U.S. NUCLEAR REGULATORY COMMISSION

August 1988

REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

Reissued to correct Tables 1, 5, and 6.

REGULATORY GUIDE 1.155
(Task SI 501-4)

STATION BLACKOUT

A. INTRODUCTION

Criterion 17, "Electric Power Systems," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," includes a requirement that an onsite electric power system and an offsite electric power system be provided to permit functioning of structures, systems, and components important to safety.

Criterion 1, "Quality Standards and Records," of Appendix A to 10 CFR Part 50 includes a requirement for a quality assurance program to provide adequate assurance that structures, systems, and components important to safety will perform their safety functions.

Criterion 18, "Inspection and Testing of Electric Power Systems," of Appendix A to 10 CFR Part 50 includes a requirement for appropriate periodic testing and inspection of electric power systems important to safety.

The Commission has amended its regulations in 10 CFR Part 50. Paragraph (a), "Requirements," of § 50.63, "Loss of All Alternating Current Power," requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout (i.e., loss of the offsite electric power system concurrent with reactor trip and unavailability of the onsite emergency ac electric power system) of a specified duration. Section 50.63 requires that, for the station blackout duration, the plant be capable of maintaining core cooling and appropriate containment integrity. It also identifies the factors that must be considered in specifying the station blackout duration.

Criteria 1 and 18 of Appendix A to 10 CFR Part 50 apply to safety-related equipment needed to cope with station blackout and other safety functions. Appendix A of this regulatory guide provides quality assurance guidance for non-safety systems and equipment used to meet the requirements of § 50.63.

This guide describes a method acceptable to the NRC staff for complying with the Commission regulation that requires nuclear power plants to be capable of coping with a station blackout for a specified duration. This guide applies to all light-water-cooled nuclear power plants.

The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

Any information collection activities related to this regulatory guide are contained as requirements in the revision of 10 CFR Part 50 that provides the regulatory basis for this guide. The information collection requirements in Part 50 have been cleared under the Office of Management and Budget Clearance No. 3150-0011.

B. DISCUSSION

The term "station blackout" refers to the complete loss of alternating current electric power to the essential and nonessential switchgear buses in a nuclear power plant. Station blackout therefore involves the loss of offsite power concurrent with turbine trip and failure of the onsite emergency ac power system, but not the loss of available ac power to buses fed by station batteries through inverters or the loss of power from "alternate ac sources." Station blackout and alternate ac source are defined in § 50.2. Because many safety systems required for reactor core decay heat removal and containment heat removal are dependent on ac power, the consequences of a station blackout could be severe. In the event of a station blackout, the capability to cool the reactor core would be dependent on the availability of systems that do not require ac power from the essential and nonessential switchgear buses and on the ability to restore ac power in a timely manner.

The concern about station blackout arose because of the accumulated experience regarding the reliability of ac power supplies. Many operating plants have experienced a total loss of offsite electric power, and more occurrences are expected in the future. In almost every one of these loss-of-offsite-power events, the onsite emergency ac power supplies have been available immediately to supply the power needed by vital safety equipment. However, in some instances, one of the redundant emergency ac power supplies has been unavailable. In a few cases there has been a complete loss of ac power, but during these events ac power was restored in a short time without any serious consequences. In addition, there have been numerous instances when emergency diesel generators have failed to start and run in response to tests conducted at operating plants.

The results of the Reactor Safety Study (Ref. 1) showed that, for one of the two plants evaluated, a station blackout event could be an important contributor to the total risk from nuclear power plant accidents. Although this total risk was found to be small, the relative importance of station blackout events was established. This finding and the accumulated diesel generator failure experience increased the concern about station blackout.

In a Commission proceeding addressing station blackout, it was determined that the issue should be analyzed to identify preventive or mitigative measures that can or should be taken. (See Florida Power & Light Company (St. Lucie Nuclear Power Plant, Unit No. 2) ALAB-603, 12 NRC 30 (1980); modified CLI-81-12, 13 NRC 838 (1981).)

The issue of station blackout involves the likelihood and duration of the loss of offsite power, the redundancy and reliability of onsite emergency ac power systems, and the potential for severe accident sequences after a loss of all ac power. References 2 through 7 provide detailed analyses of these topics. Based on risk studies performed to date, the results indicate that estimated core melt frequencies from station blackout vary considerably for different plants and could be a significant risk contributor for some plants. In order to reduce this risk, action should be taken to resolve the safety concern stemming from station blackout. The issue is of concern for both PWRs and BWRs.

This guide primarily addresses the following three areas: (1) maintaining highly reliable ac electric power systems, (2) developing procedures and training to restore offsite and onsite emergency ac power should either one or both become unavailable, and (3) ensuring that plants can cope with a station blackout for some period of time based on the probability of occurrence of a station blackout at a site as well as the capability for restoring ac power in a timely fashion for that site.

One factor that affects ac power system reliability is the vulnerability to common cause failures associated with design, operational, and environmental factors. Existing standards and regulatory guides include specific design criteria and guidance on the independence of preferred (offsite) power circuits (see General Design Criterion 17, "Electric Power Systems," and Section 5.1.3 of Reference 8) and the independence of and limiting interactions between diesel generator units at a nuclear station (see General Design Criterion 17, Regulatory Guide 1.6, "Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems," Regulatory Guide 1.75, "Physical Independence of Electric Systems," and Reference 9). In developing the recommendations in this guide, the staff has assumed that, by adhering to such standards, licensees have minimized, to the extent practical, single-point vulnerabilities in design and operation that could result in a loss of all offsite power or all onsite emergency ac power.

Onsite emergency ac power system unavailability can be affected by outages resulting from testing and maintenance. Typically, this unavailability is about 0.007 (Reference 5), which is small compared to the minimum emergency diesel generator reliability specified in Regulatory Position 1.1 of this regulatory guide (i.e., 0.95 or 0.975 reliability per demand). However, in some cases outages due to maintenance can be a significant contributor to emergency diesel generator unavailability. This contribution can be kept low by having high-quality test and maintenance procedures and by scheduling regular diesel generator maintenance at times when the reactor is shut down. Also, limiting conditions for operation in the technical specifications are designed to limit the diesel generator unavailability when the plant is operating. As long as the unavailability due to testing and maintenance is not excessive, the maximum emergency diesel generator failure rates for each diesel generator specified in Regulatory Position 1.1 would result in acceptable overall reliability for the emergency ac power system.

Based on § 50.63, all licensees and applicants are required to assess the capability of their plants to maintain adequate core cooling and appropriate containment integrity during a station blackout and to have procedures to cope with such an event. This guide presents a method acceptable to the NRC staff for determining the specified duration for which a plant should be able to withstand a station blackout in accordance with these requirements. The application of this method results in selecting a minimum acceptable station blackout duration capability from 2 to 16 hours, depending on a comparison of the plant's characteristics with those factors that have been identified as significantly affecting the risk from station blackout. These factors include redundancy of the onsite emergency ac power system (i.e., the number of diesel generators available for decay heat removal minus the number needed for decay heat removal), the reliability of onsite emergency ac power sources (e.g., diesel generators), the frequency of loss of offsite power, and the probable time to restore offsite power.

Licensees may propose durations different from those specified in this guide. The basis for alternative durations would be predicated on plant-specific factors relating to the reliability of ac power systems such as those discussed in Reference 2.

The information submitted to comply with § 50.63 is also required to be incorporated in an update to the FSAR in accordance with paragraph 50.71(e)(4). It is expected that the applicant or licensee will have available for review, as required, the analyses and related information supporting the submittal.

Concurrent with the development of this regulatory guide, and consistent with discussions with the NRC staff, the Nuclear Management and Resource Council (NUMARC) has developed guidelines and procedures for assessing station blackout coping capability and duration for light water reactors (NUMARC-8700, Ref. 10). The NRC staff has reviewed these guidelines and analysis methods and concludes that NUMARC-8700 provides guidance for conformance to § 50.63 that is in large part identical to the guidance provided in this regulatory guide. Table 1 of this regulatory guide provides a section-by-section comparison between Regulatory Guide 1.155 and NUMARC-8700. The use of NUMARC-8700 is further discussed in Section C, Regulatory Position, of this guide.

C. REGULATORY POSITION

This regulatory guide describes a means acceptable to the NRC staff for meeting the requirements of § 50.63 of 10 CFR Part 50. NUMARC-8700 (Ref. 10) also provides guidance acceptable to the staff for meeting these requirements. Table 1 provides a cross-reference to NUMARC-8700 and notes where the regulatory guide takes precedence.

1. ONSITE EMERGENCY AC POWER SOURCES (EMERGENCY DIESEL GENERATORS)

1.1 Emergency Diesel Generator Target Reliability Levels

The minimum emergency diesel generator (EDG) reliability should be targeted at 0.95 per demand for each EDG for plants in emergency ac (EAC) Groups A, B, and C and at 0.975 per demand for each EDG for plants in EAC Group D (see Table 2). These reliability levels will be considered minimum target reliabilities and each plant should have an EDG reliability program containing the principal elements, or their equivalent, outlined in Regulatory Position 1.2. Plants that select a target EDG reliability of 0.975 will use the higher level as the target in their EDG reliability programs.

The EDG reliability for determining the coping duration for a station blackout will be determined as follows:

1. Calculate the most recent EDG reliability for each EDG based on the last 20, 50, and 100 demands using definitions and methodology in Section 2 of NSAC-108, "Reliability of Emergency Diesel Generators at U.S. Nuclear Power Plants" (Ref. 11), or equivalent.[1]

2. Calculate the nuclear unit "average" EDG reliability for the last 20, 50, and 100 demands by averaging the results from step 1 above.

3. Compare the calculated "average" nuclear unit EDG reliability from step 2 above against the following criteria:

   Last 20 demands > 0.90 reliability
   Last 50 demands > 0.94 reliability
   Last 100 demands > 0.95 reliability

4. If the EAC group is A, B, or C AND any of the three evaluation criteria in step 3 are met, the nuclear unit may select an EDG reliability target of either 0.95 or 0.975 for determining the applicable coping duration from Table 2.

   If the EAC group is D and any of the three evaluation criteria in step 3 are met, the allowed EDG reliability target is 0.975.

5. If the EAC group is A, B, or C and NONE of the selection criteria in step 3 are met, an EDG reliability level of 0.95 must be used for determining the applicable coping duration from Table 2. Additionally, if the "averaged" nuclear unit EDG reliability is less than 0.90 based on the last 20 demands, the acceptability of a coping duration based on an EDG reliability of 0.95 from Table 2 must be further justified.

   If the EAC group is D and NONE of the three evaluation criteria in step 3 are met, the required coping duration (derived by using Table 2) should be increased to the next highest coping level (i.e., 4 hours to 8 hours, 8 hours to 16 hours).

1.2 Reliability Program

The reliable operation of onsite emergency ac power sources should be ensured by a reliability program designed to maintain and monitor the reliability level of each power source over time for assurance that the selected reliability levels are being achieved. An EDG reliability program would typically be composed of the following elements or activities (or their equivalent):

1. Individual EDG reliability target levels consistent with the plant category and coping duration selected from Table 2.

2. Surveillance testing and reliability monitoring programs designed to track EDG performance and to support maintenance activities.

[1] This EDG reliability is not suitable for probabilistic risk analyses for design basis accidents because of the differing EDG start-reliability requirement that would be applicable for such probabilistic risk analyses.

3. A maintenance program that ensures that the target EDG reliability is being achieved and that provides a capability for failure analysis and root-cause investigations.

4. An information and data collection system that services the elements of the reliability program and that monitors achieved EDG reliability levels against target values.

5. Identified responsibilities for the major program elements and a management oversight program for reviewing reliability levels being achieved and ensuring that the program is functioning properly.

1.3 Procedures for Restoring Emergency AC Power

Guidelines and procedures for actions to restore emergency ac power when the emergency ac power system is unavailable should be integrated with plant-specific technical guidelines and emergency operating procedures developed using the emergency operating procedure upgrade program established in response to Supplement 1, "Requirements for Emergency Response Capability" (Generic Letter No. 82-33),[2] to NUREG-0737, "Clarification of TMI Action Plan Requirements" (Ref. 12).

2. OFFSITE POWER

Procedures should include the actions necessary to restore offsite power and use nearby power sources[3] when offsite power is unavailable. As a minimum, the following potential causes for loss of offsite power should be considered:

- Grid undervoltage and collapse
- Weather-induced power loss
- Preferred power distribution system faults[4] that could result in the loss of normal power to essential switchgear buses

3. ABILITY TO COPE WITH A STATION BLACKOUT

The ability to cope with a station blackout for a certain time provides additional defense-in-depth should both offsite and onsite emergency ac power systems fail concurrently. Regulatory Position 3.1 provides a method to determine an acceptable minimum time that a plant should be able to cope with a station blackout based on the probability of a station blackout at the site as well as the capability for restoring ac power for that site. Each nuclear power plant has the capability to remove decay heat and maintain appropriate containment integrity without ac power for a limited period of time. Regulatory Position 3.2 provides guidance for determining the length of time that a plant is actually able to cope with a station blackout. If the plant's actual station blackout capability is significantly less than the acceptable minimum duration, modifications may be necessary to extend the plant's ability to cope with a station blackout. Should plant modifications be necessary, Regulatory Position 3.3 provides guidance on making such modifications. Whether or not modifications are necessary, procedures and training for station blackout events should be provided according to the guidance in Regulatory Position 3.4.

[2]Modifications or additions to generic technical guidelines that are necessary to deal with a station blackout for the specific plant design should be identified as deviations in the plant-specific technical guidelines as required by Supplement 1 to NUREG-0737 (Ref. 12) and outlined in NUREG-0899, "Guidelines for the Preparation of Emergency Operating Procedures" (Ref. 13).

[3]This includes such items as nearby or onsite gas turbine generators, portable generators, hydro generators, and black-start fossil power plants.

[4]Includes such failures as the distribution system hardware, switching and maintenance errors, and lightning-induced faults.

3.1 Minimum Acceptable Station Blackout Duration Capability

Each nuclear power plant should be able to withstand and recover from a station blackout lasting a specified minimum duration. The specified duration of station blackout should be based on the following factors:

1. The redundancy of the onsite emergency ac power system (i.e., the number of power sources available minus the number needed for decay heat removal),

2. The reliability of each of the onsite emergency ac power sources (e.g., diesel generator),

3. The expected frequency of loss of offsite power, and

4. The probable time needed to restore offsite power.

A method for determining an acceptable minimum station blackout duration capability as a function of the above site- and plant-related characteristics is given in Table 2. Tables 3 through 8 provide the necessary detailed descriptions and definitions of the various factors used in Table 2. Table 3 identifies different levels of redundancy of the onsite emergency ac power system used to define the emergency ac power configuration groups in Table 2. Table 4 provides definitions of the three offsite power design characteristic groups used in Table 2. The groups are defined according to various combinations of the following factors: (1) independence of offsite power (I), (2) severe weather (SW), (3) severe weather recovery (SWR), and (4) extremely severe weather (ESW). The definitions of the factors I, SW, SWR, and ESW are provided in Tables 5 through 8, respectively. After identifying the appropriate groups from Tables 3 and 4 and the reliability level of the onsite emergency ac power sources (determined in accordance with Regulatory Position 1.1), Table 2 can be used to determine the acceptable minimum station blackout duration capability for each plant.

3.2 Evaluation of Plant-Specific Station Blackout Capability

Each nuclear power plant should be evaluated to determine its capability to withstand and recover from a station blackout of the acceptable duration determined for that plant (see Regulatory Position 3.1). The following considerations should be included when determining the plant's capability to cope with a station blackout.

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.

3.2.2. The capability of all systems and components necessary to provide core cooling and decay heat removal following a station blackout should be determined, including station battery capacity, condensate storage tank capacity, compressed air capacity, and instrumentation and control requirements.

3.2.3. The ability to maintain adequate reactor coolant system inventory to ensure that the core is cooled should be evaluated, taking into consideration shrinkage, leakage from pump seals, and inventory loss from letdown or other normally open lines dependent on ac power for isolation.

3.2.4. The design adequacy and capability of equipment needed to cope with a station blackout for the required duration and recovery period should be addressed and evaluated as appropriate for the associated environmental conditions. This should include consideration as appropriate of the following:

1. Potential failures of equipment necessary to cope with the station blackout,
2. Potential environmental effects on the operability and reliability of equipment necessary to cope with the station blackout, including possible effects of fire protection systems,
3. Potential effects of other hazards, such as weather, on station blackout response equipment (e.g., auxiliary equipment to operate onsite buses or to recover EDGs and other equipment as needed),
4. Potential habitability concerns for those areas that would require operator access during the station blackout and recovery period.

Evaluations that have already been performed need not be duplicated. For example, if safety-related equipment required during a total loss of ac power has been qualified to operate under environmental conditions exceeding those expected under a station blackout (e.g., loss of heating, ventilation, and air conditioning), additional analyses need not be performed. Equipment will be considered acceptable for station blackout temperature environments if an assessment has been performed that provides reasonable assurance that the required equipment will remain operable.

3.2.5. Consideration should be given to using available non-safety-related equipment, as well as safety-related equipment, to cope with a station blackout provided such equipment meets the recommendations of Regulatory Positions 3.3.3 and 3.3.4. Onsite or nearby alternate ac (AAC) power sources that are independent and diverse from the normal Class 1E emergency ac power sources (e.g., gas turbine, separate diesel engine, steam supplies) will constitute an acceptable station blackout coping capability provided an analysis is performed that demonstrates the plant has this capability from the onset of station blackout until the AAC power source or sources are started and lined up to operate all equipment necessary to cope with station blackout for the required duration.

In general, equipment required to cope with a station blackout during the first 8 hours should be available on the site. For equipment not located on the site, consideration should be given to its availability and accessibility in the time required, including consideration of weather conditions likely to prevail during a loss of offsite power.

If the AAC source or sources meet the recommendations of Section 3.3.5 and can be demonstrated by test to be available to power the shutdown buses within 10 minutes of the onset of station blackout, no coping analysis is required.

3.2.6. Consideration should be given to timely operator actions inside or outside the control room that would increase the length of time that the plant can cope with a station blackout provided it can be demonstrated that these actions can be carried out in a timely fashion. For example, if station battery capacity is a limiting factor in coping with a station blackout, shedding nonessential loads on the batteries could extend the time until the battery is depleted. If load shedding or other operator actions are considered, corresponding procedures should be incorporated into the plant-specific technical guidelines and emergency operating procedures.

3.2.7. The ability to maintain "appropriate containment integrity" should be addressed. "Appropriate containment integrity" for station blackout means that adequate containment integrity is ensured by providing the capability, independent of the preferred and blacked-out unit's onsite emergency ac power supplies, for valve position indication and closure for containment isolation valves that may be in the open position at the onset of a station blackout. The following valves are excluded from consideration:

1. Valves normally locked closed during operation,
2. Valves that fail closed on a loss of power,

3. Check valves,

4. Valves in nonradioactive closed-loop systems not expected to be breached in a station blackout (this does not include lines that communicate directly with containment atmosphere), and

5. Valves of less than 3-inch nominal diameter.

3.3 Modifications To Cope with Station Blackout

If the plant's station blackout capability, as determined according to the guidance in Regulatory Position 3.2, is significantly less than the minimum acceptable plant-specific station blackout duration (as developed according to Regulatory Position 3.1 or as justified by the licensee or applicant on some other basis and accepted by the staff), modifications to the plant may be necessary to extend the time the plant is able to cope with a station blackout. If modifications are needed, the following items should be considered:

3.3.1. If, after considering load shedding to extend the time until battery depletion, battery capacity must be extended further to meet the station blackout duration recommended in Regulatory Position 3.1, it is considered acceptable either to add batteries or to add a charging system for the existing batteries that is independent of both the offsite and the blacked-out unit's onsite emergency ac power systems, such as a dedicated diesel generator.

3.3.2. If the capacity of the condensate storage tank is not sufficient to remove decay heat for the station blackout duration recommended in Regulatory Position 3.1, a system meeting the requirements of Regulatory Position 3.5 to resupply the tank from an alternative water source is an acceptable means to increase its capacity provided any power source necessary to provide additional water is independent of both the offsite and the blacked-out unit's onsite emergency ac power systems.

3.3.3. If the compressed air capacity is not sufficient to remove decay heat and to maintain appropriate containment integrity for the station blackout duration recommended in Regulatory Position 3.1, a system to provide sufficient capacity from an alternative source that meets Regulatory Position 3.5 is an acceptable means to increase the air capacity provided any power source necessary to provide additional air is independent of both the offsite and the blacked-out unit's onsite emergency ac power systems.

3.3.4. If a system is required for primary coolant charging and makeup, reactor coolant pump seal cooling or injection, decay heat removal, or maintaining appropriate containment integrity specifically to meet the station blackout duration recommended in Regulatory Position 3.1, the following criteria should be met:

1. The system should be capable of being actuated and controlled from the control room, or if other means of control are required, it should be demonstrated that these steps can be carried out in a timely fashion, and

2. If the system must operate within 10 minutes of a loss of all ac power, it should be capable of being actuated from the control room.

3.3.5. If an AAC power source is selected specifically for satisfying the requirements for station blackout, the design should meet the following criteria:

1. The AAC power source should not normally be directly connected to the preferred or the blacked-out unit's onsite emergency ac power system.

2. There should be a minimum potential for common cause failure with the preferred or the blacked-out unit's onsite emergency ac power sources. No single-point vulnerability should exist whereby a weather-related event or single active failure could disable any portion of the blacked-out unit's onsite emergency ac power sources or the preferred power sources and simultaneously fail the AAC power source.

3. The AAC power source should be available in a timely manner after the onset of station blackout and have provisions to be manually connected to one or all of the redundant safety buses as required. The time required for making this equipment available should not be more than 1 hour as demonstrated by test. If the AAC power source can be demonstrated by test to be available to power the shutdown buses within 10 minutes of the onset of station blackout, no coping analysis is required.

4. The AAC power source should have sufficient capacity to operate the systems necessary for coping with a station blackout for the time required to bring and maintain the plant in safe shutdown.

5. The AAC power system should be inspected, maintained, and tested periodically to demonstrate operability and reliability. The reliability of the AAC power system should meet or exceed 95 percent as determined in accordance with NSAC-108 (Ref. 11) or equivalent methodology.

An AAC power source serving a multiple-unit site where onsite emergency ac sources are not shared between units should have, as a minimum, the capacity and capability for coping with station blackout in any of the units.

At sites where onsite emergency sources are shared between units, the AAC power sources should have the capacity and capability to ensure that all units can be brought to and maintained in safe shutdown (i.e., those plant conditions defined 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.

Plants that have more than the required redundancy of emergency ac sources for loss-of-offsite-power conditions, on a per nuclear unit basis, may use one of the existing emergency sources as an AAC power source provided it meets the applicable criteria for an AAC source. Additionally, emergency diesel generators with 1-out-of-2-shared and 2-out-of-3-shared ac power configurations may not be used as AAC power sources.

3.3.6. If a system or component is added specifically to meet the recommendations on station blackout duration in Regulatory Position 3.1, system walk downs and initial tests of new or modified systems or critical components should be performed to verify that the modifications were performed properly. Failures of added components that may be vulnerable to internal or external hazards within the design basis (e.g., seismic events) should not affect the operation of systems required for the design basis accident.

3.3.7. A system or component added specifically to meet the recommendations on station blackout duration in Regulatory Position 3.1 should be inspected, maintained, and tested periodically to demonstrate equipment operability and reliability.

3.4 Procedures and Training To Cope with Station Blackout

Procedures[5] and training should include all operator actions necessary to cope with a station blackout for at least the duration determined according to Regulatory Position 3.1 and to restore normal long-term core cooling/decay heat removal once ac power is restored.

3.5 Quality Assurance and Specification Guidance for Station Blackout Equipment That Is Not Safety-Related

Appendices A and B provide guidance on quality assurance (QA) activities and specifications respectively for non-safety-related equipment used to meet the requirements of § 50.63 and not already covered by existing QA requirements in Appendix B or R of Part 50. Appropriate activities should be implemented from among those listed in these appendices depending on whether the non-safety equipment is being added (new) or is existing. This QA guidance is applicable to non-safety systems and equipment for meeting the requirements of § 50.63 of 10 CFR Part 50. The guidance on QA and specifications incorporates a lesser degree of stringency by eliminating requirements for involvement of parties outside the normal line organization. NRC inspections will focus on the implementation and effectiveness of the quality controls described in Appendices A and B. Additionally, the equipment installed to meet the station blackout rule must be implemented such that it does not degrade the existing safety-related systems. This is to be accomplished by making the non-safety-related equipment as independent as practicable from existing safety-related systems. The non-safety systems identified in Appendix B are acceptable to the NRC staff for responding to a station blackout.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff's plans for using this regulatory guide. Except in those cases in which the applicant or licensee proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described in this guide may be used in the evaluation of submittals by applicants for construction permits and operating licenses (as appropriate) and will be used to evaluate licensees who are required to comply with § 50.63, "Loss of All Alternating Current Power," of 10 CFR Part 50.

[5] Procedures should be integrated with plant-specific technical guidelines and emergency operating procedures developed using the emergency operating procedure upgrade program established in response to Supplement 1 of NUREG-0737 (Ref. 12). The task analysis portion of the emergency operating procedure upgrade program should include an analysis of instrumentation adequacy during a station blackout.

TABLE 1

CROSS-REFERENCE BETWEEN REGULATORY GUIDE 1.155 AND NUMARC-8700

Regulatory Position in R.G. 1.155	Section in NUMARC-8700
1.1	3.2.3, 3.2.4
1.2	Appendix D
1.3	4.2.1, 4.3.1
2	4.2.2, 4.3.2
3.1	3
3.2.1	2.2.1, 2.2.2
3.2.2	2.9, 7.2.1, 7.2.2, 7.2.3
3.2.3	2.5
3.2.4	2.7, 4.2.1, 4.2.2, 7.2.4, Appendices E and F
3.2.5	7.1.1, 7.1.2, Appendices B and C
3.2.6	4.2.1, 4.3.1, 7.2.1, 7.2.2, 7.2.3
3.2.7	2.10, 7.2.5
3.3.1	7.2.2
3.3.2	7.2.1
3.3.3	7.2.3
3.3.4	2.5
3.3.5	2.3.1, 7.1.1, 7.1.2, Appendices A, B, and C
3.3.6	None (Use Regulatory Guide 1.155)
3.3.7	4.2.1(12), 4.3.1(12), Appendices A and B
3.4	4
3.5	None (Use Regulatory Guide 1.155)
Appendix A	None (Use Regulatory Guide 1.155)
Appendix B	None (Use Regulatory Guide 1.155

TABLE 2

ACCEPTABLE STATION BLACKOUT DURATION CAPABILITY (HOURS)[a]

	Emergency AC Power Configuration Group[b]						
	A		B		C		D
	Unit "Average" EDG Reliability[c]						
Offsite Power Design Characteristic Group[d]	0.975	0.95	0.975	0.95	0.975	0.95	0.975
P1	2	2	4	4	4	4	4
P2	4	4	4	4	4	8	8
P3	4	8	4	8	8	16	8

[a]Variations from these times will be considered by the staff if justification, including a cost-benefit analysis, is provided by the licensee. The methodology and sensitivity studies presented in NUREG-1032 (Ref. 2) are acceptable for use in this justification.

[b]See Table 3 to determine emergency ac power configuration group.

[c]See Regulatory Position 1.1.

[d]See Table 4 to determine groups P1, P2, and P3.

TABLE 3

EMERGENCY AC POWER CONFIGURATION GROUPS[a]

EAC Power Configuration Group	Number of EAC Power Sources[b]	Number of EAC Power Sources Required To Operate AC-Powered Decay Heat Removal Systems[c]
A	3[d]	1
	4	1
B	4	2
	5	2
C	2[d]	1
	3[e]	1
D	2[f]	1
	3	2
	4	3
	5	3

[a]Special-purpose dedicated diesel generators, such as those associated with high-pressure core spray systems at some BWRs, are not counted in the determination of EAC power configuration groups.

[b]If any of the EAC power sources are shared among units at a multi-unit site, this is the total number of shared and dedicated sources for those units at the site.

[c]This number is based on all the ac loads required to remove decay heat (including ac-powered decay heat removal systems) to achieve and maintain safe shutdown at all units at the site with offsite power unavailable.

[d]For EAC power sources not shared with other units.

[e]For EAC power sources shared with another unit at a multi-unit site.

[f]For shared EAC power sources in which each diesel generator is capable of providing ac power to more than one unit at a site concurrently.

TABLE 4

OFFSITE POWER DESIGN CHARACTERISTIC GROUPS

Group	Offsite Power Design Characteristics			
	Sites that have any combination of the following factors:			
	I[a]	SW[b]	SWR[c]	ESW[d]
P1	1 or 2	1 or 2	1 or 2	1 or 2
	1 or 2	1	1 or 2	3
	1 or 2	3	1	1 or 2
P2	All other sites not in P1 or P3.			
	Sites that expect to experience a total loss of offsite power caused by grid failures at a frequency equal to or greater than once in 20 site-years, unless the site has procedures to recover ac power from reliable alternative (nonemergency) ac power sources within approximately one-half hour following a grid failure.			
	or			
	Sites that have any combination of the following factors:			
P3	I	SW	SWR	ESW
	Any I	5	2	Any ESW
	Any I	1,2,3, or 4	1 or 2	5
	Any I	5	1	Any ESW
	Any I	4	2	1,2,3, or 4
	1 or 2	3	2	4
	3	3	2	3 or 4

[a]See Table 5 for definitions of independence of offsite power (I) groups.

[b]See Table 6 for definitions of severe weather (SW) groups.

[c]See Table 7 for definitions of severe weather recovery (SWR) groups.

[d]See Table 8 for definitions of extremely severe weather (ESW) groups.

TABLE 5

DEFINITIONS OF INDEPENDENCE OF OFFSITE POWER GROUPS

Category	I		
	1	2	3
1. Independence of offsite power sources	1. All offsite power sources are connected to the plant through two or more switchyards or separate incoming transmission lines, but at least one of the ac sources is electrically independent of the others. (The independent 69-kV line in Figure 1 is representative of this design feature.) OR	1.a. All offsite power sources are connected to the plant through one switchyard. OR 1.b. All offsite power sources are connected to the plant through two or more switchyards, and the switchyards are electrically connected. (The 345- and 138-kV switchyards in Figures 2 and 3 represent this design feature.) AND	AND
2. Automatic and manual transfer schemes for the Class 1E buses when the normal source of ac power fails and when the back-up sources of offsite power fail. a. The normal source of ac power is assumed to be the unit main generator.	2.a. After loss of the normal ac source, (1) There is an automatic transfer of all safe-shutdown buses to a separate preferred alternate power source. (2) There is an automatic transfer of all safe-shutdown buses to one preferred power source. If this preferred power source fails, there is another automatic transfer to the remaining preferred power sources or to alternate offsite power source. OR	2.a. After loss of the normal ac power source, there is an automatic transfer of all safe-shutdown buses to one preferred alternate power source. If this source fails, there may be one or more manual transfers of power source to the remaining preferred or alternate offsite power sources. OR	2.a. If the normal source of ac power fails, there are no automatic transfers and one or more manual transfers of all safe-shutdown buses to preferred or alternate offsite power sources. OR There is one automatic transfer and no manual transfer of all safe-shutdown buses to one preferred or one alternate offsite power source.
b. If the Class 1E buses are normally designed to be connected to the preferred or alternate power sources.	2.b. Each safe-shutdown bus is normally connected to a separate preferred alternate power source with automatic or manual transfer capability between the preferred or alternate sources.	2.b. The safe-shutdown buses are normally aligned to the same preferred power source with either an automatic or manual transfer to the remaining preferred or alternate ac power source.	

TABLE 6

DEFINITIONS OF SEVERE WEATHER (SW) GROUPS

SW Group	Estimated Frequency of Loss of Offsite Power Due to Severe Weather, f (per Site-Year)*
1	$f < 3.3 \times 10^{-3}$
2	$3.3 \times 10^{-3} \leq f < 1 \times 10^{-2}$
3	$1 \times 10^{-2} \leq f < 3.3 \times 10^{-2}$
4	$3.3 \times 10^{-2} \leq f < 1 \times 10^{-1}$
5	$1 \times 10^{-1} \leq f$

*The estimated frequency of loss of offsite power due to severe weather, f, is determined by the following equation:

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

where h_1 = annual expectation of snowfall for the site, in inches

h_2 = annual expectation of tornadoes (with wind speeds greater than or equal to 113 miles per hour) per square mile at the site

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

b = 72.3 for sites with transmission lines on one right-of-way

h_3 = annual expectation of storms at the site with wind velocities between 75 and 124 mph

h_4 = annual expectation of hurricanes at the site

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

c = 0.78 if switchyard *is* vulnerable to the effects of salt spray

The annual expectation of snowfall, tornadoes, and storms may be obtained from National Weather Service data from the weather station nearest to the plant or by interpolation, if appropriate, between nearby weather stations. The basis for the empirical equation for the frequency of loss of offsite power due to severe weather, f, is given in Appendix A to Reference 2.

TABLE 7

DEFINITIONS OF SEVERE WEATHER RECOVERY (SWR) GROUPS

SWR Group	Definition
1	Sites with enhanced recovery (i.e., sites that have the capability and procedures for restoring offsite (nonemergency) ac power to the site within 2 hours following a loss of offsite power due to severe weather).
2	Sites without enhanced recovery.

TABLE 8

DEFINITIONS OF EXTREMELY SEVERE WEATHER (ESW) GROUPS

ESW Group	Annual expectation of storms at a site with wind velocities equal to or greater than 125 miles per hour (e)*
1	$e < 3.3 \times 10^{-4}$
2	$3.3 \times 10^{-4} \leq e < 1 \times 10^{-3}$
3	$1 \times 10^{-3} \leq e < 3.3 \times 10^{-3}$
4	$3.3 \times 10^{-3} \leq e < 1 \times 10^{-2}$
5	$1 \times 10^{-2} \leq e$

*The annual expectation of storms may be obtained from National Weather Service data from the weather station nearest to the plant or by interpolation, if appropriate, between nearby weather stations.

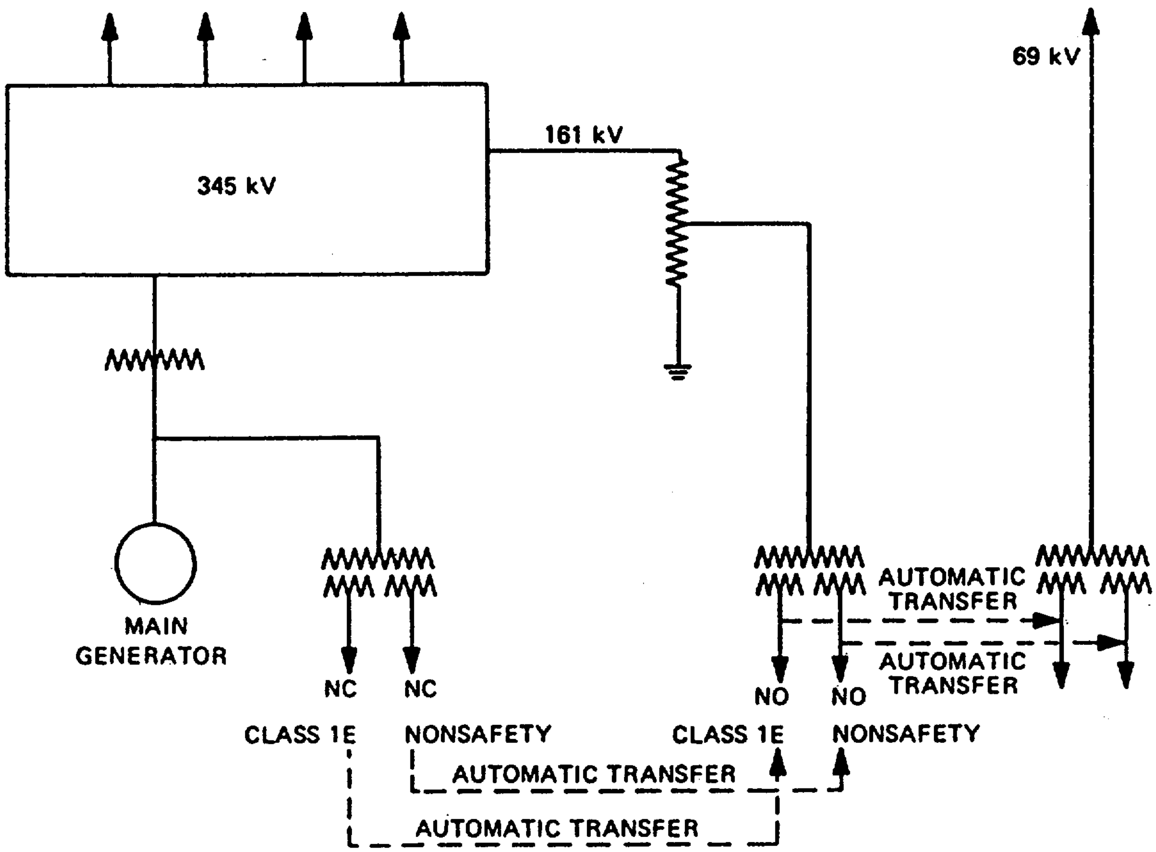

Figure 1. Schematic Diagram of Electrically Independent Transmission Line

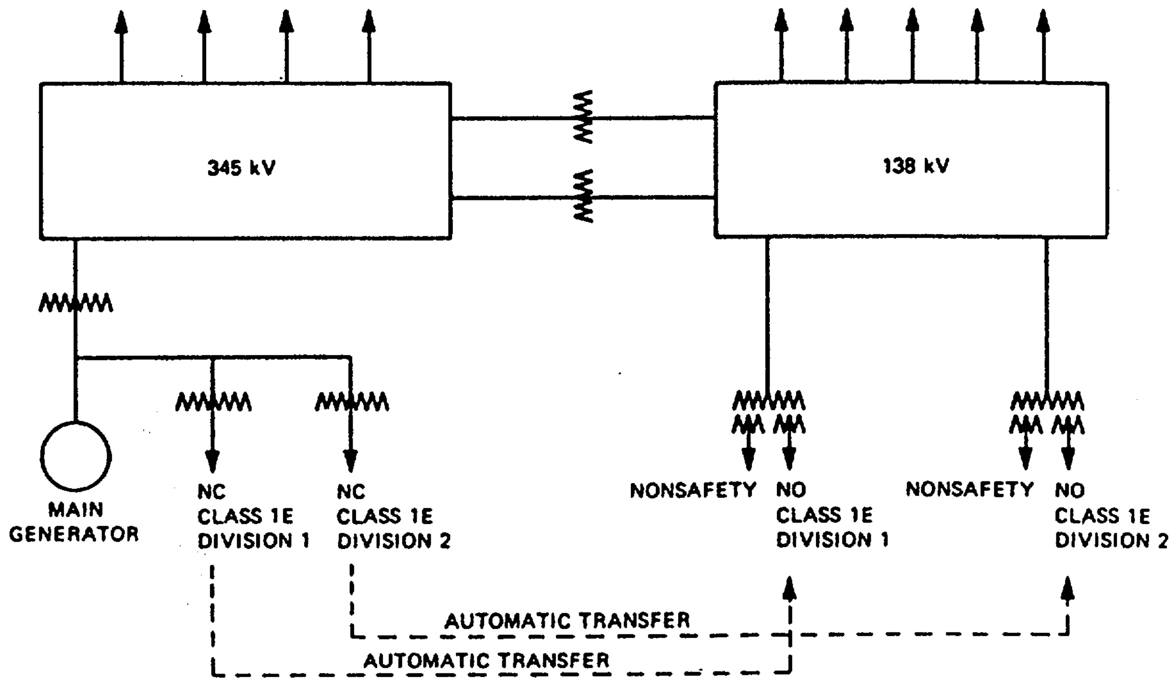

Figure 2. Schematic Diagram of Two Switchyards Electrically Connected (One-Unit Site)

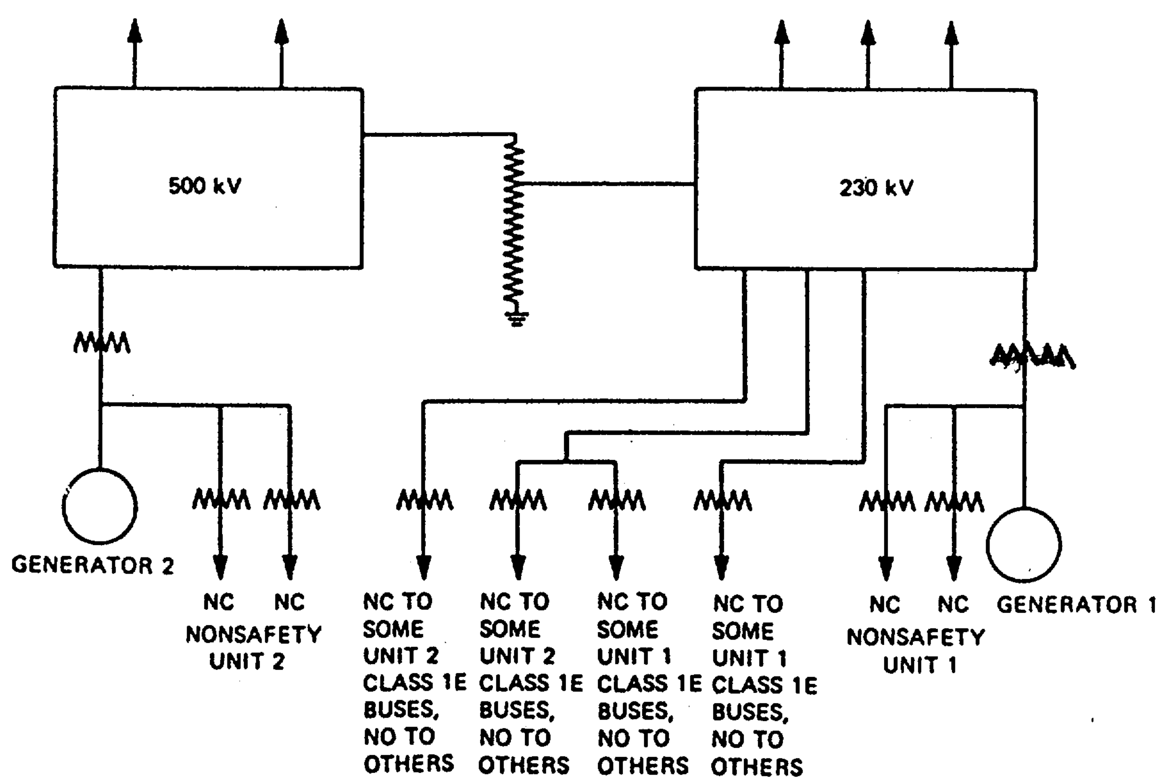

Figure 3. Schematic Diagram of Two Switchyards Electrically Connected (Two-Unit Site)

REFERENCES

1. U.S. Nuclear Regulatory Commission, "Reactor Safety Study," WASH-1400, October 1975.[1]

2. U.S. Nuclear Regulatory Commission, "Evaluation of Station Blackout Accidents at Nuclear Power Plants, Technical Findings Related to Unresolved Safety Issue A-44," NUREG-1032, June 1988.[1]

3. A. M. Rubin, "Regulatory/Backfit Analysis for the Resolution of Unresolved Safety Issue A-44, Station Blackout," U.S. Nuclear Regulatory Commission, NUREG-1109, June 1988.[1]

4. U.S. Nuclear Regulatory Commission, "Collection and Evaluation of Complete and Partial Losses of Offsite Power at Nuclear Power Plants," NUREG/CR-3992 (ORNL/TM-9384), February 1985.[1]

5. U.S. Nuclear Regulatory Commission, "Reliability of Emergency AC Power System at Nuclear Power Plants," NUREG/CR-2989 (ORNL/TM-8545), July 1983.[1]

6. U.S. Nuclear Regulatory Commission, "Emergency Diesel Generator Operating Experience, 1981-1983," NUREG/CR-4347 (ORNL/TM-9739), December 1985.[1]

7. U.S. Nuclear Regulatory Commission, "Station Blackout Accident Analyses (Part of NRC Task Action Plan A-44)," NUREG/CR-3226 (SAND82-2450), May 1983.[1]

[1]NRC publications may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Post Office Box 37082, Washington, DC 20013-7082; or from the National Technical Information Service, Springfield, VA 22161.

8. Institute of Electrical and Electronics Engineers, "IEEE Standard for Preferred Power Supply for Nuclear Power Generating Stations," IEEE Std 765-1983, June 1983.[2]

9. Institute of Electrical and Electronics Engineers, "IEEE Standard Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations," IEEE Std 387-1984, June 1984.[2]

10. Nuclear Management and Resources Council, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," NUMARC-8700, November 1987.[3]

11. Electric Power Research Institute, "Reliability of Emergency Diesel Generators at U.S. Nuclear Power Plants," NSAC-108, September 1986.[4]

12. U.S. Nuclear Regulatory Commission, "Clarification of TMI Action Plan Requirements: Requirements for Emergency Response Capability" (Generic Letter 82-33), Supplement 1 to NUREG-0737, January 1983.[1]

13. U.S. Nuclear Regulatory Commission, "Guidelines for the Preparation of Emergency Operating Procedures," NUREG-0899, August 1982.[1]

[2]Copies may be obtained from the Institute of Electrical and Electronics Engineers Service Center, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855.

[3]Copies may be obtained from the Nuclear Management and Resources Council, 1776 Eye Street NW., Washington, DC 20006.

[4]Copies may be obtained from the Electric Power Research Institute, Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303.

APPENDIX A

QUALITY ASSURANCE GUIDANCE FOR NON-SAFETY SYSTEMS AND EQUIPMENT

The QA guidance provided here is applicable to non-safety systems and equipment used to meet the requirements of § 50.63 and not already explicitly covered by existing QA requirements in 10 CFR Part 50 in Appendix B or R. Additionally, non-safety equipment installed to meet the station blackout rule must be implemented so that it does not degrade the existing safety-related systems. This is accomplished by making the non-safety equipment as independent as practicable from existing safety-related systems. The guidance provided in this section outlines an acceptable QA program for non-safety equipment used for meeting the station blackout rule and not already covered by existing QA requirements. Activities should be implemented from this section as appropriate, depending on whether the equipment is being added (new) or is existing.

1. Design Control and Procurement Document Control

Measures should be established to ensure that all design-related guidelines used in complying with § 50.63 are included in design and procurement documents, and that deviations therefrom are controlled.

2. Instructions, Procedures, and Drawings

Inspections, tests, administrative controls, and training necessary for compliance with § 50.63 should be prescribed by documented instructions, procedures, and drawings and should be accomplished in accordance with these documents.

3. Control of Purchased Material, Equipment, and Services

Measures should be established to ensure that purchased material, equipment, and services conform to the procurement documents.

4. Inspection

A program for independent inspection of activities required to comply with § 50.63 should be established and executed by (or for) the organization performing the activity to verify conformance with documented installation drawings and test procedures for accomplishing the activities.

5. Testing and Test Control

A test program should be established and implemented to ensure that testing is performed and verified by inspection and audit to demonstrate conformance with design and system readiness requirements. The tests should be performed in accordance with written test procedures; test results should be properly evaluated and acted on.

6. Inspection, Test, and Operating Status

Measures should be established to identify items that have satisfactorily passed required tests and inspections.

7. Nonconforming Items

Measures should be established to control items that do not conform to specified requirements to prevent inadvertent use or installation.

8. Corrective Action

Measures should be established to ensure that failures, malfunctions, deficiencies, deviations, defective components, and nonconformances are promptly identified, reported, and corrected.

9. Records

Records should be prepared and maintained to furnish evidence that the criteria enumerated above are being met for activities required to comply with § 50.63.

10. Audits

Audits should be conducted and documented to verify compliance with design and procurement documents, instructions, procedures, drawings, and inspection and test activities developed to comply with § 50.63.

APPENDIX B

GUIDANCE REGARDING SYSTEM AND STATION EQUIPMENT SPECIFICATIONS

	Alternate AC Sources	Alternate Battery Systems
Safety-Related Equipment (Compliance with IEEE-279)	Not required, but the existing Class 1E electrical systems must continue to meet all applicable safety-related criteria.	Not required, but the existing Class 1E battery systems must continue to meet all applicable safety-related criteria.
Redundancy	Not required.	Not required.
Diversity from Existing EDGs	See Regulatory Position 3.3.5 of this guide.	Not required.
Independence from Existing Safety-Related Systems	Required if connected to Class 1E buses. Separation to be provided by 2 circuit breakers in series (1 Class 1E at the Class 1E bus and 1 non-Class 1E).	Required if connected to Class 1E battery systems. Separation to be provided by 2 circuit breakers in series (1 Class 1E at the Class 1E bus and 1 non-Class 1E).
Seismic Qualification	Not required.	Not required.
Environmental Consideration	If normal cooling is lost, needed for station blackout event only and not for design basis accident (DBA) conditions. Procedures should be in place to effect the actions necessary to maintain acceptable environmental conditions for the required equipment. See Regulatory Position 3.2.4.	If normal cooling is lost, needed for station blackout event only and not for accident conditions. Procedures should be in place to effect the actions necessary to maintain acceptable environmental conditions for the required equipment. See Regulatory Position 3.2.4.
Capacity	Specified in § 50.63 and Regulatory Position 3.3.5.	Specified in § 50.63 and Regulatory Position 3.3.1.
Quality Assurance	Indicated in Regulatory Position 3.5.	Indicated in Regulatory Position 3.5.
Technical Specification for Maintenance, Limiting Condition, FSAR, etc.	Should be consistent with the Interim Commission Policy Statement on Technical Specifications (Federal Register Notice 52 FR 3789) as applicable.	Should be consistent with the Interim Commission Policy Statement on Technical Specifications (Federal Register Notice 52 FR 3789) as applicable.
Instrumentation and Monitoring	Must meet system functional requirements.	Must meet system functional requirements.
Single Failure	Not required.	Not required.
Common Cause Failure (CCF)	Design should, to the extent practicable, minimize CCF between safety-related and non-safety-related systems.	Design should, to the extent practicable, minimize CCF between safety-related and non-safety-related systems.

APPENDIX B (Continued)

	Water Source (Existing Condensate Storage Tank or Alternative)	Instrument Air (Compressed Air System)	Water Delivery System (Alternative to Auxiliary Feedwater System, RCIC System, or Isolation Condenser Makeup)
Safety-Related Equipment (Compliance with IEEE-279)	Not required, but the existing Class 1E systems must continue to meet all applicable safety-related criteria.	Not required, but the existing Class 1E systems must continue to meet all applicable safety-related criteria.	Not required, but the existing Class 1E systems must continue to meet all applicable safety-related criteria.
Redundancy	Not required.	Not required.	Not required.
Diversity	Not required.	Not required.	Not required.
Independence from Safety-Related Systems	Ensure that the existing safety functions are not compromised, including the capability to isolate components, subsystems, or piping, if necessary.	Ensure that the existing safety functions are not compromised, including the capability to isolate components, subsystems, or piping, if necessary.	Ensure that the existing safety functions are not compromised, including the capability to isolate components, subsystems, or piping, if necessary.
Seismic Qualification	Not required.	Not required.	Not required.
Environmental Consideration	Need for station blackout event only and not for DBA conditions. See Regulatory Position 3.2.4. Procedures should be in place to effect the actions necessary to maintain acceptable environmental conditions for required equipment.	Needed for station blackout event only and not for DBA conditions. See Regulatory Position 3.2.4. Procedures should be in place to effect the actions necessary to maintain acceptable environmental conditions for required equipment.	Needed for station blackout event only and not for DBA conditions. See Regulatory Position 3.2.4. Procedures should be in place to effect the actions necessary to maintain acceptable environmental conditions for required equipment.
Capacity	Capability to provide sufficient water for core cooling in the event of a station blackout for the specified duration to meet § 50.63 and this regulatory guide.	Sufficient compressed air to components, as necessary, to ensure that the core is cooled and appropriate containment integrity is maintained for the specified duration of station blackout to meet § 50.63 and this regulatory guide.	The capacity to provide sufficient cooling water flow to ensure that the core is cooled in the event of a station blackout for the specified duration to meet § 50.63 and this regulatory guide.
Quality Assurance	As indicated in Regulatory Position 3.5.	As indicated in Regulatory Position 3.5.	As indicated in Regulatory Position 3.5.
Technical Specifications for Maintenance, Surveillance, Limiting Condition, FSAR, etc.	Should be consistent with the Interim Commission Policy Statement on Technical Specifications (Federal Register Notice 52 FR 3789) as applicable.	Should be consistent with the Interim Commission Policy Statement on Technical Specifications (Federal Register Notice 52 FR 3789) as applicable.	Should be consistent with the Interim Commission Policy Statement on Technical Specifications (Federal Register Notice 52 FR 3789) as applicable.
Instrumentation and Monitoring	Must meet system functional requirements.	Must meet system functional requirements.	Must meet system functional requirements.
Single Failure	Not required.	Not required.	Not required.

	Water Source (Existing Condensate Storage Tank or Alternative)	Instrument Air (Compressed Air System)	Water Delivery System (Alternative to Auxiliary Feedwater System, RCIC System, or Isolation Condenser Makeup)
Common Cause Failure (CCF)	Design should, to the extent practicable, minimize CCF between safety-related and non-safety-related systems.	Design should, to the extent practicable, minimize CCF between safety-related and non-safety-related systems.	Design should, to the extent practicable, minimize CCF between safety-related and non-safety-related systems.

	RCS Makeup System (PWRs and BWRs Without RCIC)	Isolation Condenser (BWRs Without RCIC)	Instrumentation and Control Room Indications for Verification of RCS Natural Circulation (PWRs and BWRs Without RCIC)
Safety-Related Equipment (Compliance with IEEE-279)	Not required, but the existing Class 1E systems must continue to meet all applicable safety-related criteria.	Not required, but the existing Class 1E systems must continue to meet all applicable safety-related criteria.	Not required, but the existing Class 1E systems must continue to meet all applicable safety-related criteria.
Redundancy	Not required.	Not required.	Not required.
Diversity	Not required.	Not required.	Not required.
Independence from Safety-Related Systems	1. Safety-grade isolation devices required between this RCS makeup system and existing safety-related makeup water systems. 2. A malfunction of this non-safety-grade makeup system should not affect the design safety function of any safety-related systems.	1. Safety-grade isolation devices required between this system and existing safety-related systems. 2. A malfunction of this non-safety-related system should not affect the design safety function of any safety-related systems.	A malfunction of this instrumentation and monitoring system should not affect the design safety function of any safety-related instrumentation and monitoring systems powered by onsite or offsite ac power buses.
Seismic Qualification	Not required.	Not required.	Not required.
Environmental Consideration	Needed for station blackout event only and not for DBA conditions if normal cooling is lost. See Regulatory Position 3.2.4. Procedures should be in place to effect the actions necessary to maintain acceptable environmental conditions for the required equipment.	Needed for station blackout event only and not for DBA conditions if normal cooling is lost. See Regulatory Position 3.2.4. Procedures should be in place to effect the actions necessary to maintain acceptable environmental conditions for the required equipment.	Needed for station blackout event only and not for DBA conditions if normal cooling is lost. See Regulatory Position 3.2.4. Procedures should be in place to effect the actions necessary to maintain acceptable environmental conditions for the required equipment.
Capacity	Sufficient RCS makeup so that core temperatures are maintained at acceptably low values considering a loss of RCP water inventory through a postulated RCP seal failure during the specified duration of station blackout, with a minimum assumed RCP seal leakage of 20 gpm per RCP, unless a lower value is justified.	Provide sufficient capacity for decay heat removal. During the specified duration of station blackout, the isolation condenser pool side requires a water makeup system powered by sources independent from onsite and offsite ac buses.	Provide sufficient instrumentation and control room indications for parameters required for verification of RCS natural circulation during the specified duration of station blackout.
Quality Assurance	As indicated in Regulatory Position 3.5.	As indicated in Regulatory Position 3.5.	As indicated in Regulatory Position 3.5.

	RCS Makeup System (PWRs and BWRs Without RCIC)	Isolation Condenser (BWRs Without RCIC)	Instrumentation and Control Room Indications for Verification of RCS Natural Circulation (PWRs and BWRs Without RCIC)
Technical Specifications for Maintenance, Surveillance, Limiting Condition, FSAR, etc.	Should be consistent with the Interim Commission Policy Statement on Technical Specifications (Federal Register Notice 52 FR 3789) as applicable.	Should be consistent with the Interim Commission Policy Statement on Technical Specifications (Federal Register Notice 52 FR 3789) as applicable.	Should be consistent with the Interim Commission Policy Statement on Technical Specifications (Federal Register Notice 52 FR 3789) as applicable.
Instrumentation and Monitoring	Must meet system functional requirements.	Must meet system functional requirements.	---
Single Failure	Not required.	Not required.	Not required.
Common Cause Failure (CCF)	Design should, to the extent practicable, minimize CCF between safety-related and non-safety-related systems.	Design should, to the extent practicable, minimize CCF between safety-related and non-safety-related systems.	Design should, to the extent practicable, minimize CCF between safety-related and non-safety-related systems.

*U.S. GOVERNMENT PRINTING OFFICE: 1988-202-292:80149

REGULATORY ANALYSIS

A separate regulatory analysis was not prepared for this regulatory guide. The regulatory analysis prepared for the station blackout rule, NUREG-1109, "Regulatory/Backfit Analysis for the Resolution of Unresolved Safety Issue A-44, Station Blackout," provides the regulatory basis for this guide and examines the costs and benefits of the rule as implemented by the guide. A copy of NUREG-1109 is available for inspection and copying for a fee at the NRC Public Document Room, 1717 H Street NW., Washington, DC 20555. Copies of NUREG-1109 may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Post Office Box 37082, Washington, DC 20013-7082; or from the National Technical Information Service, Springfield, VA 22161.

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

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

FIRST CLASS MAIL
POSTAGE & FEES PAID
USNRC

PERMIT No. G-67