Attachment 1

SAIC-91/6677

TECHNICAL EVALUATION REPORT

DONALD C. COOK NUCLEAR PLANT UNITS 1 AND 2

STATION BLACKOUT EVALUATION

TAC Nos. 68532 and 68533

Science Applications International Corporation

An Employee-Owned Company

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TECHNICAL EVALUATION REPORT

DONALD C. COOK NUCLEAR PLANT UNITS 1 AND 2
STATION BLACKOUT EVALUATION

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 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 vulnerability to 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 consistent systematic responses from licensees to the SBO rule and to expedite the staff review process, NUMARC developed two generic response documents. These documents were reviewed and endorsed (9) by the NRC staff for the purposes of plant-specific submittals. The documents are titled:

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

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

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

In 1989, a joint NRC/SAIC team headed by an NRC staff member performed audit reviews of the methodology and documentation that support the licensees' submittals for several plants. These audits revealed several deficiencies which were not apparent from the review of the licensees' submittals using the agreed upon generic response format. These deficiencies raised a generic question regarding the degree of the licensees' conformance to the requirements of the SBO rule. To resolve this question, on January 4, 1990, NUMARC issued additional guidance as NUMARC 87-00 Supplemental Questions/Answers (10) addressing the NRC's concerns regarding the deficiencies. NUMARC requested that the licensees send their supplemental responses to the NRC addressing these concerns by March 30, 1990.

2.0 REVIEW PROCESS

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

A. Minimum acceptable SBO duration (Section 3.1),

B. SBO coping capability (Section 3.2),

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

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 (11), and d) determination of the accepted EDG target reliability. Once these factors are known, Table 3-8 of NUMARC 87-00 or
Table 2 of RG 1.155 provides a matrix for determining the required coping duration.

For the SBO coping capability, the licensee's submittal is reviewed to assess the availability, adequacy and capability of the plant systems and components needed to achieve and maintain a safe shutdown condition and recover from an SBO of acceptable duration which is determined above. The review process follows the guidelines given in RG 1.155, Section 3.2, to assure:

a. availability of sufficient condensate inventory for decay heat removal,

b. adequacy of the Class-1E battery capacity to support safe shutdown,

c. availability of adequate compressed air for air-operated valves necessary for safe shutdown,

d. adequacy of the ventilation systems in the vital and/or dominant areas that include equipment necessary for safe shutdown of the plant,

e. ability to provide appropriate containment integrity, and

f. ability of the plant to maintain adequate reactor coolant system inventory to ensure core cooling for the required coping duration.

The licensee's submittal is reviewed to verify that required procedures (i.e., revised existing and new) for coping with SBO are identified and that appropriate operator training will be provided.

The licensee's submittal is reviewed for any proposed modifications to emergency AC sources, battery capacity, condensate capacity, compressed air capacity, ventilation system, containment isolation integrity and primary coolant make-up capability. Technical specifications and quality assurance requirements set forth by the licensee to ensure high reliability of the equipment, specifically added or assigned to meet the requirements of the SBO rule, are assessed for their adequacy.

This SBO evaluation is based on a review of the licensee's submittals dated April 14, 1989 (12) and March 30, 1990 (13), telephone conversation with the licensee on February 27, 1991, the licensee's response to the question raised during the telephone conversation (16), and the available information in the plant Update Final Safety

Analysis Report (UFSAR) (14); 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, Indiana Michigan Power Company (IMP), calculated (12) a minimum acceptable station blackout duration of four hours for the D. C. Cook Station. The licensee stated that no modifications are necessary to attain this proposed coping duration.

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

1. **Offsite Power Design Characteristics**

   The plant AC power design characteristics group is "P2" based on:

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

   b. Estimated frequency of LOOPs due to extremely severe weather (ESW) which places the plant in ESW Group "2,"

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

   d. Independence of the plant offsite power system characteristic of "I1/2."

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

The EAC power configuration group at D. C. Cook is "C." The site is equipped with two emergency ac power supplies, one of which is necessary to operate safe shutdown equipment following a LOOP.

3. **Target Emergency Diesel Generator Reliability**

The licensee stated that a target EDG reliability of 0.975 was selected based on having a unit average EDG reliability of greater than 0.975 for the last 20 demands, consistent with NUMARC 87-00. In a later submittal (13) the licensee stated that the targeted reliability will be maintained.

Review of Licensee's Submittal

Factors which affect the estimation of the SBO coping duration are: the estimated frequency of LOOPs due to ESW and SW conditions, the independence of the offsite power system grouping, the expected frequency of grid-related LOOPs, the classification of EAC, and the selection of EDG target reliability.

The licensee's classification of ESW group "2" for D. C. Cook site is in agreement with that given in Table 3-2 of NUMARC 87-00. Using Table 3-3 of NUMARC 87-00, the expected frequency of LOOPs at D. C. Cook due to SW condition is estimated to be "0.0179" or "0.0092" depending on the site having offsite power transmission lines either on one or multiple rights-of-way, respectively. These values place D. C. Cook in SW group "3" and "2," respectively. A review of the D. C. Cook UFSAR did not indicate whether the site could be considered to have transmission lines on multiple rights-of-way, however the licensee provided information in response to questions (16) which verifies that the site can be considered as having multiple rights-of-way, hence SW "2" is appropriate.

Our review of the plant UFSAR indicates that each unit has an onsite electrical system which consists of eight 4160 volt bases, four of which are Class-1E (see Figure 1). The primary power source for all of the 4160 volt buses is the main generator, however there is an automatic transfer to the auxiliary transformers (TR 101AB and TR 101CD for Unit 1 and TR 201AB and TR 201CD for Unit 2) upon loss of the main generator. Also, there is a manual transfer to a second source of off-site power (TR 12EP-1) which can support the safe-shutdown load of one unit and the engineered safeguard equipment in the other.

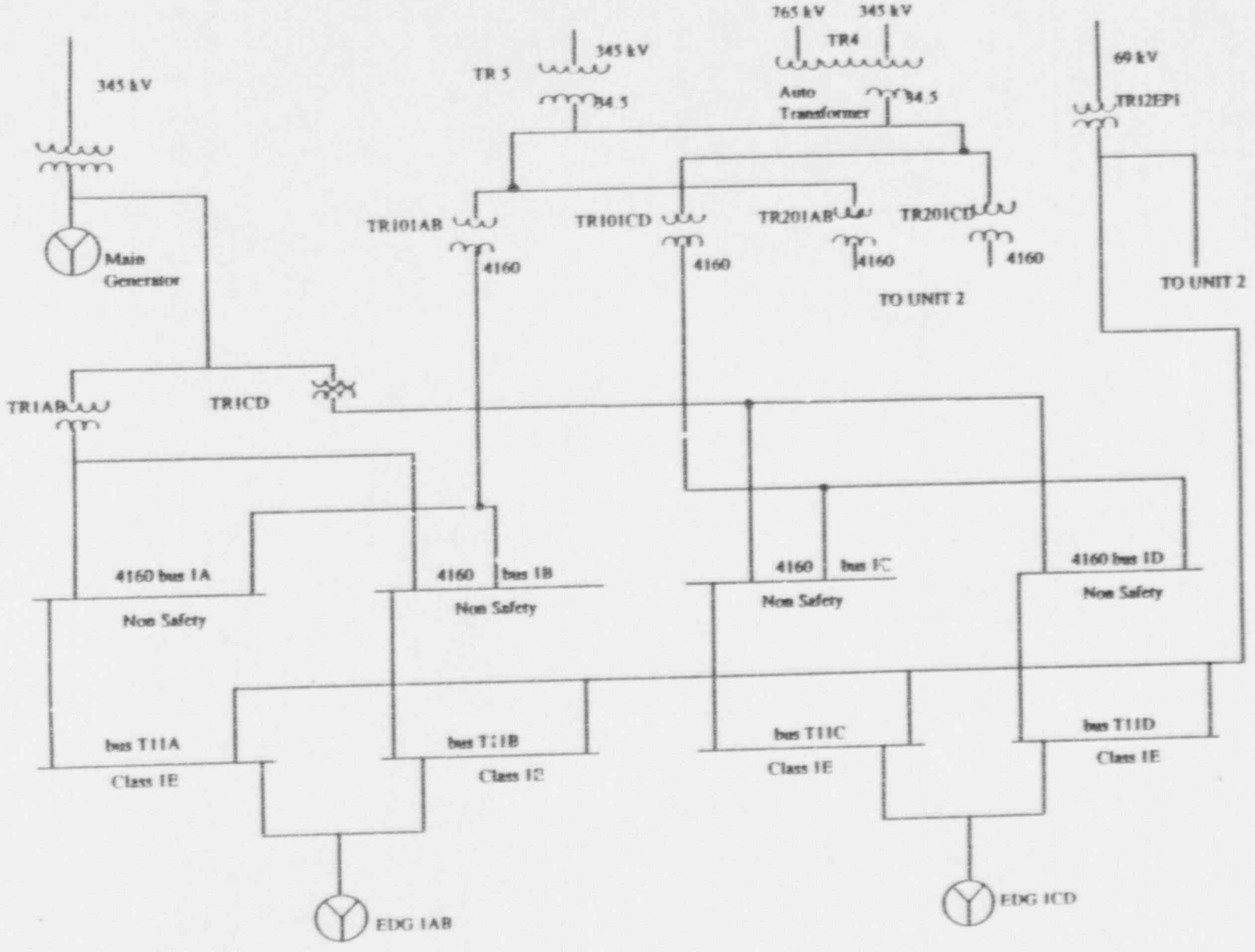
Based on the above, we agree with the licensee that the site independence of offsite power grouping is "I1/2."

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., indicates that D. C. Cook did not have a grid-related LOOP up to 1984. In the absence of any contradicting information, we agree with the licensee's statement that the frequency of grid-related LOOPs is expected to be less than one per 20 years.

D. C. Cook has two emergency AC power supplies, of which one is needed to power safe shutdown loads following a LOOP, hence the licensee correctly identifies this configuration as "C."

The final characteristic needed to establish the coping duration is the target EDG reliability. The licensee stated (12) that the assignment of the EDG target reliability of 0.975 is based on having a unit average EDG reliability of greater than 0.90 for the last 20 demands. Although this selection is consistent with the criteria given in both the RG 1.155 and NUMARC 87-00, the licensee needs to evaluate the EDG reliability for the last 50 and 100 demands as well. These

Figure 1. D.C. Cook One Line Electrical



statistics are only available on site for review, therefore, we are unable to verify the assignment of the EDG target reliability at this time. However, based on the information in the NSAC-108, which gives the EDG reliability data at U.S. nuclear reactors for calendar years 1983 to 1985, the EDGs at D. C. Cook experience an average reliability of 0.987 per diesel per year. Using this data, it appears that the target EDG reliability (0.975) selected by the licensee (12) is appropriate.

Utilizing the above factors in Table 3-5a of NUMARC 87-00 results in an offsite power design characteristic of "P1," not "P2" as originally indicated by the licensee (12). The licensee was informed of this change during the telephone conversation on February 27, 1991. The licensee was not aware of the revision to the NUMARC 87-00, Table 3.5a.

Although the sites with an offsite power characteristic group "P1" and an EAC group "C" can select a 0.950 EDG target reliability, the licensee has chosen (16) to stay with 0.975 EDG target reliability. The licensee indicated that this target reliability will be maintained. With regard to the EDG reliability program, the licensee stated (13) that the plant currently uses the guidance of RG 1.108 to establish periodic surveillance, however, a technical specification change may be pursued to adopt NSAC-108 as well as NUMARC Initiative 5A (NUMARC 87-00, Appendix D).

3.2 Station Blackout Coping Capability

The plant coping capability with a Station Blackout 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 (12) that 90,000 gallons of water would be required for decay heat removal at either unit during a four hour SBO event. The calculation is based on the expression provided in Section 7.2.1 of NUMARC 87-00. The minimum permissible condensate storage tank level, per Technical Specifications, provides 175,000 gallons of water.

In response to the questions raised during the review, the licensee stated (16) that the primary system will be cooled down and depressurized during an SBO. The primary pressure will be reduced using the steam generator (SG) power operated relief valves (PORVs). The SG pressure will be sharply reduced by keeping the PORVs wide open initially. The steam generator pressure will be regulated at 200 psig in order to prevent injection of the accumulator nitrogen into the primary system. The turbine driven auxiliary feedwater (AFW) pump, in association with the battery powered auxiliary feedwater control valves, will maintain steam generator level.

Review of Licensee's Submittal

Based on a maximum reactor power of 3250 MWt for Unit 1 and 3411 MWt for Unit 2, a four hour SBO would require 71,890 and 75,451 gallons of condensate respectively, for decay heat removal, using NUMARC methodology. The licensee's calculation of the required condensate includes condensate needed for the primary/secondary side cooldown and pressure reduction. Our review of similar plants with reactor thermal power of 3411 MWt indicates that ~170,000 gallons of condensate would

be needed to remove decay heat and cool down the primary system. It is our judgement that the licensee has under-estimated the water requirements for the cooldown. However, based on the available condensate, the site is judged to have sufficient condensate inventory for decay heat removal and cooldown during an SBO event.

2. **Class 1E Battery Capacity**

Licensee's Submittal

The licensee stated (12) that the Class 1E batteries were determined to be inadequate to meet station blackout loads for four hours. Stripping of loads not required to mitigate the station blackout event will be required to cope for four hours. These loads will be identified in plant procedures.

In its response to questions raised during this review, the licensee stated (16) that the turbine DC emergency lube oil pump of each main feedwater pump, the AMSAC invertor power supply, and the main turbine DC emergency bearing oil pumps will be shed. The loads will be shed within one hour of the initiation of an SBO event. The battery sizing calculations are based on IEEE-Std 485. The calculations consider a design margin (at least 5%), a temperature correction factor (based on expected temperature), and an aging factor (25%).

Review of Licensee's Submittal

The UFSAR states that there are three class-1E batteries, i.e., Division 1 and 2 station batteries and the "N Train" battery, all of which are 250 volt and sized to provide power to all connected loads for three hours. In order to conserve the battery capacity so it can support SBO loads over

four hours, three non-class 1E loads will be shed (16): both main feedwater pump turbine DC emergency lube oil pumps, the AMSAC invertor power supply, and the main turbine DC emergency bearing oil pumps.

Since no battery calculations were provided for review, we consider the licensee's identified loads to be appropriate, pending future audit. However, the IEEE-Std '85 recommends that a 10% to 15% design margin be used in the battery sizing calculation to compensate for less than optimum operating conditions, recent discharge, or ambient temperature less than anticipated. The licensee needs to verify that such a margin has been used, or show other conservatisms that were used in the battery sizing calculations in order to compensate for lack of the assumed margin.

3. **Compressed Air**

Licensee's Submittal

The licensee stated that air-operated valves relied upon to cope with an SBO for four hours will be either operated manually or have sufficient backup sources. Valves requiring manual operation or back-up sources for operation will be identified in plant procedures.

Review of Licensee's Submittal

The auxiliary feedwater and the atmospheric steam dump, or PORV systems were reviewed to determine their dependency on compressed air. Compressed air is not needed for operation of the auxiliary feedwater system, as the valves and controls are powered by the Class-1E batteries. By following the emergency remote shutdown procedure, back-up bottled nitrogen for operation of the air operated PORVs is provided (16) through

a manual connection. There are additional nitrogen bottles in reserve, if needed. Based on the licensee's statement (16) that the loader stations from which the PORVs are operated with the nitrogen are not near the valves themselves and that the stations are also equipped with emergency lighting, we conclude that sufficient compressed air is available for the operation of the needed air-operated valves, and there are no adverse habitability considerations.

4. **Effects of Loss of Ventilation**

Licensee's Submittal

The dominant areas of concern (DACs) and the control room are listed in the following table along with their associated station blackout temperature, type of heat-up analysis performed, and justification for Reasonable Assurance of Operability (RAO) (12 and 16):

AREA	FINAL TEMP	ANALYSIS	RAO JUSTIFICATION
Steam Driven Auxiliary Feedwater pump room	133.6°F	NUMARC	equipment evaluation per NUMARC
Control Room	119°F	Transient	less than 120°F
Inverter Room	121°F	Transient	equipment evaluation per NUMARC

Reasonable assurance of equipment operability is established without further analysis if the temperature in a DAC is calculated to be equal to or less than 120°F (NUMARC 87-00 Supplemental Questions/Answer #2.2) (10).

The licensee stated that reasonable assurance of the operability of SBO response equipment in the steam-driven auxiliary feedwater pump room has been assessed using Appendix F to NUMARC 87-00 and/or the Topical Report. No modifications or associated procedures are required to provide reasonable assurance for equipment operability.

Review of Licensee's Submittal

The licensee's temperature rise calculations were neither received nor reviewed. Therefore, this review is based on summaries provided by the licensee in its submittals. As such, the review only covers the assumptions and method identified by the licensee and assumes the calculated temperatures to be accurate, pending future audit/verification. Our findings regarding the licensee's calculations are summarized below:

o **Control Room**

We reviewed the licensee's provided information for the control room heat-up calculations and found the initial conditions and the assumptions to be reasonable, except for the following two items:

1) The licensee assumed the outside air temperature to be 95°F. Review of the NUREG/CR-1390 (17) extreme annual temperature for the D. C. Cook site indicates that the outside air temperature could reach 106°F once every 50 years. Therefore, the 95°F air temperature is non-conservative.

2) The licensee assumed the temperature above the control room drop ceiling panels, "attic area," to be 100°F initially and to remain unchanged for the duration. In reality, this temperature increases during the SBO period.

On the other hand, the licensee assumed an initial control room temperature of 95°F, and added 10 kW heat load to the heat generated during normal operating condition for conservatism. Overall, we believe the calculated room temperature to be acceptable. However, the licensee needs to open the control room cabinet doors within 30 minutes of an SBO event as guided in NUMARC 87-00 Supplemental Questions/Answers.

o **Inverter Room**

The licensee's assumptions seem reasonable except for the outside air temperature. However, its impact on the final temperature is expected to be small. With regard to equipment operability in this room, the licensee should have used the manufacturer equipment qualification temperatures for the inverters (CRID inverters) as opposed to the use of generic data given in Appendix F of NUMARC 87-00. It is our understanding the inverters are normally qualified for a 104°F ambient air temperature. The licensee needs to verify that the CRID inverters are qualified for 121°F.

o **Containment**

NUMARC Supplemental Questions/Answers asked (11) the licensees to verify that the conditions resulting from LOCA/HELB in the containment envelope the conditions expected during an SBO event. However, the licensee did not provide the results of its verification. This needs to be verified and documented.

5. **Containment Isolation**

Licensee's Submittal

The licensee stated that the plant list of containment isolation valves (CIVs) was reviewed to verify that containment isolation valves that must be operated under SBO conditions can be positioned, with indication, independent of the preferred and class-1E AC power supplies. No modifications or procedure changes were necessary to ensure containment integrity under SBO conditions. In response to questions raised during the telephone conversation on February 27, 1991, the licensee supplied (16) a list of 14 CIVs which cannot be excluded by the criteria given in RG 1.155 or NUMARC 87-00, and provided reasoning why these CIVs could also be excluded.

Review of Licensee's Submittal

The exclusions allowed by RG 1.155 (paragraph 3.2.7) were applied to the list of containment isolation valves in the UFSAR and the resultant list of CIVs of concern was compared to the list supplied by the licensee. Unfortunately, comparison is difficult because the licensee's list does not use the same system of identification of the valves or penetrations as the UFSAR does. Therefore, our comparison could only be done based on description, provided (16) by the licensee and may need verification.

The licensee identifies 14 CIVs that cannot be excluded by the criteria of RG 1.155. We reviewed the licensee's explanations on each of the 14 CIVs and except for the following CIVs we agree with the licensee's arguments that adequate containment integrity is obtainable during an SBO event.

- MCM-221 and -231 -- Although these valves are required to be in the open position during an SBO, the licensee needs to list them in a procedure and ensure that these valves could be closed, if needed.

6. **Reactor Coolant Inventory**

Licensee's Submittal

The licensee stated that the ability to maintain adequate reactor coolant system (RCS) inventory to ensure that the core is cooled has been assessed for four hours. A plant-specific analysis was used for this assessment. The expected rates of reactor coolant inventory loss under SBO conditions do not result in core uncovering. Therefore, RCS makeup systems under SBO conditions are not required to maintain core cooling under natural circulation (including reflux boiling).

Review of Licensee's Submittal

Expected maximum losses from the RCS are 25 gpm from each of the four RCS pumps and 25 gpm allowed by the Technical Specifications, for a total of 125 gpm. Over four hours this leak rate results in a loss of 30,000 gallons. This is equivalent to an RCS mass loss of ~250,000 lbm. The primary system at D. C. Cook has an estimated liquid volume of 11,780 ft^3 (~530,000 lbm) of water at guaranteed power. A loss of this quantity of water from the RCS would not uncover the core. This review concurs with the licensee's assessment.

NOTE:

"The 25 gpm reactor coolant pump seal leak rate was agreed to between NUMARC and the staff pending resolution of generic Issue (GI) 23. If the final resolution of GI-23 defines higher seal leak rates than assumed for the RCS inventory evaluation, the licensee needs to be aware of the potential impact of this resolution on its analyses and actions addressing conformance to the SBO rule."

3.3 Proposed Procedures and Training

Licensee's Submittal

The licensee stated (12) that plant procedures have been reviewed and, where necessary will be modified by July 31, 1989 to meet the guidelines in NUMARC 87-00, Section 4, in the following areas:

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

The licensee listed the names of all procedures which are intended to be reviewed and changed/modified as necessary in its submittal (12).

Review of Licensee's Submittal

We neither received nor reviewed the affected procedures. These procedures are plant-specific actions concerning the required activities to cope with an SBO event. The licensee identified the procedures that have been reviewed as well as those that have been modified to cope with an SBO event. It is the licensee's

responsibility to revise and implement these procedures, as needed, to mitigate an SBO event and to assure that these procedures are complete and correct, and that the associated training needs are carried out accordingly.

3.4 Proposed Modifications

Licensee's Submittal

The licensee stated (13) that two plant modifications are required to enhance the coping capability during a 4-hour SBO event:

1. Two of four RCS temperature channels are normally powered by an opposite unit diesel-backed power source. However, based on single failure criteria postulated within NUMARC 87-00 for the non-SBO unit, this opposite unit power source may not be available. Direct RCS pressure indication may be lost for use in the SBO-recovery EOP depending on the source of power established for recovery. Modifications necessary for ensuring direct indication of RCS pressure and temperature in the event of a SBO are scheduled for implementation during both units' 1990 refueling outages.

2. Several additional emergency lights were identified as needed. These lights will be added as part of the Long Range Planning Module of the Plant Integrated Management System. At present, reliance will be placed on operators' flashlights.

Review of Licensee's Submittal

The proposed modifications if properly implemented will provide the information needed by the operators and enhance the operators ability to perform functions

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

3.5 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 Appendices A and B.

4.0 CONCLUSIONS

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

1. **Class-1E Battery Capacity**

   The IEEE-Std 485 recommends that a 10% to 15% design margin be used in the battery sizing calculation to compensate for less than optimum operating conditions, recent discharge, or ambient temperature less than anticipated. Since no battery calculations were provided for review, it is not clear what margins the licensee used in the battery sizing calculations. Therefore, the licensee needs to verify that such a margin has been used, or show other conservatisms that were used in the sizing calculations to compensate for lack of the assumed margin.

2. **Effects of Loss of Ventilation**

a. Control Room

   Our review indicates that the final calculated temperature to be reasonable when considering all the assumptions made for the calculation of temperature rise in this room. However, to be consistent with the guidance provided in NUMARC 87-00, Supplemental Questions and Answers the licensee needs to open the control cabinet doors within 30 minutes of an SBO accident.

b. CRID Inverter Room

The licensee needs to use the manufacturer's equipment qualification temperatures for the CRID inverters as opposed to the use of generic data given in Appendix F of NUMARC 87-00. It is our understanding the inverters are normally qualified for a 104°F ambient air temperature. The licensee needs to verify that the CRID inverters are qualified for the calculated ambient temperature of 121°F.

c. Containment

NUMARC Supplemental Questions/Answers asked (11) the licensees to verify that the conditions resulting from LOCA/HELB in the containment envelope the conditions expected during an SBO event. However, the licens[illegible] not provide the results of its verification. This needs to be verified and documented.

3. **Containment Isolation**

The licensee identifies 14 CIVs that can not be excluded by the criteria of RG 1.155. We reviewed the licensee's explanations on each of the 14 CIVs and agree with the licensee's conclusions that adequate containment integrity is obtainable during an SBO event, except for the following CIVs:

- MCM-221 and -231 -- Although these valves are required to be in the open position for the operation of the AFW turbine during an SBO, the licensee needs to list them in a procedure and ensure that these valves could be closed, if needed.

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 Appendices A and B.

5.0 REFERENCES

1. The Office of Federal Register, "Code of Federal Regulations Title 10 Part 50.63," 10 CFR 50.63, January 1, 1989.

2. U.S. Nuclear Regulatory Commission, "Evaluation of Station Blackout Accidents at Nuclear Power Plants - Technical Findings Related To Unresolved Safety Issue A-44," NUREG-1032, Baranowsky, P. W., June 1988.

3. U.S. Nuclear Regulatory Commission, "Collection and Evaluation of Complete and Partial Losses of Offsite Power at Nuclear Power Plants," NUREG/CR-3992, February 1985.

4. U.S. Nuclear Regulatory Commission, "Reliability of Emergency AC Power System at Nuclear Power Plants," NUREG/CR-2989, July 1983.

5. U.S. Nuclear Regulatory Commission, "Emergency Diesel Generator Operating Experience, 1981-1983," NUREG/CR-4347, December 1985.

6. U.S. Nuclear Regulatory Commission, "Station Blackout Accident Analyses (Part of NRC Task Action Plan A-44)," NUREG/CR-3226, May 1983.

7. U.S. Nuclear Regulatory Commission Office of Nuclear Regulatory Research, "Regulatory Guide 1.155 Station Blackout," August 1988.

8. Nuclear Management and Resources Council, Inc., "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," NUMARC 87-00, November 1987.

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

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

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

12. Alexich M. P., letter to Document Control Desk, U.S. Nuclear Regulatory Commission, "Generic Response to Station Blackout Rule for Plants Using AC Independent Station Blackout Response Power," dated April 14, 1989.

13. Alexich M. P., letter to Document Control Desk, U.S. Nuclear Regulatory Commission, "Additional Information for Station Blackout (SBO)," dated March 30, 1990.

14. Donald C. Cook Nuclear Plant Updated Final Safety Analysis Report.

15. NUMARC 87-00 Supplemental Questions/Answers and Major Assumptions, dated January 4, 1990.

16. Donald C. Cook Nuclear Plant response to questions, received March 27, 1991.

17. NUREG/CR-1390, "Probability Estimates of the Temperature Extremes for the Contiguous United States," May 1980.