technical specification temperature limit were used for the control-room initial temperature, the final temperature will be 113°F. The licensee stated (15) that the control-room cabinet doors will be opened if the control-room temperature exceeds 104°F. Since the final calculated temperature is below 120°F, the control room is not a dominant area of concern. However, the licensee needs to open the cabinet doors within 30 minutes of the onset of an SBO event in the absence of air conditioning, in accordance with NUMARC 87-00 Supplemental Questions and Answers.

3) Drywell/Containment

The licensee did not provide any analysis of the drywell heat-up during an SBO event. The licensee stated that it has verified that the drywell conditions during an SBO event will be bounded by other accident conditions analyzed in the plant USAR. Based on this and the absence of any adverse information, we accept the licensee's statement, pending future verification.

4) Steam Tunnel

Although the licensee stated that there is no equipment in the main steam tunnel which needs to be operated during an SBO event, the licensee needs to verify that there are no valves which would be required to operate should containment isolation become necessary. If the licensee determines that there are some valves which must be closed if containment isolation becomes necessary, then it needs to ensure that the valves will be able to be closed at the expected main steam tunnel temperature.

5) Cable-Spreading Room

The licensee stated that the reactivity control system inverters will be turned off by SBO procedure. This will eliminate the main heat load in this area. This action, however, needs to be taken early in the SBO event, preferably within 30 minutes, to minimize the heat-up.

In addition, we have the following concerns:

1) RCIC-Pump Room

The licensee did not perform a heat-up calculation for the RCIC-pump room during an SBO. The RCIC pump starts upon reactor vessel low level and will not be tripped manually per EOP. However, the pump may fail due to high room temperature. Since HPCS, which the licensee is proposing to use, can support the function provided by the RCIC pump, we conclude that RCIC failure is of no concern during an SBO event. However, the licensee needs to evaluate the RCIC-pump room temperature and ensure that the RCIC system will not fail due to high temperature, as such action is not considered good operating practice.

2) Division-I and -II Switchgear Rooms

The licensee did not provide any information on the expected temperatures in the Division-I and -II switchgear rooms. However, the licensee did indicate (15) that these switchgear rooms are large and will not have any SBO heat loads, with the exception of MOV isolation, if needed. We agree in concept with the licensee's statement concerning the heat loads in the Division-I and -II switchgear rooms. The licensee, however, needs to perform an analysis for these rooms to confirm that there will be no appreciable temperature rise and have the results in its SBO submittal supporting documentation.

5. Containment Isolation

Licensee's Submittal

The licensee stated that the plant list of containment isolation valves (CIVs) was reviewed and it was determined that all of the valves which must be capable of being closed or operated (cycled) under SBO conditions can be positioned with indication independent of the preferred and class-1E power supplies. The licensee also stated that modifications and the associated procedure changes are necessary to ensure that appropriate containment integrity can be provided under SBO conditions. These modifications consist of a temporary cable connection between MCCs using spare breakers which will permit the Division-III AC source to power several isolation valves, and appropriate battery-powered lighting for making the cable connections. This will allow closure of required inboard isolation MOVs from the control room with position indication. The licensee stated (15) that procedures will list the CIVs to be closed, one at a time to avoid overloading the temporary cable or the AC power source, and will address normally closed MOVs to ensure that they are closed.

Review of Licensee's Submittal

Through the proposed cross-connect (see Proposed Modifications) during an SBO event, the licensee will have AC power available to the needed CIVs. This allows the licensee to operate CIVs and confirm that normally closed MOVs are fully closed. Therefore, adequate containment integrity can be provided during an SBO event.

6. Reactor Coolant Inventory

Licensee's Submittal

The licensee stated that the AAC source powers the necessary make-up systems to maintain adequate reactor coolant system (RCS) inventory to ensure that the core is cooled for the required coping duration.

Review of Licensee's Submittal

Reactor coolant make-up is necessary to remove decay heat, to cooldown the primary system, and to replenish the RCS inventory losses due to the assumed leak rate of 66 gpm (18 gpm per recirculation pump per NUMARC 87-00 guideline and 30 gpm for the technical specifications maximum allowable leakage). The HPCS pump, which is powered by the Division-III EDG, has a maximum flow rate of 6110 gpm. Therefore, the HPCS pump has sufficient capacity to compensate for the postulated leak rate and decay-heat removal, and to maintain the core cooled and covered during an SBO event.

NOTE:

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

3.4 Proposed Procedures and Training

Licensee's Submittal

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

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

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

Review of Licensee's Submittal

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

3.5 Proposed Modifications

Licensee's Submittal

The licensee proposes to run a temporary cable from the HPCS MCC EF1E-1 to MCC EF1C07. This temporary connection will allow the valve manipulations necessary to initiate the upper-pool dump and to close the necessary CIVs, one at a time, from the control room. The use of the temporary cable will be proceduralized and the cable will be stored in a designated location. The licensee added (15) that battery-powered lighting will also be provided.

Review of Licensee's Submittal

We believe that the proposed modification is beneficial as it will facilitate the operator actions required should containment isolation become necessary. However, our review has identified several concerns which the licensee needs to respond and which may require additional modifications for their resolutions.

3.6 Quality Assurance and Technical Specifications

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

4.0 CONCLUSIONS

Based on our review of the licensee's submittals and the information available in the USAR for Perry Station, we find that the submittal conforms with the SBO rule by following the guidance of RG 1.155 with the following exceptions:

1. EDG Target Reliability Program

   The licensee's submittal does not document the conformance of the plant's EDG reliability program with the guidance of RG 1.155, Section 1.2 and NUMARC 87-00, Appendix D. The licensee, however, is committed to maintain the target EDG reliability of 0.95.

2. Proposed AAC Power Source

   The Division-III EDG is capable of powering the HPCS pump and its supporting systems, with a minimal excess margin to power other necessary shutdown equipment. This excess margin is also sufficient to operate some necessary MOVs, one at a time. The licensee proposes to cross-connect two motor control centers (MCCs) with a temporary cable (see Proposed Modifications section). The licensee needs to have an established procedure for performing the cross-connection between the MCCs, and to train the operators accordingly in order to prevent any common-cause failure.

3. Effects of Loss of Ventilation

   The licensee's temperature-rise calculations were neither received nor reviewed. Therefore, this review is based on the summaries provided (10 and 15) by the licensee in its submittals. Our review of this information yields the following comments:

1) Division III/HPCS Operation

Initially, the licensee stated (10) that the HPCS switchgear room will remain below 130°F, and that it had determined that there is reasonable assurance of equipment operability at this temperature. After the telephone conversation on February 8, 1991, in its response to the questions, the licensee stated (15) that, based on an initial temperature of 75°F, the room will be below 88°F and that this is not an EQ concern since the lowest temperature effect is at 104°F. This is apparently a discrepancy from the licensee's initial statement. The licensee needs to resolve this discrepancy and have the resolution documented in its SBO submittal supporting documentation.

2) Control Room

The licensee needs to open the cabinet doors within 30 minutes of the onset of an SBO event in the absence of air conditioning, in accordance with NUMARC 87-00 Supplemental Questions and Answers.

3) Steam Tunnel

If the licensee determines that there are some valves which must be closed if containment isolation becomes necessary, then it needs to ensure that the valves will be able to be closed at the expected main steam tunnel temperature.

4) Cable-Spreading Room

The licensee stated that the reactivity control system inverters, which are located in the cable-spreading room, will be turned off by SBO procedures. The licensee needs to turn off the inverters early in the SBO event, preferably within the first 30 minutes, to reduce the heat generation in this room.

5) Division-I and -II Switchgear Rooms

The licensee indicated that the Division-I and -II switchgear rooms are large and will not have any SBO heat loads, with the exception of MOV isolation, if needed. We agree in concept with the licensee's statement concerning the heat loads in the Division-I and -II switchgear rooms. The licensee, however, needs to perform an analysis for these rooms to confirm that there will be no appreciable temperature rise and have the results in its SBO submittal supporting documentation.

6) RCIC-Pump Room

The licensee did not perform a heat-up calculation for the RCIC-pump room during an SBO. It is our understanding that the licensee will use RCIC until it fails due to high temperature (no other failure is assumed). Since HPCS can support the function provided by the RCIC pump, we conclude that RCIC failure is of no concern. However, the licensee needs to evaluate the RCIC-pump room temperature and ensure that the RCIC system will not fail due to high temperature, as such action is not considered good operating practice.

4. Proposed Modifications

Our review has identified several concerns which the licensee needs to respond and which may require additional modifications for their resolutions.

5. Quality Assurance and Technical Specifications

The licensee's submittals do not document the conformance of the plant's SBO equipment with the guidance of 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. Nuclear Safety Analysis Center, "The Reliability of Emergency Diesel Generators at U.S. Nuclear Power Plants," NSAC-108, Wyckoff, H., September 1986.

10. Kaplan, A., letter to NRC Document Control Desk, "Response to Station Blackout Rule Using HPCS Division III as Alternate AC Power," dated April 17, 1989.

11. Perry Station Updated Final Safety Analysis Report.

12. Kaplan, A., letter to NRC Document Control Desk, "Supplemental Response on Station Blackout Rule," Docket No. 50-440, dated March 30, 1990.

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

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

15. Lyster, M. D., letter to NRC Document Control Desk, "Supplemental Response on Station Blackout," dated March 15, 1991.