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IPN-89-025

U. S. Nuclear Regulatory Commission
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Washington, D.C. 20555

Subject: Indian Point 3 Nuclear Power Plant
Docket No. 50-286
Response to 10 CFR Part 50.63
"Loss of All Alternating Current Power" - Station Blackout

References:

1. U. S. Nuclear Regulatory Commission, Regulatory Guide 1.155, "Station Blackout", August 1988.

2. Nuclear Management and Resources Council Report No. 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors."

Dear Sir:

On July 21, 1988, the Nuclear Regulatory Commission (NRC) amended its regulations in 10 CFR Part 50 to include a new section, 10 CFR 50.63 "Loss of All Alternating Current Power." 10 CFR 50.63 requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout (SBO) of a specified duration. Regulatory Guide (RG) 1.155 (Reference 1) provides guidance acceptable to the NRC Staff for satisfying the requirements of 10 CFR 50.63. RG 1.155 states that the NRC staff has determined that NUMARC 87-00 (Reference 2) is also acceptable to the NRC staff for meeting these requirements.

The Authority has evaluated the Indian Point 3 Nuclear Power Plant against the requirements of the SBO rule using the guidance from NUMARC 87-00. Detailed results of this evaluation are in the Attachment to this letter. As a result of this evaluation, Indian Point 3 has a SBO coping duration category of four hours. No modifications are required to attain a four hour coping duration.

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A schedule for implementing the modifications and associated procedure changes described in the Attachment will be submitted within 30 days after notification is received from the Director, Office of Nuclear Reactor Regulation, in accordance with the requirements of 10 CFR 50.63 (c) (3).

Should you or your staff have any questions regarding this matter, please contact Mr. P. Kokolakis of my staff.

Very truly yours,

John C. Brons
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Enclosure

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ATTACHMENT TO IPN-89-025

RESPONSE TO 10 CFR 50.63
"LOSS OF ALL ALTERNATING CURRENT POWER"
STATION BLACKOUT

INTRODUCTION

On July 21, 1988, the Nuclear Regulatory Commission (NRC) amended its regulations in 10 CFR Part 50. A new section, 10 CFR 50.63 "Loss of All Alternating Current Power", was added which requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout (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 station blackout duration. §50.63 requires that, for the duration of the station blackout, the plant be capable of maintaining core cooling and containment integrity. Furthermore, this section requires that each licensee submit the following information:

1. A station blackout duration including a justification for the selection based on the redundancy and reliability of the onsite emergency alternating current (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 station blackout events for the time duration as determined in 1 above and for recovery from SBO; and

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

The NRC has issued Regulatory Guide 1.155 which describes a means acceptable to the NRC Staff for meeting the requirements of 10 CFR 50.63. Regulatory Guide (RG) 1.155 states that the NRC Staff has determined that NUMARC 87-00 (Reference 2) provides guidance that is in large part identical to the RG 1.155 guidance and is, therefore, also 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.

The Authority has evaluated the Indian Point 3 Nuclear Power Plant against the requirements of the SBO rule using the guidance from NUMARC 87-00 except where RG 1.155 takes precedence. The results of this evaluation follows.

A. **PROPOSED STATION BLACKOUT (SBO) DURATION**

The five step procedure outlined in NUMARC 87-00, Section 3 was used to determine the Indian Point 3 SBO duration category of four hours. No modifications were required to attain a four hour coping duration category.

The following plant factors were used to determine the proposed station blackout duration:

1. Alternating current Power Design Characteristic Group is "P3". P3 is defined as:

> *Sites whose off-site power sources are* (1) least redundant or independent combined with moderate severe weather potential, (2) most susceptible to extended off-site power losses due to weather-initiated or grid-related events, or (3) susceptible to grid-related events.

This Group for Indian Point 3 is based on:

a. Expected frequency of grid-related loss of off-site power (LOOPs) events exceeds once per 20 years.

Grid-related loss of off-site power events are defined as LOOPs that are strictly associated with the loss of the transmission and distribution system due to insufficient generating capacity, excessive loads, or dynamic instability. Although grid failure may also be caused by other factors, such as severe weather conditions or brush fires, these events are not considered grid-related since they were caused by external events.

The industry average frequency of grid-related events is approximately 0.020 per site-year, with most events isolated to a few systems. According to NUREG-1032, the average occurrence for the majority of systems is about once per 100 site-years. 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.

b. Estimated frequency of LOOP events due to extremely severe weather (ESW), places the plant in ESW Group 4.

The estimated frequency of loss of off-site power due to extremely severe weather is determined by the annual expectation of storms at the site with wind velocities greater than or equal to 125 m.p.h. These events are normally associated with the occurrence of great hurricanes where windspeeds may cause widespread transmission system unavailability for extended periods. Since electrical distribution systems are not designed for these conditions, it is assumed that the occurrence of such windspeeds will directly result in the loss of off-site power.

A loss of off-site power frequency estimate for ESW for Indian Point 3 is based on data provided by the NRC (which is obtained from the National Oceanic and Atmospheric Administration). The data indicates that Indian Point 3 is in Group 4 with an annual windspeed expectation of $e < 1 \times 10^{-2}$.

c. Estimated frequency of LOOP events due to severe weather (SW), places the plant in SW Group 2.

Four factors were used to calculate the estimated frequency of loss of off-site power due to severe weather. These factors were combined in the relationship outlined in NUMARC 87-00 §3.2.1 to yield:

$$f = 5.75 \times 10^{-5}$$

Based on NUMARC 87-00, Table 3-4 "Severe Weather Groups", Indian Point 3 is in severe weather Group "2".

d. The independence of offsite power system places Indian Point 3 in the I1/2 Group.

The I1/2 group is characterized by features associated with greater independence and redundancy of off-site power sources, and a more desirable transfer scheme.

All off-site power sources are connected to the plant through one switchyard. After loss of the normal AC source, there is an automatic transfer of all safe-shutdown buses to a separate preferred alternate power source.

e. Determination of loss off-site AC power characteristic group (P Group) is separated into three basic groups: 1) independence of off-site power; 2) severe weather potential; and 3) extremely severe weather potential.

Plant-specific, pre-hurricane shutdown requirements and procedures which meet the guidelines of §4.2.3 of NUMARC 87-00 are not required for Indian Point 3 nor are such procedures credited in the determination of the AC Power Design Characteristic Group. Therefore, using the previous parts of this calculation, NUMARC 87-00 Table 3-5a "Off-site Power Design Characteristic Group Matrix" was used in determining the "P3" category.

2. After the likelihood of losing off-site power, the redundancy of the emergency AC power system is the next most important contributor to station blackout risk. With greater Emergency AC Power system redundancy, the potential for station blackout diminishes, as does the likelihood of core damage.

The Emergency AC Power Configuration Group for Indian Point 3 is "A". Group A is characterized by:

highly redundant and independent EAC sources to safe shutdown equipment.

This Group is based on:

a. Three emergency AC power supplies not taken credit for as alternate AC power sources. The three Emergency Diesel Generators (EDG) are each considered to be a standby power supply.

b. One emergency AC power supply is sufficient to operate safe shutdown equipment following a LOOP event. Each of the Indian Point 3 EDGs is rated at 1750KW which exceeds the shutdown load requirement.

3. The Emergency Diesel Generator (EDG) target reliability for Indian Point 3 is 0.975. This target reliability was determined for a four-hour coping duration using the evaluation criteria in NUMARC 87-00, §3.2.4; which is based on having a nuclear unit average EDG reliability for the last 100 demands greater than 0.95.

To determine the Indian Point 3 required station blackout coping duration category requirement, Table 3-8 of NUMARC 87-00 was used along with three factors:

- EDG reliability (0.975)
- Off-site power design characteristic (P3)
- EAC configuration (Group A)

From Table 3-8, the required coping duration category for Indian Point 3 is four hours.

4. An alternate AC (AAC) power source will be utilized at Indian Point 3 which will meet the criteria specified in Appendix B to NUMARC 87-00.

The AAC power source will be available within one hour of the onset of the station blackout event and has sufficient capacity and capability to operate systems necessary for coping with a station blackout for the required SBO duration (four hours) to bring and maintain the plant in safe shutdown. An AC independent coping analysis was performed for the one hour required to bring the AAC power source on line.

Figure 1 presents the interrelationships between the buses and power source associated with the Indian Point 3 Nuclear Power Plant AAC.

The installed Appendix R Diesel Generator unit will serve as the AAC power source for Indian Point 3. The Appendix R diesel is an Alco Model 251F Diesel Generator rated at 2500KW at 900 RPM installed in its own building north of the Auxiliary Boiler Feed Pump Building. An underground fuel oil storage tank with a 4000 gallon capacity is located south of the diesel. This will provide between 16 and 24 hours of operation at full load. The diesel generator was sized to provide sufficient capacity to power all of the loads requiring emergency backup power during an Appendix R scenario. The diesel generator installation is a self contained package which is designed to operate upon a complete loss of power, AC and/or DC. The package contains a starting air compressor, batteries, a

battery charger, alarm panel annunciators, jacket water heater, lube oil heater, fuel oil and lube oil pumps and necessary filters and strainers.

The 6.9KV tie-in from the Appendix R Diesel Generator is to the Gas Turbine Substation which is located north of the Turbine Building. Distribution from the AAC is via the 6.9KV buses to the 480V safeguards buses. A single train will be designated as the AAC. Any one of three potential trains consisting of specific combinations of 6.9KV and 480V buses and associated DC power/control and instrumentation buses are capable of distributing power from the Appendix R diesel to the minimum required shutdown loads. As a practical matter and to permit flexibility, procedures will not restrict the distribution of AAC power during an SBO to any one power train but rather will permit energizing combinations of buses associated with the three trains. The loads placed on the energized buses will be limited to the capacity of the AAC source.

B. PROCEDURE DESCRIPTION

Plant procedures have been reviewed and modified, as necessary, to meet the guidelines in NUMARC 87-00, Section 4 in the following areas:

1. Station Blackout response procedures (ECA-0.0, "Loss of All AC Power," ECA-0.1, "Loss of All AC Power Recovery Without SI Required," and ECA-0.2, "Loss of All AC Power Recovery With SI Required") conform to NUMARC 87-00 §4.2.1.

2. Priority actions for the restoration of AC power to Indian Point 3 consistent with NUMARC 87-00, §4.2.2 (1), (2), and (3) are the same actions specified by Consolidated Edison Company of New York for Indian Point Unit No. 2 (Docket No. 50-247). The Authority has reviewed Consolidated Edison's planned course of action for restoring AC power to the nuclear units and concludes those actions are sufficient to conform to the NUMARC positions.

   AC power restoration procedures (SOP-EL-14, "Energization of 480V Buses from the Appendix R Diesel Generator") specify the sequence of circuit breaker operations required to restore AC power to shutdown equipment once preferred and/or standby EDG power become available in conformance with NUMARC 87-00, §4.2.2(5).

3. Severe weather procedures (OD-8, "Guidelines For Severe Weather") conform to NUMARC 87-00, §4.2.3.

C. COPING ASSESSMENT SUMMARY

The ability of the Indian Point 3 plant to cope with a four hour station blackout event utilizing the AAC source has been assessed. The AAC source has the capacity and capability to power the equipment necessary to cope with a station blackout event. The AAC source is capable of being aligned to power the shutdown buses within one hour of the onset of a station blackout. The coping assessment has been performed using the guidance described in Section 7 of NUMARC 87-00. The results of the assessment are summarized below:

1. It has been determined from Section 7.2.1 of NUMARC 87-00 that 66,913 gallons of water are required for decay heat removal for four hours. The minimum permissible condensate storage tank level per technical specifications provides 360,000 gallons of water which exceeds the required quantity for coping with a four hour station blackout. No plant modifications or procedure changes are needed to utilize this water source.

2. A battery capacity calculation has been performed pursuant to NUMARC 87-00, Section 7.2.2. confirming that the station batteries have sufficient capacity to meet station blackout loads for one hour.

3. Air-operated valves relied upon to cope with a station blackout for one hour can either be operated manually or have sufficient backup sources independent of the preferred power supply. Valves requiring manual operation or that need backup sources for operation are identified in plant procedures.

4. The calculated steady state ambient air temperature for the steam driven AFW pump room at Indian Point 3 (the dominant area of concern for PWRs) during a station blackout induced loss of ventilation is 128°F.

   Reasonable assurance of the operability of station blackout response equipment in the AFW pump room has been assessed using Appendix F to NUMARC 87-00. No modifications or associated procedures are required to provide reasonable assurance of equipment operability.

   The assumption in NUMARC 87-00, Section 2.7.1 that the control room will not exceed 120°F during a station blackout has been assessed. The control room at Indian Point 3 does not exceed 120°F during a station blackout. Therefore, the control room is not a dominant area of concern. The control room is not identified as a dominant area of concern since HVAC is available after the AAC is brought on line (one hour).

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 station blackout conditions can be positioned (with indication) independent of the preferred 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. The ability to maintain adequate reactor coolant system inventory to ensure that the core is cooled has been assessed for the required one hour coping duration. The generic analyses listed in Section 2.5.2 of NUMARC 87-00 were used for this assessment and are applicable to the specific design of the Indian Point 3 Nuclear Power Plant. The expected rates of reactor coolant inventory loss under SBO conditions do not result in core uncovery in a SBO of one hour. Therefore, makeup systems in addition to those currently available under SBO conditions are not required to maintain core cooling under natural circulation.

IP-3 ELECTRICAL DISTRIBUTION

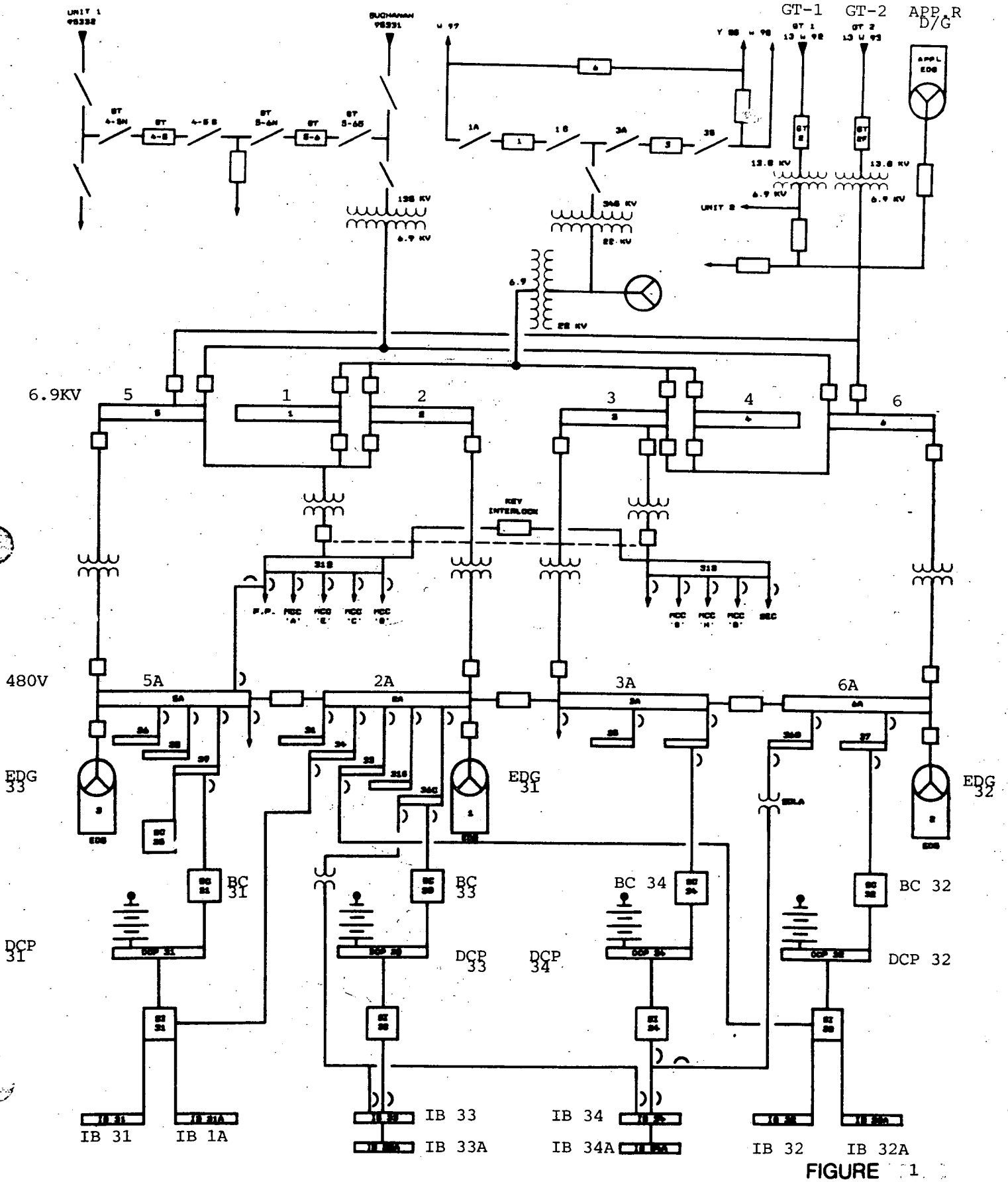

FIGURE 1