ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)

STATION BLACKOUT (SBO) EVALUATION

AUGUST 1992

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1.0 INTRODUCTION

1.1 OVERVIEW AND SUMMARY

10 CFR 50.63 (the SBO Rule), which became effective July 21, 1988, requires light-water-cooled nuclear power plants to be able to withstand a complete loss of ac-power for a specified duration and to maintain reactor core cooling during that period. Pursuant to 10 CFR 50.63(c)(1), information defined in 10 CFR 50.63(c)(1)(i - iv) must be submitted to the Director of the Office of Nuclear Reactor Regulation by 270 days after the date of Operating License issuance.

By letter dated April 22, 1992 (Reference 1), TVA indicated its plans for early submittal of SBO information as discussed at the TVA/NRC management meeting on March 24, 1992. The WBN strategy for coping with an SBO, as indicated in the referenced letter and confirmed by this enclosure, is with an ac-independent approach.

This enclosure provides the information defined in 10 CFR 50.63(c)(1). As detailed herein, TVA proposes a 4-hour coping duration for WBN, and provides justification for this coping duration as follows:

Power Design Characteristic Group (P Group)	P1
Extremely Severe Weather (ESW Group)	1
Severe Weather (SW Group)	2
Emergency AC Power Configuration (EAC Group)	D
Independence of Offsite Power (I Group)	I 1/2
Proposed EDG Reliability Target	0.975
Station Blackout Coping Duration	4 hours

Additionally, the supplementary information below describes the following aspects related to coping with a 4-hour SBO event at WBN:

1) The minimum equipment necessary for coping with a 4-hour SBO event has been identified, along with the locations of such equipment and the associated dc-power, instrumentation, and controls for that equipment.

2) The WBN vital batteries have been analyzed and found adequate for providing the necessary dc-power to instruments and controls necessary during the SBO event. Load shedding of the vital batteries is required, and the necessary procedures and training will be developed.

3) The effects of the loss of heating, ventilation, and air conditioning (HVAC) have been analyzed for the areas containing the

minimum SBO equipment identified, and these effects do not preclude the proper operation of the minimum equipment and instruments for the duration of the SBO.

4) Condensate inventory has been evaluated to ensure core cooling and decay heat removal during the 4-hour SBO duration, and found sufficient.

5) Reactor Coolant System (RCS) inventory has been evaluated to ensure that the core is kept covered during the 4-hour SBO duration, and found sufficient.

6) The auxiliary compressed air supplies have been evaluated and modifications for the auxiliary feedwater (AFW) level control valves used during the SBO will be required.

7) Containment isolation valves have been reviewed and it has been determined that appropriate containment integrity can be maintained during the 4-hour SBO event.

8) Plant procedures have been identified for further review and revision to ensure that procedures used to implement the ac-independent coping strategy will be developed and the appropriate training provided.

1.2 INTRODUCTION AND CONTENTS

Section 1.0 provides an overview and summary of the results of the SBO evaluation performed for WBN Units 1 and 2, including some pertinent definitions and considerations used in performing the coping analysis.

Section 2.0 describes the assumptions and bases used to define the SBO scenario for WBN.

Section 3.0 provides the logic used to derive the WBN SBO duration of four hours, including the emergency diesel generator (EDG) target reliability that results from those analyses. This section also discusses the WBN EDG Reliability Program that will be established to ensure that the EDG target reliability is achieved and maintained.

Section 4.0 provides an overview of the information contained in the WBN detailed study and calculation which covers the major issues of concern, such as RCS inventory for keeping the core covered; verifying the Class 1E battery capacity for coping on dc-power for the 4-hour duration; Auxiliary Compressed Air System supply for the AFW level control valves; results of the analysis of the effects of the loss of HVAC during a 4-hour SBO event; and the assurance of appropriate containment integrity/isolation capability. Pursuant to 10 CFR 50.63(a)(2), these baseline assumptions, analysis, and related information are available onsite for NRC review if desired.

Section 5.0 identifies the required modifications to equipment and associated procedures identified from the SBO evaluation.

Section 6.0 briefly discusses the plant procedures that have been identified for further review and revision in order to ensure the coping capability for an SBO.

Section 7.0 discusses the Quality Assurance (QA) Program. This program will be enhanced as necessary to cover any SBO required equipment which is not already part of the WBN Quality Program.

Section 8.0 briefly discusses the Technical Specifications that may be applicable for SBO equipment.

Section 9.0 provides the references used for this enclosure.

1.3 STATION BLACKOUT AND WBN SAFE SHUTDOWN

This section discusses the SBO Rule definitions as they relate to a SBO safe shutdown plant condition.

Definitions

10 CFR 50.2 defines the following relevant terms:

> "Station blackout means the complete loss of alternating 2current (ac) electric power to the essential and nonessential switchgear buses in a nuclear power plant (i.e., loss of offsite electric power system concurrent with turbine trip and unavailability of the onsite emergency ac-power system). Station blackout does not include the loss of available ac-power to buses fed by station batteries through inverters or by alternate ac sources as defined in this section, nor does it assume a concurrent single failure or design basis accident. . . ."

> "Safe shutdown (non-design basis accident [non-DBA]) for station blackout means bringing the plant to those shutdown conditions specified in plant technical specifications as Hot Standby or Hot Shutdown, as appropriate (plants have the option of maintaining the RCS at normal operating temperatures or at reduced temperatures."

Based on the above, the WBN SBO safe shutdown condition is defined as hot standby. Because the conservation and retention of RCS inventory is important, the WBN SBO coping strategy is to remain at normal operating temperature and pressure to the extent practical, or to be in hot standby (Technical Specification MODE 3) at a minimum. This approach conserves RCS inventory, minimizes the required condensate supplies from the Condensate Storage Tank (CST) since additional condensate would be required for cooldown, minimizes the shrinkage of the RCS from cooldown, and stabilizes the plant in a safe condition until offsite power, or power from the failed EDGs, is restored. Additionally, less equipment is required to be operable during hot standby (e.g., boron injection prior to cooldown to cold shutdown conditions is not required). By maintaining the plant in a stable MODE 3 condition, the operators can devote most of their attention to coping with the SBO event (e.g., load stripping of the vital batteries).

Nonetheless, cooldown capability is retained (i.e., sufficient CST inventory is available) in the unlikely event that cooldown might be required during the SBO event.

1.4 ADDITIONAL INFORMATION

1.4.1 SBO for WBN Units 1 and 2, versus WBN Unit 1

This enclosure addresses the SBO scenario as if both Units 1 and 2 were operating. By assuming that both WBN Units 1 and 2 are in operation, the analysis applies to an SBO on either unit; one unit is in an SBO condition, and the other unit has lost one of two EDGs, and is in a non-blackout (NBO) condition. For the purposes of the analysis, one SBO unit is analyzed without any dependence on the ac-power potentially available (for common systems/areas) from the NBO unit. Therefore, no credit is taken for HVAC equipment that may be powered from the NBO unit.

Assuming that both units are in operation is conservative, in that the initial heat loads for common plant areas are analyzed assuming that the dc-powered equipment in both units is operating and generating heat.

An SBO evaluation, for Unit 1 only, would affect the loss of HVAC calculations. That is, the determinations of coping duration would remain the same, the minimum equipment required, CST capacity, and other considerations would be the same as this dual-unit evaluation. However, an SBO evaluation for Unit 1 alone would result in lower temperatures for common areas, since no Unit 2 dc-powered equipment would be assumed to operate. Thus this dual-unit evaluation is more conservative for the loss of HVAC calculations.

1.4.2 Shared Systems Considerations

The existing shared design of the WBN fluid systems, in particular the Essential Raw Cooling Water (ERCW) Systems and the Component Cooling Systems (CCS), requires certain components to be energized from the common and/or Unit 2 power sources to achieve and maintain hot standby on Unit 1. Similarly, certain components need to be energized from Unit 1 sources for Unit 2.

Furthermore, to achieve hot standby, both Train A EDGs or both Train B EDGs must be operable. For example, hot standby on Unit 1, with only Train 1A available, requires that Train 2A (not 1B or 2B) also be available. The converse is true for Train 1B. Thus hot standby for Unit 1 (or Unit 2) requires power from both Train 1A and 2A, or from both Train 1B and 2B, but cannot be achieved from Train 1A or 1B alone.

For SBO coping duration analyses, the determination of how many EDGs are necessary must account for the need of two specific EDGs (either the "1A-2A" EDGs or the "1B-2B" EDGs).

The sharing of fluid and electrical trains results in the requirement that any randomly chosen three EDGs will provide either the "A-A" EDGs or the "B-B" EDGs. See Section 3.0, wherein the coping duration factors are evaluated.

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2.0 ASSUMPTIONS AND BASES

2.1 GENERAL ASSUMPTIONS AND BASES

NUMARC 87-00, Revision 1, Section 2.4, and Appendices I and J (Reference 2) provide the majority of the assumptions and the bases for the assumptions used herein. Therefore, the NUMARC bases for the following assumptions are not repeated here. Instead, if there are any assumptions different from the NUMARC 87-00, Revision 1, assumptions, the bases for those assumptions are provided.

2.1.1 RCS Inventory Losses

RCS leakage from letdown need not be considered during the SBO event.

BASIS: NO LETDOWN LINE LOSSES:

The letdown line is isolated on a loss-of-offsite-power (LOOP) and/or an SBO and thus any letdown losses are isolated at the onset of the event.

The only RCS inventory losses which therefore need to be considered are the losses from the Reactor Coolant Pump (RCP) seal leakage, and the Technical Specification allowable identified RCS leakage losses, as documented in NUMARC 87-00, Revision 1. The NUMARC 87-00, Revision 1 values are used.

RCP seal leakage is assumed as 25 gallons per minute per pump/seal, for a total of 100 gallons per minute.

The WBN draft proposed Technical Specification allowable identified RCS leakage is 10 gallons per minute.

The above RCS inventory losses add up to a total of 110 gallons per minute, which is used for the 4-hour SBO duration.

2.1.2 Operator Actions

Operator actions are governed by plant procedures, and the appropriate procedures and training will be developed during closure of the SBO issues at WBN. Operator actions within the control room are assumed to occur at the onset of the event (i.e., recognition of the SBO versus a LOOP, ensuring reactor trip, monitoring the steam generator level and pressure, etc.).

Operator actions outside of the control room are not assumed to occur until at least 30 minutes into the SBO event.

BASIS: OPERATOR ACTIONS IN THE CONTROL ROOM:

Proper and immediate operator responses to emergencies and off-normal conditions are assured by the development of the appropriate procedures and training on those procedures. In addition, the plant response to a LOOP and/or an SBO is automatic (e.g., isolation valves automatically go their safe position on loss of power and/or loss of air; the Main Feedwater System isolation valves and Main Steamline isolation valves operate automatically; an AFW actuation signal is generated automatically, etc.). The operators will notice immediately that an SBO is occurring when the LOOP occurs and the affected (three) EDGs do not automatically start within 15 seconds, and the plant remains on dc-power only.

BASIS: OPERATOR ACTIONS OUTSIDE THE CONTROL ROOM WITHIN 30 MINUTES:

Although it is expected that operator responses to emergencies and off-normal conditions will be expeditious, the conservative assumption of no effective actions outside the control room until at least 30 minutes have elapsed allows for notification of auxiliary operators, collection of the proper equipment such as flashlights, door keys, etc., and access to plant areas which may be remote from the control room.

2.1.3 <u>Access to Plant During Loss of HVAC</u>

When an SBO occurs, the ac-powered HVAC is assumed lost and the loss of HVAC will result in elevated room temperatures ranging from moderate to severe, depending on the initial and remaining heat loads in each plant area. Operator access to affected plant areas is assumed to be feasible for short excursions (about 15 minutes) to manipulate valves or open breakers, as long as the bulk steady-state temperatures calculated for those areas remains below 122°F. Areas reaching steady-state temperatures above 122°F are assumed to be too warm even for brief operator access and successful accomplishment of the mission.

BASIS: OPERATOR EXCURSIONS INTO AREAS AT 122°F:

Operations personnel do not continually occupy the plant areas in question, and thus elevated temperature effects concerning continuous habitability are not relevant. For the present analysis, a need for operator access into areas at 122°F has not been identified. A few containment isolation valves, located outside the containment, could require a brief excursion into an area for manipulation of a valve handwheel if it is hypothesized that core damage appears imminent and containment isolation capability needs to be assured. This should take only a few minutes, with approximately 15 minutes maximum estimated.

(Note: since the core remains covered during the SBO transient, even if cooldown to cold shutdown is required, the imminent core damage scenario is hypothetical.) The pipe chase and the turbine-driven (TD) AFW pump rooms are the areas that reach 122°F. Reasonable engineering judgement provides the assurance that brief entry into an area at 122°F will not adversely affect successful accomplishment of this mission.

BASIS: OPERATOR ACCESS TO AREAS WHICH HEAT UP TO MORE THAN 122°F:

Even though access into areas above 122°F would be for only brief excursions, for the same reasons outlined above, it is felt that the assumption of no allowed operator access into these areas is the more prudent and conservative approach. This assumption does not adversely affect the containment integrity/isolation valve closure capability evaluations.

2.1.4 Restoration of AC Power

AC-power is restored from either the offsite power sources or the EDGs. In order to simplify the procedure reviews and revisions, the assumption is made that the ac-power is restored from the EDGs, or, if both offsite and onsite emergency power are available, the assumption is made that the plant will preferentially repower the blackout unit using the EDGs. Thus no credit is taken for the restoration of ac-power from the switchyard, and no credit is taken for the 250V non-1E station batteries.

BASIS: AC POWER RESTORATION FROM EDGs:

The assumptions inherent in an SBO scenario are non-mechanistic in that a LOOP initiating event is postulated to occur from a switchyard event due to random faults, or an external event such as a grid disturbance, or a weather event that affects the offsite power system either throughout the grid or at the plant. The SBO event is then postulated to occur due to assumed (but non-mechanistic) failures of two EDGs for one WBN unit, and another failure (again non-mechanistic) of one EDG on the other unit. The SBO event is ended when ac-power is restored to the shutdown buses from either offsite or onsite power. There is no requirement to restore ac-power from both sources.

This assumption is expected to allow use of, or only minor revision to, LOOP procedures which direct and synchronize the load powering from the operating EDGs back to the offsite power sources. In addition, this assumption allows for use of LOOP procedures using the operable EDGs for a long period of time, which may be required if a grid or switchyard failure requires more than the 4-hour SBO duration to rectify.

2.2 ADDITIONAL ASSUMPTIONS

Regulatory Guide (RG) 1.155 (Reference 3) indicates the following pertinent guidance at Position 3.2.1:

> "The evaluation should be performed assuming that the station blackout event occurs while the reactor is operating at 100% rated thermal power and has been at this power level for at least 100 days."

Based on the above guidance, and following current industry practice, additional considerations and assumptions that define the SBO event at the WBN site are presented below. NUMARC 87-00, Revision 1, guidance is used also.

2.2.1 <u>Initial Plant Conditions</u>

Both WBN Units 1 and 2 have been and are operating at 100% power in a "normal" configuration; i.e., it is not necessary to postulate off-normal conditions such as equipment out of service, equipment undergoing test, or equipment undergoing repairs; nor is it necessary to postulate that the plant is in any limiting condition of operation. For WBN, the normal at-power configuration is four EDGs operable, with the fifth EDG available as an "installed spare." (No credit is taken during the SBO event for the fifth EDG.) The normal alignment of fluid systems is assumed, and no equipment is out of service for repair or tests.

2.2.2 <u>Initiating SBO Event</u>

An SBO is then postulated for WBN as follows: A total LOOP is postulated concurrently on both units; one unit (the SBO unit) also suffers a total loss of the ac emergency power system (i.e., a loss of two EDGs), and the other unit (NBO unit) must be able to achieve a SBO safe shutdown assuming a single failure (non-DBA). The single failure assumed on the NBO unit is a loss of one of the two remaining EDGs normally available. This SBO condition is postulated to last for the duration determined on a plant-specific basis (see Section 3.0 below).

2.2.3 <u>No Concurrent Design Basis Events or Abnormal Occurrences</u>

The SBO event is not postulated to occur with a concurrent design basis accident or other design basis event. The LOOP/SBO is not assumed to be caused by a fire, flood, or seismic activity; these are not expected to occur with sufficient frequency to require explicit criteria and are not considered in the SBO scenario.

2.2.4 Reactor Trip

Following the LOOP, the reactor automatically trips with sufficient shutdown margin to maintain subcriticality at a SBO safe shutdown.

2.2.5 SBO Safe Shutdown Condition

As indicated in the 10 CFR 50.2 definition of SBO safe shutdown, placing both units in a hot standby (Technical Specification MODE 3) condition, and maintaining such a condition, stabilizes the SBO unit in a SBO safe shutdown condition. Mode changes (e.g., to a MODE 5 cold shutdown condition) are not required to be postulated for SBO.

2.2.6 No Additional Failures

No independent failures, other than those causing the SBO event, are assumed to occur in course of the transient. (The effects of the loss of HVAC are analyzed in Section 4.)

2.2.7 Automatic Valves Operability

Main Steam System valves (e.g., main steam isolation valves (MSIV), main steam safety valves (MSSV), turbine stop valves, atmospheric dump valves (ADV), etc.) operate properly to remove decay heat.

2.2.8 Relief Valves Operability

Safety/relief valves or dc power operated relief valves (PORVs) operate properly and normal valve reseating is assumed.

2.2.9 End of SBO Transient

The SBO event ends when ac-power is restored to shutdown buses from any source (i.e., from either offsite or onsite power at the end of the SBO duration). Also see Section 2.1.4 above.

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3.0 DETERMINATION OF WBN STATION BLACKOUT (SBO) COPING DURATION

The NUMARC guidance document, which is consistent with the NRC Staff's RG 1.155, was used in a 5-part process to determine the offsite power design characteristic group. These steps are shown in Subsections 3.1 through 3.5 below. The WBN EDG target reliability is determined in Subsection 3.6, and finally the WBN required SBO coping duration is determined in Subsection 3.7.

3.1 SITE SUSCEPTIBILITY TO GRID-RELATED LOOP EVENTS (P-GROUP)

This subsection determines that the WBN site is not classified as P Group P3.

Plants should be classified as P3 sites if the expected frequency, based on prior experience, of grid-related events exceeds once per 20 years, not including events of less than 5 minutes duration. As indicated in NUMARC 87-00, Revision 1, Section 3.2.1:

> "NUREG-1032 notes sites having a frequency of grid-related events at the once per 20 site-year frequency are limited to St. Lucie, Turkey Point, and Indian Point. Accordingly, no other sites are expected to exceed the once per 20 site-year frequency of grid-related loss-of-offsite power events."

WBN, therefore, is not expected to exceed the once per 20 year frequency of grid-related LOOP events.

The alternative offsite power design characteristic groups, P1 or P2, are determined later based on the determination of the ESW Group; the SW Group; and the independence of offsite power, I Group, as shown in Subsections 3.2 through 3.4 below.

3.2 FREQUENCY OF LOOP DUE TO EXTREMELY SEVERE WEATHER (SW GROUP)

For this enclosure, the NUMARC 87-00, Revision 1, Table 3-2 information is used to determine the ESW Group.

NUMARC 87-00, Revision 1, Table 3-2 indicates that the WBN site, with a frequency of storms greater than 125 mph of 10-4 per year, is classified as ESW Group 1.

3.3 FREQUENCY OF LOOP DUE TO SEVERE WEATHER (SW GROUP)

Four factors are used to calculate the estimated frequency of LOOP due to severe weather:

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1) Annual expectation of snowfall for the site (in inches)
2) Annual expectation of tornadoes of severity f2 or greater at the site; i.e., windspeeds greater than or equal to 113 mph (in events per square mile)
3) Annual expectation of storms for the site with wind velocities between 75 and 124 mph
4) Annual expectation of storms with significant salt spray for the site.

Using the NUMARC 87-00, Revision 1 information presented in Table 3-3, the following values for the four factors are given:

1) 10 inches annual snowfall ($= h_1$)

2) 0.0001422 events per square mile of tornadoes of severity f2 or greater ($= h_2$)

3) 0.1 storms per year with wind velocities between 75 and 124 mph ($= h_3$)

4) 0 storms with significant salt spray ($= h_4$).

These values are inserted into the following equation found in NUMARC 87-00, Revision 1 and in RG 1.155:

Estimated frequency of LOOP due to severe weather, f, is

$$f = (1.3 \times 10^{-4})h_1 + (b)h_2 + (0.012)h_3 + (c)h_4,$$

where:

b = 12.5 for sites with transmission lines on two or more right-of-ways spreading out in different directions from the switchyard, and

c = 0 if the switchyard is not vulnerable to the effects of salt spray.

The WBN Final Safety Analysis Report (FSAR) (Reference 4), Subsection 8.2, indicates that the transmission lines are on two or more rights-of-way spreading out in different directions from the switchyard, and the NUMARC information indicates that salt spray is not relevant to the WBN site. By substituting the values given above in the equation for f, we obtain:

$$f = (1.3 \times 10^{-4})(10) + (12.5)(0.0001422) + (0.012)(0.1) + (0)(0)$$

which yields $f = 4.2775 \times 10^{-3}$

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From NUMARC 87-00, Revision 1, Table 3-4 (or RG 1.155, Table 6), this value of f is assigned severe weather SW Group 2.

3.4 INDEPENDENCE OF OFFSITE POWER SYSTEM (I GROUP)

Per NUMARC 87-00, Revision 1, the offsite power system is in the I3 Group if a "yes" answer can be assigned to condition "A" below, and a "yes" answer can be assigned to either conditions "B(1)" or "B(2)" below:

A. All offsite power sources are connected to the unit's safe shutdown buses through one switchyard, or two or more electrically connected switchyards.

The answer to "A" is "yes"; as described in the WBN FSAR Section 8.2:

"Preferred shutdown power is supplied from TVA's 161 kV transmission grid at Watts Bar Hydro Plant switchyard over two separate transmission lines, each connecting to two 161 - 6.9 Kv common station service transformers at Watts Bar Nuclear Plant."

Since condition "A" is answered "yes," questions "B(1)" or "B(2)" are investigated to determine whether either question is answered "yes." If neither question "B(1)" nor "B(2)" results in a "yes" answer, then WBN is not in an I3 category.

B(1) The normal source of ac-power is from the unit main generator and there are no automatic transfers and one or more manual transfers of all safe shutdown buses to preferred or alternate offsite sources.

The answer to "B(1)" is "no"; the normal source of ac-power to the Class 1E shutdown circuits is not from the unit main generator. Also see "B(2)" and its response.

B(2) The normal source of ac power is from the unit main generator and there is one automatic transfer and no manual transfers of all safe shutdown buses to one preferred or one alternate offsite power source.

The answer to "B(2)" is "no," because the normal source of ac-power is not from the unit main generator, but rather from the WBN Hydro Plant switchyard. Two offsite 161 kV transmission lines from the WBN Hydro Plant switchyard are connected to the common service station transformers (CSSTs) C and D, which power the Class 1E shutdown loads. On a loss of one of the incoming transmission lines the capability exists for a manual transfer of the loads from the affected CSST (C or D) to the other CSST and thereby power the four shutdown boards from one CSST. Should the other offsite power source, i.e., an incoming transmission line, be lost (and thus a total loss of offsite power occurs), the shutdown boards fed from CSSTs C and D are fed from the onsite EDGs.

Based on the above, WBN does not meet the NUMARC guidance for classifying the offsite power system as Group I3. Per the NUMARC guidance, WBN therefore falls into offsite power system Group I1/2.

Note that, pursuant to the NRC letter of May 4, 1992 (Reference 5), the I1/2 classification was confirmed using RG 1.155, Table 5, and NUREG-1032 Tables A.2 and A.3. These reviews did not affect the above determination that the WBN plant is offsite power system Group I1/2. Using the RG 1.155, Table 5, the WBN configuration would be in Group I1. Note that the normal source of ac-power at WBN is not from the unit main generator, but from the WBN Hydro Plant switchyard via two offsite power transmission lines as described above.

Having now determined the ESW Group (1) in Subsection 3.2, the SW Group (2) in Subsection 3.3, and the I Group (I1/2) in this subsection, NUMARC 87-00, Revision 1, provides a matrix, Table 3-5a, to determine the offsite ac-power design characteristic group (the P Group).

NUMARC Table 3-5a indicates that for the above rankings, the WBN site falls into a P Group P1. This value, plus the information obtained in Subsection 3.5 below, ultimately leads to a target EDG reliability, and thence to the WBN coping duration in hours.

3.5 CONFIGURATION OF EMERGENCY AC (EAC) POWER SYSTEM

Determination of the EAC power system configuration, using the guidance of NUMARC 87-00, Revision 1 is a three-part process, consisting of 1) determining the number of EDGs not credited as alternate ac-power sources; 2) identifying the smallest number EDGs necessary for SBO safe shutdown; and 3) selecting the EAC configuration group.

ENCLOSURE 1

WATTS BAR NUCLEAR PLANT

STATION BLACKOUT

NUMARC GENERIC RESPONSE FORMAT

AUGUST 1992

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WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2
STATION BLACKOUT (SBO) EVALUATION
NUMARC GENERIC RESPONSE FORMAT

On July 21, 1988, NRC amended its regulations in 10 CFR 50. A new section, 50.63, was added which requires that each light-water-cooled nuclear power plant be able to withstand and recover from an SBO of a specified duration. Utilities are expected to have the baseline assumptions, analyses, and related information used in their coping evaluation available for NRC review. It also identifies the factors that must be considered in specifying the SBO duration. Section 50.63 requires that, for the SBO duration, the plant be capable of maintaining core cooling and appropriate containment integrity. Section 50.63 further requires that each licensee submit the following information:

1. A proposed SBO duration including a justification for the selection based on the redundancy and reliability of the onsite emergency ac-power sources, the expected frequency of loss of offsite power, and the probable time needed to restore offsite power;

2. A description of the procedures that will be implemented for SBO events for the duration (as determined in 1 above) and for recovery therefrom; and

3. A list and proposed schedule for any needed modifications to equipment and associated procedures necessary for the specified SBO duration.

The NRC has issued Regulatory Guide (RG) 1.155, "Station Blackout," which describes a means acceptable to the NRC Staff for meeting the requirements of 10 CFR 50.63. RG 1.155 states that the NRC Staff has determined that NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout At Light Water Reactors," also provides guidance that is in large part identical to the RG 1.155 guidance and is acceptable to the NRC Staff for meeting these requirements.

Table 1 to RG 1.155 provides a cross-reference between RG 1.155 and NUMARC 87-00 and notes where the RG takes precedence.

TVA has evaluated the WBN Units 1 and 2 against the requirements of the SBO rule using guidance from NUMARC 87-00, Revision 1, except where RG 1.155 takes precedence. (Applicable NUMARC 87-00, Revision 1, sections are shown in parentheses.)

A. Proposed Station Blackout Duration

NUMARC 87-00, Revision 1, Section 3, was used to determine a proposed SBO duration of four hours. The following modifications will be implemented to attain this proposed coping duration category:

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STATION BLACKOUT (SBO) EVALUATION
NUMARC GENERIC RESPONSE FORMAT

The only modifications required for the SBO event are the air-operated, turbine-driven (TD) auxiliary feedwater (AFW) pump level control valves. The amount of air available to operate these valves will be supplemented by the addition of compressed nitrogen bottles. The control of the valves in the present procedures is manual, and operators are dispatched immediately when they recognize the need for steam generator control. Modifications and the associated procedure changes will provide compressed nitrogen control of these valves for the four-hour SBO coping duration requirement (Section 5.2).

The following plant factors were identified in determining the proposed SBO duration:

1. AC-Power Design Characteristic Group is P1 based on:

   a. Expected frequency of grid-related loss-of-offsite-power (LOOP) does not exceed once per 20 years (Section 3.2.1, Part 1A, p. 3-3);

   b. Estimated frequency of LOOPs due to extremely severe weather (ESW) places the plant in ESW Group 1 (Section 3.2.1, Part 1B, p. 3-4);

   c. Estimated frequency of LOOPs due to severe weather (SW) places in the plant in SW Group 2 (Section 3.2.1, Part 1C, p. 3-7);

   d. The offsite power system is in the I 1/2 Group (Section 3.2.1, Part 1D, p. 3-10);

   e. WBN is not subject to the effects of a hurricane; hence, prehurricane procedures are not applicable. Note, however, that plant-specific pre-tornado requirements and procedures which meet the guidelines of Section 4.3.3 of NUMARC 87-00, Revision 1 will be implemented (Section 4.3.3, p. 4-15).

2. The emergency ac-power (EAC) configuration group is Group D for WBN Unit 1 or Unit 2 based on (Section 3.2.2, Part 2C, p. 3-15):

   a. There are four emergency ac-power supplies (emergency diesel generators (EDG)) not credited as alternate ac-power sources (Section 3.2.2, Part 2A, p. 3-14);

   b. Two specific EDGs out of three are necessary to operate SBO safe shutdown equipment following a LOOP (Section 3.2.2, Part 2B, p. 3-14);

3. The target EDG reliability is 0.975.

   A target EDG reliability of 0.975 was selected based on the NUMARC minimum target reliability for plants in EAC Group D (Section 3.2.4, p. 3-16).

B. Procedure Description

Plant procedures will be reviewed and modified, if necessary, to meet the guidelines in NUMARC 87-00, Revision 1, Section 4, in the following areas.

1. AC-power restoration per NUMARC 87-00, Revision 1, Section 4.2.2:

   ECA 0.0 (Emergency Contingency Action), "Loss of All Shutdown Power;"

   AOI-35 (Abnormal Operating Instruction), "Loss of Offsite Power."

2. Severe weather per NUMARC 87-00, Revision 1, Section 4.2.3:

   AOI-08, "Tornado Watch/Warning."

Plant procedures will be reviewed and changed necessary to meet NUMARC 87-00, Revision 1, will be implemented, as needed, in the following areas:

1. SBO response per NUMARC 87-00, Revision 1, Section 4.2.1:

   ECA 0.0, "Loss of All Shutdown Power;"

   ECA 0.1, "Recovery From Loss of All AC Power Without SI Required;"

   AOI-35, "Loss of Offsite Power."

2. Procedure changes associated with any modifications required after assessing coping capability per NUMARC 87-00, Revision 1, Section 7:

   ECA 0.0 will be revised to address the increased nitrogen supply duration associated with the addition of the nitrogen containers.

C. Proposed Modifications and Schedule

The ability of WBN Units 1 and 2 to cope with an SBO for four hours in accordance with NUMARC 87-00, Revision 1, Section 3.2.5 and as determined in Section "A" above was assessed using NUMARC 87-00, Revision 1, Section 7, with the following results:

ENCLOSURE 1

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2
STATION BLACKOUT (SBO) EVALUATION
NUMARC GENERIC RESPONSE FORMAT

1. Condensate Inventory for Decay Heat Removal (Section 7.2.1)

It has been determined from 7.2.1 of NUMARC 87-00, Revision 1, that 75,451 gallons of water are required for decay heat removal for four hours (NUMARC 87-00, Revision 1, Section 3.2.5). The minimum permissible condensate storage tank level per the WBN proposed draft technical specifications provides on the order of 210,000 gallons of water per unit, which exceeds the required quantity for coping with a four-hour SBO.

2. Class 1E Battery Capacity (Section 7.2.2)

A battery capacity calculation verifies that the Class 1E batteries have sufficient capacity to meet SBO loads for four hours assuming loads not needed to cope with a SBO are stripped. These loads will be identified in ECA 0.0 which will be revised to include battery load stripping.

3. Compressed Air (Section 7.2.3)

The following modifications and procedure changes are necessary to ensure that air-operated valves required for decay heat removal during a SBO of a four-hour duration have sufficient backup sources for operation or can be manually operated:

The only air-operated valves that require modification for the SBO event are the air-operated, TDAFW pump level control valves. The amount of air available to operate these valves will be supplemented by the addition of compressed nitrogen bottles. The control of the valves in the present procedures is manual, and operators are dispatched immediately when they recognize the need for steam generator control. Modifications and the associated procedure changes will provide compressed gas control of these valves for the four-hour SBO coping duration requirement (Section 5.2).

4. Effects of Loss of Ventilation (Section 7.2.4)

The calculated steady state ambient average air temperature for the steam driven AFW pump room (the dominant area of concern for a PWR) during a SBO induced loss of ventilation is 122°F.

The steady state ambient average air temperature has been calculated for the following areas containing equipment required for a four-hour SBO:

AREA	TEMPERATURE
- Main Control Room Complex (without HVAC)	104°F
- Turbine-Driven Auxiliary Feedwater Pump Room	122°F
- South Main Steam Valve Room	177°F
- 125V Vital Battery Rooms	95°F
- 125V Vital Battery Board Rooms	103°F
- Cable Spreading Room	104°F
- Pipe Chase	122°F
- 480V Board Rooms	104°F
- 6.9kV and 480V Shutdown Board Room	103°F

The assumption in NUMARC 87-00, Revision 1, Section 2.7.1, that the control room will not exceed 120°F during an SBO has been addressed. The control room at WBN Units 1 and 2 does not exceed 120°F during an SBO. Therefore, the control room is not a dominant area of concern.

Reasonable assurance of the operability of SBO response equipment in the above dominant areas of concern has been assessed. No modifications or associated procedures are required to provide reasonable assurance for equipment operability.

5. Containment Isolation (Section 7.2.5)

The plant list of containment isolation valves has been reviewed to verify that valves which must be capable of being closed or that must be operated (cycled) under SBO conditions can be positioned (with indication) independent of the preferred and blacked-out unit's Class IE power supplies. No plant modifications and/or associated procedure changes were determined to be required to ensure that appropriate containment integrity can be provided under SBO conditions.

6. Reactor Coolant Inventory (Section 2.5)

The ability to maintain adequate reactor coolant system inventory to ensure that the core is cooled has been assessed for four hours. The generic analyses listed in Section 2.5.2 of NUMARC 87-00, Revision 1, were used for this assessment and are applicable to the specific design of WBN Units 1 and 2. The expected rates of the reactor coolant inventory loss under SBO conditions, do not result in core uncovery in an SBO of 4-hours. Therefore, makeup systems in addition to those currently available under SBO conditions are not required to maintain core cooling under natural circulation.

The modifications and associated procedure changes identified in Parts A, B and C above will be completed within two years after the notification provided by the Director, Office of Nuclear Reactor Regulation, in accordance with 10 CFR 50.63(c)(3).

The details of the derivation of the above information are provided in Enclosure 2 to this letter.

AUG 31 1992

If there are any questions concerning this matter, please telephone John Vorees at (615) 365-8819.

Very truly yours,

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3.5.1 Number of EDGs Normally Available

WBN FSAR Section 8.1 identifies four EDGs for the two WBN units.The WBN draft proposed Technical Specifications require four EDGs to be available, to allow for single failure of one EDG.

3.5.2 Number of Necessary EDGs for SBO

The SBO event requires that the SBO unit and the NBO unit must achieve the SBO safe shutdown/hot standby functions described in Subsection 1.3. The WBN design of shared fluid systems is such that, with three EDGs available (for example 1A, 2A and 2B), shutdown of Unit 1 and/or Unit 2 would require the use of EDG 1A and 2A. Normal shutdown on Unit 1 or Unit 2 could not be obtained using EDG 1A alone, nor could it be obtained using EDGs 1A and 2B. The EDGs normally available are four EDGs. The number of necessary EDGs for SBO is three, since a random selection of any three EDGs ensures that at least the "A-A" or the "B-B" EDGs are in that random selection. A random selection of two EDGs would not ensure the specific EDGs required. Therefore, to obtain two specific EDGs, any three EDGs are necessary for SBO.

3.5.3 EAC Power Configuration Group

Because a unit needs the "1A-2A" or the "1B-2B" EDGs for shutdown and based on the discussion above, the WBN plant is conservatively a 3/4 shared arrangement.

Using NUMARC 87-00, Revision 1, Table 3-7 (or RG 1.155, Table 3), this 3 EDGs required out of 4 EDGs normally available places WBN into EAC Group D.

3.6 EMERGENCY DIESEL GENERATOR (EDG) RELIABILITY

The NUMARC guidance for determining the current EDG reliability is based on operating power plants. WBN is still under construction, and the NUMARC EDG reliability values are not applicable. Therefore, a "target" EDG reliability is established, that the plant must meet after receipt of the operating license.

The EDG reliability relevant to this evaluation is a "target" reliability value that is determined from the information derived previously, and relates that information to the coping duration. The NUMARC minimum target reliability for plants in EAC Group D is 0.975 per demand.

WBN will utilize this target reliability of 0.975 in the reliability program established to conform to RG 1.155 and NUMARC 87-00, Revision 1, Appendix D. WBN is following the resolution of GI B-56 and understands that the resolution could potentially impact the above guidance provided for the reliability program.

Based on the above, the WBN EDG target reliability per demand is 0.975.

3.7 WBN REQUIRED SBO COPING DURATION

Given the offsite power group (P Group) from Subsection 3.4, the EAC Group from Subsection 3.5, and the EDG target reliability from Subsection 3.6, the coping duration category is obtained from NUMARC 87-00, Revision 1, Table 3-8 (or RG 1.155, Table 2). For WBN, which has been shown to be P Group P1, EAC Group D, with target reliability 0.975, the proposed SBO coping duration is 4 hours.

Each of the evaluations discussed hereinafter is based on this 4-hour SBO duration category.

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

4.0 COPING WITH A 4-HOUR STATION BLACKOUT EVENT

Having determined the duration of the SBO event for WBN (i.e., 4 hours), the ac-independent approach evaluates the capability of a WBN SBO unit to cope with, and recover from, this event. The SBO unit relies on available process steam, dc-power, and compressed air supplies to operate equipment necessary to achieve and maintain a hot standby (Technical Specification MODE 3) SBO safe shutdown condition until emergency ac-power from the "A-A" or "B-B" EDGs, or offsite ac-power, is restored. During the SBO event, the equipment relied upon is electrically independent of the offsite or EDG ac-power sources. A single SBO safe shutdown (hot standby) path is used and is sufficient to stabilize the plant by achieving and maintaining hot standby.

4.1 COPING WITH A 4-HOUR SBO EVENT

The capacity and capability of various systems and components were examined to ensure that the functional requirements, of adequate core cooling and appropriate containment integrity, were met without reliance on ac-power. A summary of these evaluations is provided below. See the assumptions and description of the SBO scenario provided in Section 2.0.

4.1.1 Auxiliary Feedwater (AFW) System

The importance of the steam-supplied TDAFW System flowpath during the early stages of the SBO is recognized for ensuring decay heat removal. The TDAFW pump and the valves in its supply and discharge lines are required for successful accomplishment of AFW flow to at least one steam generator (SG), but for more effective heat removal, flow to two SGs is assumed in the evaluation. On the TDAFW pump supply side, one valve is always in the normally open position to supply steam from SG 1 to the TDAFW pump, and the flowpath from the TDAFW pump is then to SGs 1 and 4. Therefore these SGs were assumed available for heat removal. Any SG overpressure condition, should it occur, is relieved automatically by the MSSVs which operate automatically. The 125V vital battery system supplies power and control for the TDAFW pump and associated valves. The TDAFW pump uses water from the CST and discharges through the AFW line into SGs 1 and 4 through a series of normally open valves, except for the air-operated level control valves, which fail closed on a loss of air.

Successful operation of the AFW System thus depends further on the CST inventory, the flowpath from the CST to the TDAFW Pump, the 125V vital battery system, and on the auxiliary compressed air (ACA) system supply to open, keep open, and position as required, the level control valves. These interfaces are discussed below.

Based on the evaluation of the system and components, the AFW System is adequate to cope with a 4-hour SBO event at WBN.

4.1.2 Condensate Inventory for Decay Heat Removal

A normally open flowpath exists from the CST to the TDAFW Pump. The WBN draft proposed minimum Technical Specification inventory in the CST is on the order of 210,000 gallons. Using the methodology described in NUMARC 87-00, Revision 1, Section 7.2.1, where the WBN plant rating is 3411 MWt, and for a hot standby condition during the 4-hour SBO event with no cooldown required or desired, the calculated CST inventory required for decay heat removal is derived as equal to 75,451 gallons of water. This is much less than the minimum volume available, and therefore the CST inventory is more than adequate for the SBO event.

If the assumption is made that the reactor was at 102% power prior to the event, the CST inventory required would be 76,960 gallons of water, which is much less than the minimum available.

In the highly unlikely event that cooldown to cold shutdown conditions might be required (which need not be postulated since the RCS inventory is more than ample to keep the core covered during the SBO, as shown in Section 4.1.4 below), it is estimated that the additional amount of CST water required for the cooldown (i.e., in addition to the 4-hour hot standby amounts above) would be approximately 121,200 gallons of water. The minimum permissible WBN draft proposed Technical Specification inventory of approximately 210,000 gallons provides the total amount of water required during this hypothetical evolution.

Based on the above, there is sufficient condensate inventory to cope with an SBO at WBN.

4.1.3 ACA System

The TDAFW pump level control valves are the only air-operated devices that require an air supply from the ACA system. WBN will modify the design of the level control valves in the TDAFW lines to the SGs such that the required AFW flow is provided during a 4-hour SBO event.

Assuming implementation of the above commitment, the ACA system interface with the TDAFW pump discharge level control valves is deemed adequate for a 4-hour SBO event.

4.1.4 Reactor Coolant System (RCS) Inventory

Inventory losses from the RCS are assumed as 25 gpm per RCP seal, and 10 gpm of allowable identified RCS leakage (from the WBN draft proposed Technical Specifications). WBN understands that if the final resolution of Generic Issue (GI) 23 defines higher RCP leakage rates than assumed here, it could potentially impact these analyses and actions addressing conformance to the SBO Rule.

The inventory losses assumed here, a total of 110 gpm during the 4-hour SBO event, are conservative and are not expected to increase from the SBO event and resultant plant conditions.

The letdown line isolation valve closes when the air supply is loss subsequent to a loss of ac-power, thus there are no letdown losses.

The total volume of the WBN RCS is about 12,145 ft^3, and the reactor vessel water volume is about 4,945 ft^3. The RCS inventory losses described above total 26,400 gallons or about 3,530 ft^3. Thus the leakage losses from the RCS inventory during an SBO do not result in core uncovery.

If a highly unlikely event occurs during the SBO such that cooldown to cold shutdown conditions might be postulated, a shrinkage loss of about 3,653 ft^3 is estimated. This shrinkage loss, plus the leakage losses, still result in sufficient RCS inventory remaining to keep the core covered.

The natural circulation heat removal mode is dependent on the density difference between the coolant in the hot leg and the cold leg of an RCS loop. This density difference provides the driving force since cooling is available to the steam generator during an SBO. Adequate cooling is provided since the CST inventory is sufficient for the 4-hour duration. Thus, natural circulation is achievable for the SBO duration.

Based on the above, the RCS inventory is sufficient, without makeup, to keep the core covered and to maintain natural circulation cooling and reflux cooling during a 4-hour SBO event at WBN.

4.1.5 Class 1E Battery Capacity

The Class 1E 125V vital batteries have been analyzed and found adequate to provide dc-power during a 4-hour SBO event as long as the non-required loads are stripped from the batteries. The equipment required to be operable for coping with a 4-hour SBO event, to maintain a SBO safe shutdown/hot standby conditions, has been identified. A list of components and instrumentation required to maintain a SBO safe shutdown path utilizing the TDAFW pump has been developed, and these components and instruments remain powered by the 125V Class 1E batteries. No loads are shed that are necessary for the SBO safe shutdown path.

At least three separate circuits (equivalent to one train) of dc-powered emergency lighting is assured available in the control room. For other areas of the plant which do not require operator access, emergency lighting is assured through the presence and operability of the 8-hour Appendix R self-contained emergency lighting battery packs.

Load shedding of non-essential loads is assumed at 30 minutes into the SBO event. The loads identified as not required during the SBO, and therefore removed from the batteries, are provided in Appendix A, which also depicts the main control room emergency lighting loads remaining after the load stripping is accomplished. This Appendix also shows the resultant battery loads remaining after load stripping. Appendix B, Figure 1, indicates the 125V dc vital battery profile.

The procedures which are being reviewed and will be revised to cope with SBO are discussed in Section 6.0. At the present time, it is envisioned that Emergency Contingency Actions (ECA) 0 0 will either include the required load stripping activities, or other procedures will be modified or created to control these activities.

With load stripping, the average battery voltage at the end of the 4-hour SBO event is greater than 105.0 volts. This final voltage is above the minimum required for successful operation of equipment. The methodology of IEEE Standard 485 was used for determinations of battery sizing, load, load profile section size/time step size, and voltage profiles. The worse case minimum battery room temperature is 60°F. A temperature correction factor of 1.11 for 60°F electrolyte temperature, and an aging correction factor of 1.25 were utilized per the requirements of IEEE Standard 485.

Based on the above, the 125V vital batteries are adequate to meet the 4-hour SBO event requirements.

4.1.6 <u>Other Battery Systems</u>

In order to ensure the capability for restoration of ac-power from the EDGs, the 125V dc EDG battery system was reviewed. These batteries provide power to indicating lights and allow starting the EDGs. One EDG start will be attempted when the LOOP/SBO occurs and the affected EDG fails to start. Another start will be attempted when the first attempt fails, and then recognition of the SBO event will result. Thus attempts will be made to start an EDG only three times during an SBO, reserving a final start attempt for the end of the SBO event. The EDG batteries have been analyzed for these conditions, using the methodology of IEEE Standard 485 for determinations of battery sizing, load, load profile section size/time step size, and voltage profiles. The results demonstrate sufficient battery voltage remaining after the 4-hour SBO event to flash the generator field and provide a successful EDG start for restoration of ac- power. These SBO actions will be proceduralized during the review and revision of affected procedures. Appendix B, Figure 2 shows the 125V EDG battery load profiles.

Based on the above, the 125V dc EDG batteries are adequate for a 4-hour SBO event.

No credit is taken for the 250V non-Class 1E station batteries (e.g., for breaker closure or control in the switchyard) for restoration of ac-power from the offsite power sources at the end of the SBO event. Instead, the restoration of ac-power to equipment at the end of the SBO event is accomplished by using the EDGs. See also the discussions in Section 2.1.4.

4.1.7 Appropriate Containment Integrity

The WBN containment isolation valves fail in the safe position in accordance with the design basis of the plant.

The mechanical penetration/fluid system containment isolation valves were reviewed against the exclusion criteria provided in NUMARC 87-00, Revision 1, Section 7.2.5. No other exclusion criteria were used. Those valves which did not meet those exclusion criteria were analyzed further. These valves are associated with penetrations X-19A and B, X-44, and X-107. These valves are discussed below.

Penetrations X-19A & B: RHR Pump Suction from Containment Sump

These flow control valves 1-FCV -63-72, -72-44, -63-73, and -72-45 are ac-powered, normally closed inside containment valves, which fail in the closed position on loss of ac during a LOOP and/or SBO. Valve positions are indicated in the control room prior to the SBO, and would remain in their pre-existing condition during the SBO. The valve positions are specified by procedure and cannot be moved from their normally closed position during the SBO since ac-power is not available. Valve positions can be verified by the control room logs required to be kept for isolation valve status per plant procedures. If these valves were required to be opened following the SBO event, the valves would be operable remotely upon restoration of ac-power.

Penetration X-44: CC Return from RCP Seals

These flow control valves 1-FCV -62-61 and -62-63 are ac-powered, normally open valves in series (one valve inside containment, one valve in the pipe chase), in water-filled lines located in the pipe chase, have local position indication, and the valve in the pipe chase has manual operator capabilities which can be accessed if necessary by brief operator excursions into the area during the 4-hour SBO event. If these valves were required to be closed following the SBO event, the valves would be operable remotely upon restoration of ac-power.

Penetration X-107: RHR Supply to Pumps

These flow control valves 1-FCV -74-2 and -74-8 are ac-powered, normally closed inside containment valves, which fail in their closed position on loss of ac during a LOOP and/or SBO. Valve positions are indicated in the control room prior to the SBO, and would remain in their pre-existing condition during the SBO. The valve positions are specified by procedure and cannot be moved from their normally closed position during the SBO since ac-power is not available. Valve positions can be verified by the control room logs required to be kept for isolation valve status per plant procedures. If these valves were required to be opened following the SBO event, the valves would be operable remotely upon restoration of ac-power. Based on the above discussions, the maintenance of appropriate containment integrity is assured during a 4-hour SBO event at WBN.

4.1.8 Effects of Loss of Heating/Ventilation/Air Conditioning (HVAC)

During an SBO, the ac-powered HVAC is assumed to be inoperable. Depending on the pre-existing and remaining heat loads, areas of the plant are expected to heat up during the 4-hour SBO event and reach temperatures above the normal ventilated or cooled room temperatures. Plant areas were reviewed and analyzed for the resultant heatup effects based on continuous occupancy by the operators (i.e., the control room), or because they contained equipment identified as required to be operable during the SBO, and/or because they could require brief operator access for manual operations (e.g., possibly to read a valve position indicator, or to manually manipulate a valve). NUMARC 87-00 Revision 1, Section 7.2.4 methodology, using WBN plant-specific area geometries, heat generation rates, and wall temperatures, was used to calculate the steady-state room temperatures (except for the containment, discussed separately below).

The plant areas reviewed are:

- Main Control Room Complex (without HVAC)
- Turbine-Driven Auxiliary Feedwater Pump Room
- North Main Steam Valve Room
- South Main Steam Valve Room
- 125V Vital Battery Rooms
- 125V Vital Battery Board Rooms
- Cable Spreading Room

- Pipe Chase
- 480V Board Rooms
- 6.9kV and 480V Shutdown Board Room

Rooms are assumed to be at their normal maximum room temperature at the onset of the SBO. That is, before the SBO, temperatures (including boundary temperatures) are assumed at their normal maximum values on the applicable environmental data drawings. These temperatures are representative of the maximum normal operating conditions that would occur during the summer months.

If required for a more realistic analysis, the heat loads from ac-powered equipment, that is not operable during an SBO event in these rooms, are assumed to be negligible.

Class 1E equipment (such as instrumentation) inside containment which is needed for the SBO is pre-qualified to meet the large loss-of-coolant accident (LOCA) and the main steam line break (MSLB) temperature profiles. These temperatures are judged to be much more severe than an SBO event temperature profile, since the energy release during an SBO is considerably less than that released during a high-energy (LOCA or MSLB) line break. The SBO temperature rise is expected to be a gradual rise over the four hours versus the rapid and severe temperature rise from a LOCA or MSLB. Although the containment coolers are not available during the SBO, the ice in the ice condensers provides some containment cooling. Therefore, the instrumentation inside containment which is needed for an SBO is pre-qualified for a harsher environment which will not be exceeded during the SBO.

The resulting SBO temperatures calculated in degrees Fahrenheit are (rounded to the nearest degree):

- Main Control Room Complex (without HVAC)	104
- Turbine-Driven Auxiliary Feedwater Pump Room	122
- North Main Steam Valve Room	162
- South Main Steam Valve Room	177
- 125V Vital Battery Rooms	95
- 125V Vital Battery Board Rooms	103
- Cable Spreading Room	104
- Pipe Chase	122
- 480V Board Rooms	104
- 6.9kV and 480V Shutdown Board Room	103

There is no SBO equipment located in the North Main Steam Valve Room, thus the South Main Steam Valve Room, which contains the TDAFW Pump level control valves, is the only Dominant Area of Concern. Equipment operability is not a concern if the above temperatures are at or below the design temperature of 104°F. The operability of the TDAFW Pump is not a concern during the 4-hour SBO since that equipment is expected to withstand the bulk temperature, and there is a dc-powered fan in the room that is powered from the vital batteries. The pipe chase contains some containment isolation valves as discussed in Section 4.1.7, and operator access to these valves, which is felt to be an unlikely event, is possible if valve closure is required or local indication verification of valve position is required. Existing environmental qualification of equipment inside the South Main Steam Valve Room shows that a main feedwater line break temperature profile reaches a peak of above 300°F and decreases in four hours to 190°F. Therefore the operability of SBO required equipment in the South Main Steam Valve Room is assured by pre-qualification to a harsher environment.

Based on the above, the effects of loss of HVAC from a 4-hour SBO event at WBN are not adverse to any required equipment operability.

4.2 RECOVERY FROM A 4-HOUR SBO EVENT

As discussed in Section 4.1.6, the 125V EDG battery analyses ensure that field flashing of the generator is available for restoration of ac-power from the EDGs. Recovery procedures will be reviewed and revised as necessary as discussed in Section 6.0 below.

Based on the above, recovery from a 4-hour SBO event is achievable for the WBN plant.

4.3 CONCLUSIONS

The information provided in Sections 4.1 and 4.2 above, together with the items identified and discussed in Sections 5.0, 6.0, and 7.0 below, provide reasonable assurance that either WBN Unit 1 or WBN Unit 2 can withstand and cope with a 4-hour SBO event.

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

5.0 REQUIRED MODIFICATIONS TO EQUIPMENT

5.1 DISCUSSION

As indicated in Section 4.0 above, the minimum equipment to cope with and recover from a 4-hour SBO event has been evaluated. Part of the evaluation was to determine whether any modifications to the existing equipment were required in order to successfully accomplish the functional requirements of ensuring adequate core cooling and appropriate containment integrity.

The only necessary modification identified during the coping/recovery evaluations centers on the adequacy of the compressed air which provide pneumatic power for positioning the level control valves in the flowpath from the TDAFW pump to the SGs (SG 1 and SG 4). The compressed air supply is used to position the level control valves and thereby control AFW flow to the SGs, which are used for decay heat removal during the SBO. See the discussions in Section 4.0.

5.2 MODIFICATIONS TO EQUIPMENT

The proposed modifications are to provide nitrogen bottles which contain sufficient capacity for the duty cycle of the level control valves during a 4-hour SBO event.

WBN will modify the design of the level control valves in the TDAFW line to the SGs such that the required AFW flow is provided during a 4-hour SBO event.

5.3 PROPOSED SCHEDULE FOR IMPLEMENTATION OF EQUIPMENT MODIFICATIONS

The proposed schedule for the implementation of equipment-related modifications is two years following NRC issuance of a final Safety Evaluation for the WBN SBO evaluation.

Implementation of the equipment-related modifications includes engineering and design, modification and/or construction, startup testing, and turnover of the design option, including the affected procedures, to be used to ensure the required AFW flow is provided during a 4-hour SBO event.

This proposed schedule is consistent with the 10 CFR 50.63(c)(4) requirements.

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

6.0 PROCEDURES TO BE IMPLEMENTED

6.1 DISCUSSION

Many of the concerns related to SBO can be alleviated through industry initiatives to reduce overall SBO risk. Accordingly, on June 10, 1986, the NUMARC Board of Directors endorsed some industry initiatives to address the more important contributors to SBO risk. (See NUMARC 87-00, Revision 1, Section 1.2.) One of these initiatives (Initiative 2) involves site procedures.

In accordance with the NUMARC Initiative 2, WBN will implement site-specific procedures (which are still under development at this stage of the WBN construction completion) for:

a) coping with a 4-hour SBO event;
b) restoration of ac-power following a 4-hour SBO event; and
c) preparing the WBN plant for severe weather conditions to reduce the likelihood and consequences of LOOP and to reduce the overall risk of an SBO event.

6.2 PROCEDURES TO BE IMPLEMENTED FOR A 4-HOUR SBO

Pursuant to 10 CFR 50.63(c)(ii), this section provides a description of the procedures that will be reviewed, revised as necessary, and implemented for a 4-hour SBO event.

Note that, as indicated above, these procedures are still under development; additional procedures may be identified for revision, or new procedures may be developed, in order to cope with the 4-hour SBO event. For example, the operator actions to strip specific loads from the 125V vital batteries may require either revisions to existing procedures or creation of an SBO-specific procedure; likewise, modifications planned to the AFW level control valves/accumulators will require a revised or new procedure.

6.2.1 Station Blackout Response

Procedures identified herein, and others as necessary, will be reviewed against the guidelines provided in NUMARC 87-00, Revision 1, Section 4.2.1, in conformance with NUMARC Initiative 2a.

Since the SBO event is initiated by a LOOP, and then followed by failure of three EDGs, the following are identified as requiring review and revision as necessary to cope with a 4-hour SBO:

ECA-0.0 Emergency Contingency Actions/Instructions for Loss of Shutdown Power

Upon a LOOP, this procedure verifies isolation of RCP seal cooling, and attempts to start an EDG if it fails.

ECA-0.1 Emergency Contingency Actions/Instructions for Recovery From Loss of Shutdown Power (Without SI Required)

This procedure is used, for recovery from a LOOP, to reconnect the loads to the shutdown busses (from the EDGs to the offsite power source).

AOI-35 Abnormal Operating Instruction for Loss of Offsite Power

Upon a LOOP, these instructions direct the actions required, with the EDGs providing emergency ac-power to the safety busses.

6.2.2 AC Power Restoration

Procedures identified herein, and others as necessary, will be reviewed against the guidelines provided in NUMARC 87-00, Revision 1, Section 4.2.2, in conformance with NUMARC Initiative 2b.

Pursuant to 10 CFR 50.63(c)(ii), the following Procedure, as a minimum, will be reviewed and revised as appropriate for recovery from a 4-hour SBO event:

ECA-0.1 Emergency Contingency Actions/Instructions for Recovery From Loss of Shutdown Power (Without SI Required)

This procedure is used, for recovery from a LOOP, to reconnect the loads to the shutdown busses (from the EDGs to the offsite power source).

6.2.3 Response to Severe Weather

Procedures identified herein, and others as necessary, will be reviewed against the guidelines (as appropriate) provided in NUMARC 87-00, Revision 1, Section 4.2.3, in conformance with NUMARC Initiative 2c.

Although the NUMARC (and NRC) guidance documents are more concerned with those sites susceptible to hurricane effects (and the WBN site is not associated with hurricane effects), the following instruction, as a minimum will be reviewed and revised as appropriate to minimize the effects of a hypothetical tornado-induced LOOP/SBO:

AOI-08 Abnormal Operating Instruction for Tornado Watch or Warning

This instruction is intended to minimize the consequences of a tornado striking the WBN plant. Actions included are restraining loose items in the plant yard that could become tornado missiles, suspending activities such as fuel handling, and securing fire doors.

6.3 PROPOSED SCHEDULE FOR IMPLEMENTATION OF PROCEDURE MODIFICATIONS

The proposed schedule for the implementation of procedure-related actions is two years following NRC issuance of a final Safety Evaluation for the WBN SBO evaluation.

Procedure-related actions include reviewing, revising, and implementing the procedures to be used to cope with and recover from a 4-hour SBO event, including verification of adequate staffing, and training in the affected procedures.

This proposed schedule is consistent with the 10 CFR 50.63(c)(4) requirements.

7.0 QA PROGRAM FOR SBO EQUIPMENT

RG 1.155, "Station Blackout" (Reference 3), describes a method acceptable to the NRC for complying with 10 CFR 50.63. RG 1.155 contains Appendices A and B which provide guidance on Quality Assurance (QA) activities and specifications respectively, for non-safety-related equipment used to meet the requirements of 10 CFR 50.63 that is not already covered by QA requirements in 10 CFR 50 Appendix B or in 10 CFR 50 Appendix R.

For any non-safety-related equipment used to meet the requirements of 10 CFR 50.63 that is not already covered by QA requirements in 10 CFR 50 Appendix B or in 10 CFR 50 Appendix R, WBN will apply the guidance and specifications of RG 1.155 Appendices A and B, respectively.

8.0 TECHNICAL SPECIFICATIONS CONSIDERATIONS

The Technical Specifications for the SBO equipment are currently being considered generically by the NRC in the context of the Technical Specification Improvement Program.

At the present time, there are no Technical Specifications for SBO equipment identified by WBN as required to ensure the availability or operability of the equipment used to mitigate an SBO event, since the equipment used is already a part of the WBN draft proposed Technical Specifications, or since the equipment (e.g., the Condensate components) are in continuous use during normal plant operation.

Plant procedures, which are still under development, will be revised as necessary to reflect the appropriate testing and surveillance requirements needed to ensure the operability of the necessary SBO equipment. Refer to Section 6 0.

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

9.0 REFERENCES

1. TVA Letter dated April 22, 1992, "Watts Bar Nuclear Plant Units 1 and 2 - Station Blackout Evaluation Pursuant to 10 CFR 50.63 (TAC No. M68624)."

2. Nuclear Management and Resources Council document: NUMARC 87-00, Revision 1, "Guidelines and Technical Bases for NUMARC Initiative Addressing Station Blackout at Light Water Reactors," dated August 1991.

3. US NRC Regulatory Guide 1.155, "Station Blackout," Revision 0 dated August 1988 (reissued to correct Tables 1, 5, and 6).

4. WBN Final Safety Analysis Report (FSAR), various sections as applicable, through Amendment 70.

5. NRC Letter dated May 4, 1992, "Proposed Approach to Comply with 10 CFR 50.63, Station Blackout (TAC M68624 and M68625)"

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

LOADS SHED FROM THE 125V VITAL BATTERIES DURING SBO

The following pages are excerpts from WBN-00-D052 Appendix A

Tables 1 - 8 are the inverter loads removed

Tables 9 - 12 are the battery loads removed

Tables 13 - 16 are the MCR lighting loads remaining

Tables 17 - 20 are the resultant 125V dc Class 1E battery loads

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 1

Inverter Board 1-I
Loads Removed

DESCRIPTION	BREAKER	VA
VENTILATION SYS A BUS	6	90
SYS 31 TR A FLOW SW	7	24
BORIC ACID TANKS HTR A-A	14	60
TOILET & LOCKER RM, SPREAD RM ISOL DAMPERS	15	664
CNTMT PURGE ISOL DAMPER SOL	16	23
POST ACCIDENT SAMPLING SOLENOIDS	17	1119
AUX BLDG STEAM ISOL VLV	18	54
AUX BLDG GAS TREATMENT FAN A-A PRESS CONT	19	109
SYS 31 TR A FLOW SWITCHES	20	111
RAD MON MCR INTAKE	21	360
RAD MON MCR EMER INTAKE	22	360
RAD MON CNTMT PURGE AIR EXHAUST	24	360
RAD MON CNTMT LOWER COMPT/ERCW	30	1452
RB U1 TR A/NONESSENTIAL CONTR AIR ISOL VLVS	33	143
AUX COMPRESSOR A TR A AUX BLDG ISOL VLV	34	48
RAD RATE METERS	35	1520
LETDOWN FLOW TEMP DIVERS CONTR TR. A	37	25
SHLD BLDG VENT/CNTMT ANN ISOL AUX RELAYS	38	138
RCP 1 UV AND UF RELAYS	39	69
AUX CONTR AIR DRYER TR A	41	785

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 2

Inverter Board 2-I
Loads Removed

DESCRIPTION	BREAKER	VA
SYS 31 TR A FLOW SWITCHES	19	6
INITIATE FAST VALVING	21	364
LOCA H2 CNTMT FLOW	25	6
SYS 31 TR A FLOW SWITCHES	41	30
RCP 1 UV & UF RELAYS	42	69

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 3

Inverter Board 1-II
Loads Removed

DESCRIPTION	BREAKER	VA
VENTILATION SYSTEM B BUS	6	90
LOOSE PARTS MONITOR EQUIP PANEL	7	420
SYS 31 TRAIN B ASSOC FLOW SWITCHES	12	18
BORIC ACID TANK C HTR B-B CONT	13	30
BORIC ACID TANK B HTR B-B CONT	14	30
TOILET & LOCKER RM, SPREADING RM ISOL DAMPERS/CONTROL BLDG PRESSURE LOOP	15	664
CNTMT PURGE ISOL DAMPER SOL	16	23
POST ACCIDENT SAMPLING SOL VLVS	17	1047
AUX BLDG STEAM ISOL VLV	18	55
AUX BLDG GAS TREATMENT FAN B-B CONT	19	109
SYS 31 TR B FLOW SWITCHES	20	117
RADIATION MONITOR MCR INTAKE	21	360
RADIATION MONITOR MCR EMER INTAKE	22	360
RADIATION MONITOR CNTMT PURGE AIR EXHAUST	24	360
RAD MON CNTMT LWR COMPT ERCW	30	1452
REACTOR BLDG U1 TR B ISOL VLV	33	77
AUX COMPRESSOR B TR B AUX BLDG ISOL VLV	34	48
RAD MON INSTM	35	1446
RCP 2 SENSOR PNL 1	37	69
SHIELD BLDG VENT & CONTMT ANNULUS VLV	38	138
AUX CONT AIR DRYER TR B	42	785

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 4

Inverter Board 2-II
Loads Removed

DESCRIPTION	BREAKER	VA
SYS 31 TR B FLOW SWITCHES	14	6
LOCA H2 CNTMT FLOW MON	25	6
SYS 31 TRAIN B FLOW SWITCHES	41	36
RCP 2 UV & UF RELAYS	42	69

TABLE 5

Inverter Board 1-III
Loads Removed

DESCRIPTION	BREAKER	VA
CO_2 FIRE PROTECTION	13	
CO_2 FIRE PROTECTION	14	
CO_2 FIRE PROTECTION ISOLATION TRANSFORMER	15	1500
CONTROL RM DOORS SECURITY LOCK	17	50
CONT AIR HTR A MOISTURE ALARM	19	30
LOCA H2 CNTMT FLOW MON	25	6
FLUID DYNAMIC FLOW SENSORS	36	120
RCP 3 SENSOR PNL, UV & UF RELAYS	42	69

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 6

Inverter Board 2-III
Loads Removed

DESCRIPTION	BREAKER	VA
SHUTDOWN BD TM A/C SUPPLY CONT VLV	13	319
POST ACCIDENT SAMPLING SOLENOIDS	17	891
BORIC ACID TANK B CONT	21	30
CNTMT PURGE AIR EXH RAD MON	25	360
AFW PUMP A PRESS CONT	28	44
RCP 3 UV & UF RELAYS	33	69
CNTMT ANNULUS DP CONTROL	39	31
RB ISOL VLV UNIT 2, TRAIN A	41	79
ERCW & CNTMT RAD MON	42	552
CNTMT PURGE ISOL DAMPER SOL	43	42
RAD RATE METERS	45	1262
LETDOWN FLOW TEMP	47	25

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 7

Inverter Board 1-IV
Loads Removed

DESCRIPTION	BREAKER	VA
CO_2 FIRE PROTECTION	13	
CO_2 FIRE PROTECTION	14	
CO_2 FIRE PROTECTION ISOL XFMER	15	1500
CONTROL AIR HDR B MOISTURE ALARM	19	30
LOCA H_2 CNTMT FLOW	25	6
FLUID DYNAMIC FLOW SENSORS	36	160
RCP 4 SENSOR PANEL 1, UV & UF RELAYS	42	69

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 8

Inverter Board 2-IV
Loads Removed

DESCRIPTION	BREAKER	VA
SHUTDOWN BD RM A/C SUPPLY CONT VLV	13	319
POST ACCIDENT SAMPLING SOLENOIDS	17	819
BORIC ACID TANK B HTR B-B CONT	22	30
CNTMT PURGE AIR EXH RAD MON	25	360
RCP 4 UV & UF RELAYS	32	69
CNTMT BLDG UPPER COMPT RAD MON	33	552
CNTMT ANNULUS DP	34	31
RB UNIT 2 TR B ISOL VLV	36	143
SHIELD BLDG VENT & CNTMT ANNULUS ISOL VLV AUX RELAYS TR B	38	100
RAD RATE METERS	47	1262
CNTMT PURGE ISOL DAMPER SOL	48	42

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 9

Battery I
Loads Removed

DESCRIPTION	BREAKER	AMPS
6.9KV S/D BOARD 2A-A (BBNF)	301	3.21
480V S/D BOARD 2A1-A (BBNF)	305	0.63
480V S/D BOARD 2A2-A (BBNF)	306	1.30
480V AUX. BLDG. COM. BD (NORMAL FEEDER)	213	2.64
GAS ANALYZER 0-L-206	214	0.80
GAS WASTE DISPOSAL PNL 0-L-2C	216	6.10
COMMON STATION SWGR C (NORMAL FEEDER)	223	0.22
AUX. BORIC ACID EVAP. PKG. 0-L-1A	222	1.60
1L1 AUX. PANEL ANN. 1-L-39	221	3.40
LIGHING CABINET LD-1	325	83.20*

* See Table 13 for Lighting Loads

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 10

Battery II
Loads Removed

DESCRIPTION	BREAKER	AMPS
6.9KV S/D BOARD BA-B (BBNF)	301	2.88
480V S/D BOARD 2B1-B (BBNF)	305	0.63
480V S/D BOARD 2B2-B (BBNF)	306	1.06
U2 AFPT - ALTERNATE FEEDER	321	6.56
GAS WASTE DISPOSAL - PNL 0-L-2B	214	2.84
U1 GLAND STEAM SPILLOVER TO COND.	219	0.12
COMMON CONT. & SERVICE AIR COMP (NF)	221	4.00
COMMON STATION SWGR D NORMAL FEEDER	223	0.19
LIGHING CABINET LD-2	325	71.20*

* See Table 14 for Lighting Loads

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 11

Battery III
Loads Removed

DESCRIPTION	BREAKER	AMPS
6.9KV S/D BOARD 1A-A (BBNF)	201	4.08
480V S/D BOARD 1A1-A (BBNF)	205	0.63
480V S/D BOARD 1A2-A (BBNF)	206	1.67
WASTE DISPOSAL PNL 0-L-2A	214	4.26
U2 GEN AUX PNL ANN 2-L-39	221	3.40
LIGHING CABINET LD-3	325	43.1*

* See Table 15 for Lighting Loads

TABLE 12

Battery IV
Loads Removed

DESCRIPTION	BREAKER	AMPS
6.9KV S/D BOARD 1B-B (BBNF)	201	2.88
480V S/D BOARD 1B1-B (BBNF)	205	0.63
480V S/D BOARD 1B2-B (BBNF)	206	1.67
DRUMMING ROOM PANEL 0-L-151	214	0.21
U2 GLAND STM SPILLOVER TO COND	219	0.12
BORIC ACID EVAP. PKG. 0-L-1B	222	1.60
UNIT 1 AFPT - ALTERNATE FEEDER	321	6.56
LIGHING CABINET LD-4	325	41.20*

* See Table 16 for Lighting Loads

APPENDIX A

TABLE 13

Lighting Cabinet LD-1
Loading - All Other Loads Removed

DESCRIPTION	CIRCUIT	WATTS	AMPS
LTG - MAIN CONTROL RM	1	1800	14.4

TABLE 14

Lighting Cabinet LD-2
Loading - All Other Loads Removed (Ref. 3.1)

DESCRIPTION	CIRCUIT	WATTS	AMPS
LTG - MAIN CONTROL RM	2	1800	14.4
LTG - MAIN CONTROL RM	3	1800	12.0

TABLE 15

Lighting Cabinet LD-3
Loading - All Other Loads Removed (Ref. 3.1)

DESCRIPTION	CIRCUIT	WATTS	AMPS
LTG - MAIN CONTROL RM	9	1500	12.0
LTG - MAIN CONTROL RM	10	1500	12.0

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 16

Lighting Cabinet LD-4
Loading - All Other Loads Removed (Ref. 3.1)

DESCRIPTION	CIRCUIT	WATTS	AMPS
LTG - MAIN CONTROL RM	9	1500	12.0
LTG - MAIN CONTROL RM	10	1500	12.0

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 17

Battery I Loading

DESCRIPTION	BREAKER	AMPS
480V S/D BOARD 1A1-A (NBNF)	202	2.35
480V S/D BOARD 1A2-A (NBNF)	203	2.51
6.9KV S/D BOARD 1A-A (NBNF)	204	3.62
BATTERY BOARD I BUS FILTER	210	0.02
UNIT 1 FUSE ASSEMBLY COLUMN A	310	7.83
UNIT 1 FUSE ASSEMBLY COLUMN B	311	2.06
UNIT 1 FUSE ASSEMBLY COLUMN C	312	15.60
UNIT 1 FUSE ASSEMBLY COLUMN D	217	3.44
UNIT 1 FUSE ASSEMBLY COLUMN E	218	2.25
RX TRIP SWGR TRN A (1-L-116)	319	0.05
UNIT 1 ROD DRIVE PX SWGR 1A	215	0.05
INVERTER 1-I	326	126.56
INVERTER 2-I	327	125.01
LIGHTING CABINET LD-1	325	14.40*
U2 AFPT NORMAL FEEDER	321	6.56
DG 1A-A REMOTE CTL CKT	320	0.31
TOTAL		312.62

* See Table 13 For Loads.

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 18

Battery II Loading

DESCRIPTION	BREAKER	AMPS
480V S/D BOARD 1B1-B (NBNF)	202	2.35
480V S/D BOARD 1B2-B (NBNF)	203	2.51
6.9KV S/D BOARD 1B-B (NBNF)	204	3.62
BATTERY BOARD I BUS FILTER	210	0.02
UNIT 1 FUSE ASSEMBLY COLUMN A	310	7.83
UNIT 1 FUSE ASSEMBLY COLUMN B	311	2.00
UNIT 1 FUSE ASSEMBLY COLUMN C	312	15.60
UNIT 1 FUSE ASSEMBLY COLUMN D	217	2.04
UNIT 1 FUSE ASSEMBLY COLUMN E	218	2.25
UNIT 1 RX TRIP SWGR TRN B	319	0.05
UNIT 1 ROD DRIVE PX SWGR 1B	215	0.05
INVERTER 1-II	326	128.80
INVERTER 2-II	327	114.60
LIGHTING CABINET LD-2	325	26.40*
DG 1B-B REMOTE CTL CKT	320	0.31
TOTAL		308.43

* See Table 14 For Loads.

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 19

Battery III Loading

DESCRIPTION	BREAKER	AMPS
BATTERY BOARD III BUS FILTER	210	0.02
UNIT 2 FUSE ASSEMBLY COLUMN A	310	7.83
UNIT 2 FUSE ASSEMBLY COLUMN B	311	2.06
UNIT 2 FUSE ASSEMBLY COLUMN C	312	15.58
UNIT 2 FUSE ASSEMBLY COLUMN D	217	2.04
UNIT 2 FUSE ASSEMBLY COLUMN E	218	2.25
480V S/D BOARD 2A1-A (NBNF)	302	1.97
480V S/D BOARD 2A2-A (NBNF)	303	3.08
6.9KV S/D BOARD 2A-A (NBNF)	304	3.80
RX TRIP TRN A 2-L-116A	319	0.05
UNIT 2 ROD DRIVE PX SWGR 2A	215	0.05
INVERTER 1-III	326	124.96
INVERTER 2-III	327	70.56
LIGHTING CABINET LD-3	325	24.00*
UNIT I AFPT - NORMAL FEEDER	321	6.56
UNIT 1 ANNUNCIATOR	208	56.00
DG 2A-A REMOTE CTL CKT	320	0.31
TOTAL		321.21

* See Table 15 For Loads.

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX A

TABLE 20

Battery IV Loading

DESCRIPTION	BREAKER	AMPS
BATTERY BOARD IV BUS FILTER	210	0.02
UNIT 2 FUSE ASSEMBLY COLUMN A	310	7.83
UNIT 2 FUSE ASSEMBLY COLUMN B	311	2.06
UNIT 2 FUSE ASSEMBLY COLUMN C	312	15.57
UNIT 2 FUSE ASSEMBLY COLUMN D	217	2.13
UNIT 2 FUSE ASSEMBLY COLUMN E	218	2.25
480V S/D BOARD 2B1-A (NBNF)	302	1.87
480V S/D BOARD 2B2-A (NBNF)	303	2.79
6.9KV S/D BOARD 2B-A (NBNF)	304	3.53
UNIT 2 RX TRIP SWGR TRN B	319	0.05
UNIT 2 ROD DRIVE PX SWGR 2B	215	0.05
INVERTER 1-IV	326	123.57
INVERTER 2-IV	327	81.23
LIGHTING CABINET LD-4	325	24.00*
UNIT 2 ANNUNCIATOR	208	35.70
DG 2B-B REMOTE CTL CKT	320	0.31
TOTAL		302.96

* See Table 16 For Loads.

ENCLOSURE 2

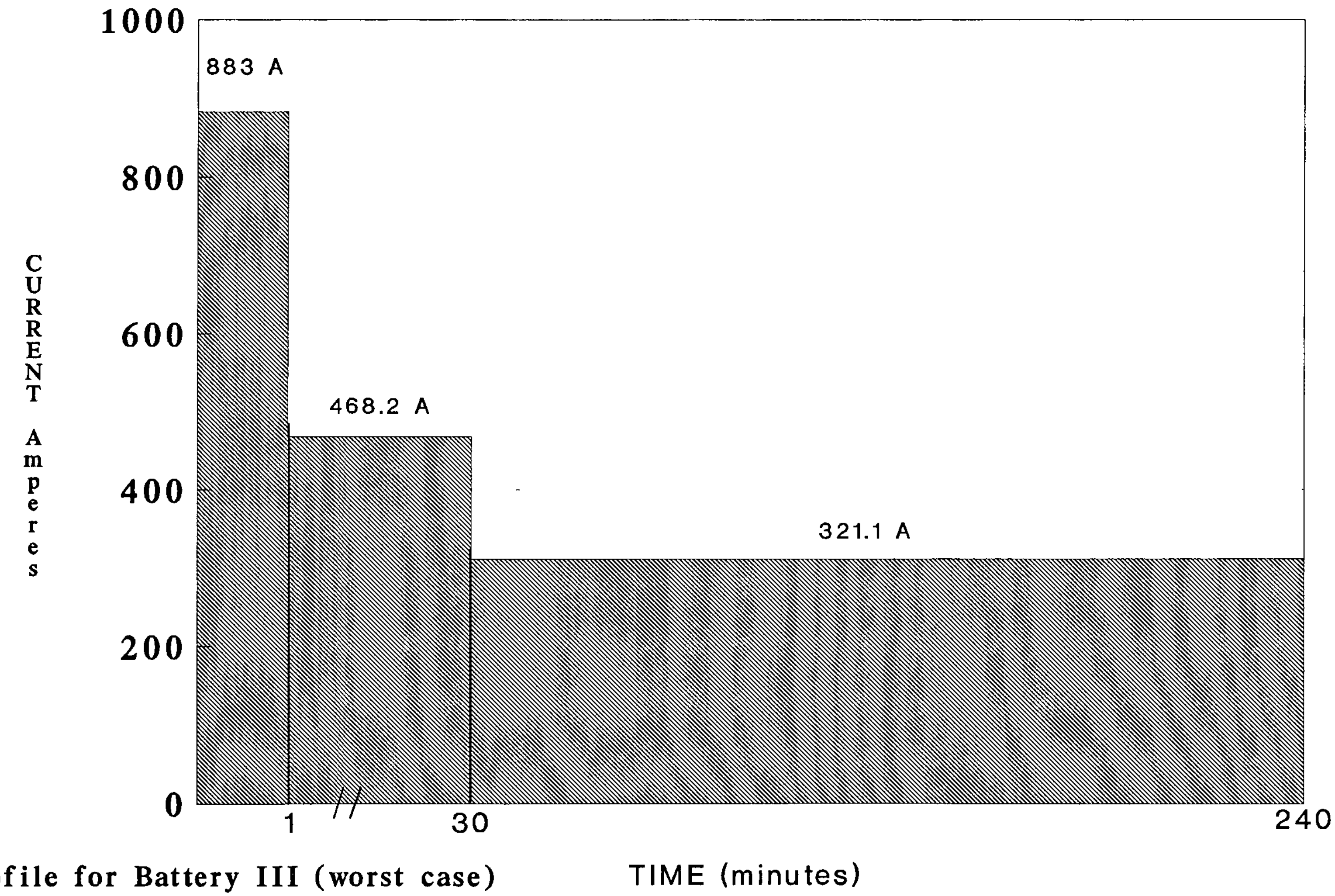
WATTS BAR NUCLEAR PLANT (WBN)
STATION BLACKOUT (SBO) EVALUATION

APPENDIX B

APPENDIX B

BATTERY LOAD PROFILES

125 VDC VITAL BATTERY LOAD PROFILE
FIGURE 1



Profile for Battery III (worst case)

125 VDC EDG BATTERY LOAD PROFILE

FIGURE 2