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(Formerly NUREG-75/087)

U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

8.2 OFFSITE POWER SYSTEM

REVIEW RESPONSIBILITIES

Primary - ~~Power Systems~~ Electrical Engineering Branch (~~PSB~~EELB)[1]

Secondary - None

I. AREAS OF REVIEW

The descriptive information, analyses, and referenced documents, including electrical single-line diagrams, electrical schematics, logic diagrams, tables, and physical arrangement drawings for the offsite power systems, presented in the applicant's safety analysis report (SAR), are reviewed. The objective of the review is to determine that this system satisfies the requirements of ~~GDC~~ General Design Criteria[2] 5, 17, and 18, and will perform its design functions during all plant operating and accident conditions. If/when provided, the alternate ac (AAC) power source for safe shutdown [non-design basis accident (non-DBA)] in the event of a station blackout is also reviewed with respect to its adequacy and independence from the offsite and onsite power systems. The AAC source may be located at or nearby the plant.[3]

The offsite power system is referred to in industry standards and regulatory guides as the "preferred power system." It includes two or more physically independent circuits capable of operating independently of the onsite standby power sources and encompasses the grid, transmission lines (overhead or underground), transmission line towers, transformers, switchyard components and control systems, switchyard battery systems, the main generator, and disconnect switches provided to supply electric power to safety-related and other equipment.

The PSBEELB[4] will review the following features of the preferred power systems during both the construction permit (CP) and operating license (OL) stages of the licensing process:

1. The preferred power system arrangement is reviewed to determine that the required minimum of two separate circuits from the transmission network to the onsite distribution system is provided. In determining the adequacy of this system, the independence of the two (or more) circuits is examined to see that both electrical and physical separation exists so as to minimize the chance of simultaneous failure. This includes a review of the assignment of power sources from the grid, location of rights-of-way, transmission lines and towers, transformers, switchyard interconnections (breakers and bus arrangements), switchyard control systems and power supplies, location of switchgear (in-plant), interconnections between switchgear, cable routings, main generator disconnect, and[5] the disconnect control system and power supply, and generator circuit breakers/load break switches.

2. The independence of the preferred power system is evaluated with respect to the onsite power system and any AAC power source provided for station blackout is evaluated.[6] The scope of review extends to the safety-related distribution system buses that are capable of being powered by standby power sources. It does not include the supply breakers of the safety-related distribution system buses. This evaluation will include a review of the electrical protective relaying and breaker control circuits and power supplies to assure ensure[7] that loss of one preferred system circuit will not cause or result in loss of the redundant counterpart, nor any AAC power source or[8] standby power source.

3. Design information and analyses demonstrating the suitability of the power sources from the grid, including transmission lines, breakers, and transformers used for supplying preferred power from distant sources, are reviewed to assure ensure that each path has sufficient capacity and capability to perform its intended function. This will require examination of loads required to be powered for each plant operating conditions;[9] continuous and fault ratings of breakers, transformers, and transmission lines; loading, unloading, and transfer effects on equipment; and power capacity available from each source.

4. The instrumentation required for monitoring and indicating the status of the preferred power system is reviewed to assure ensure that any change in the preferred power system which would prevent it from performing its intended function will be immediately identified by the control room operator. Also, all instrumentation for initiating safety actions associated with the preferred power system is reviewed.

5. The capability to test the preferred power system is reviewed.

6. Environmental conditions such as those resulting from floods, hurricanes, high and low atmospheric temperatures, rain, snow, and ice are considered in the review of the preferred power system to determine any effects on function.

7. Quality group classifications of equipment of the preferred power system are reviewed.

8. In accordance with Appendix B (attached to this SRP section), the design of the AAC power source is reviewed to verify that it conforms to the guidelines of Regulatory Guide 1.155 for satisfying the requirements of 10 CFR 50.63.[10]

<u>Review Interfaces</u>[11]

EELB also performs the following reviews under the SRP sections indicated:

1. Reviews the adequacy of the onsite power system, including standby emergency ac power sources, safety-related ac distribution systems, station batteries and associated dc systems, and instrumentation and control power systems, as part of its primary review responsibility for SRP Sections 8.3.1 and 8.3.2.[12]

2. In accordance with SRP Section 8.4 (proposed), the overall compliance with 10 CFR 50.63 requirements is reviewed including the adequacy of the station blackout analysis, the adequacy of reliability targets for onsite ac sources (diesel generators), the duration for which the plant will be able to withstand or cope with, and recover from a station blackout event, and the adequacy of dc system power supplies (e.g., batteries and chargers) that are not a part of the onsite dc power system reviewed under SRP Section 8.3.2 with respect to the specified station blackout event/duration.[13]

In the review of other areas associated with the offsite power system, the ~~PSB~~EELB[14] will coordinate other branches' evaluations that interface with the overall review of the system, as follows:

1.[15] The Reactor Systems Branch (~~RSB~~SRXB[16]) determines those system components requiring electric power as a function of time for each mode of reactor operation and accident condition as part of its primary review responsibility for SRP Sections 4.6, 5.4.6, 5.4.7, 5.4.12, ~~and~~ 6.3, and 9.3.5.[17]

2. The ~~Auxiliary~~Plant Systems Branch (~~ASB~~SPLB[18]) determines those system components requiring electric power as a function of time for each mode of reactor operation and accident condition as part of its primary review responsibility for SRP Sections 6.5.1, 6.7, 9.1.3, 9.1.4, ~~9.2~~9.2.1, 9.2.2, 9.2.4, 9.2.5, 9.2.6, ~~9.3~~9.3.1, 9.3.3, 9.4.1 through 9.4.5, 9.5.1, 10.4.5, 10.4.7, and 10.4.9.[19]

3. The ~~ASB~~SPLB[20] also verifies, on request, the adequacy of those auxiliary systems required for the proper operation of the preferred power system. These include such systems as heating and ventilation systems for switchgear in the circuits from the preferred power sources to the onsite power distribution system buses and main generator auxiliary systems such as the cooling water system, hydrogen cooling system, turbine electro-hydraulic control system[21], and air supply system.

4. The ~~ASB~~SPLB[22] verifies, on request, the physical arrangements of components and structures of the preferred power system to ~~assure~~ ensure that the paths from the preferred power sources to the standby power distribution system buses will not experience simultaneous failure under operating or postulated accident environmental

conditions. This includes the effects of floods, missiles, pipe whipping, and discharging fluids that result from equipment failures.

5. The SPLB examines fire detection and firefighting systems in preferred power system areas to ensure that the adverse effects of fire are minimized as part of its primary review responsibility for SRP Section 9.5.1. The SPLB review includes evaluation of the adequacy of fire protection provided for redundant power supplies and circuits.[23]

6. The Materials and Chemical Engineering Branch (EMCB) determines those system components requiring electric power as a function of time for each mode of reactor operation and accident condition as part of its primary review responsibility for SRP Sections 5.4.8, 9.2.3, 9.3.2, and 9.3.4.[24]

7. The ~~Environmental and Hydrologic Engineering~~Civil Engineering and Geosciences Branch (~~EHEB~~ECGB[25]) provides, on request, the information necessary to assess the effects of environmental conditions (i.e., high and low atmospheric temperature, high winds, rain, ice, and snow) on the preferred power system.

8. The Instrumentation and Controls~~ Systems~~ Branch (~~ICSB~~HICB[26]) determines those system components requiring electric power as a function of time for each mode of reactor operation and accident condition as part of its primary review responsibility for SRP Sections 7.2 through 7.7. The ~~ICSB~~HICB[27] also verifies, on request, the adequacy of the preferred power system instrumentation and controls.

~~The reviews for technical specifications and quality assurance including periodic testing, are coordinated and performed by the Standardization and Special Projects Branch and Quality Assurance Branch as part of their primary review responsibility for SRP Sections 16.0 and 17.0, respectively.~~[28]

9.[29] The Technical Specifications Branch (TSB) coordinates and performs reviews of technical specifications as part of its primary review responsibility for SRP Section 16.0.[30]

10. The Containment Systems and Severe Accident Branch (SCSB)[31] determines those system components requiring electric power as a function of time for each mode of reactor operation and accident condition as part of its primary review responsibility for SRP Sections 6.2.2, 6.2.3,[32] 6.2.4, and 6.2.5.

~~The Effluent Treatment Plant Systems Branch (ETSB) determines those system components requiring electric power as a function of time for each mode of reactor operation and accident condition as part of its primary review responsibility for SRP Section 6.5.1.~~[33]

11. The ~~Procedures and Test Review~~Quality Assurance and Maintenance Branch (~~PTRB~~HQMB[34]) determines the acceptability of the preoperational and initial startup ~~and test~~tests and programs as part of its primary review responsibility for SRP Section 14.~~0~~2.[35]

12. The HQMB reviews the adequacy of administrative, maintenance, testing, and operating procedure programs as part of its primary review responsibility for SRP Sections 13.5.1.2 and 13.5.2.2. The reviews of design, construction, and operations phase quality assurance programs, including the general methods for addressing periodic testing, maintenance, and reliability assurance, are also coordinated and performed by the HQMB as part of its primary review responsibility for SRP Chapter 17.[36]

~~The Chemical Engineering Branch (CMEB) examines the fire detection and fire fighting systems in the preferred power system areas to assure that adverse effects of fire are minimized as part of its primary review responsibility for SRP Section 9.5.1. This includes the adequacy of protection provided redundant power circuits to determine that a single design basis fire will not disable all onsite and offsite power supply circuits to the onsite distribution system.~~[37]

13. The Human Factors Assessment Branch (HHFB), as part of its primary review responsibility for SRP Sections 13.5.1.1 and 13.5.2.1, reviews the adequacy of administrative, maintenance, testing, and operating procedure programs.[38]

For those areas of review identified ~~above~~ as being ~~reviewed as~~ part of the review under other SRP sections ~~primary review responsibility of other branches~~, the acceptance criteria necessary for the review and the~~ir~~ methods of application are contained in the referenced SRP sections ~~of the corresponding primary branch~~.[39]

II. ACCEPTANCE CRITERIA

In general, the preferred power system is acceptable when it can be concluded that two separate circuits from the transmission network to the onsite Class 1E power distribution system are provided,[40] adequate physical and electrical separation exists, and the system has the capacity and capability to supply power to all safety loads and other required equipment.

Table 8-1 of SRP Section 8.1[41] lists General Design Criteria, regulatory guides, standards, and ~~staff~~branch[42] technical positions utilized as the bases for arriving at this conclusion.

The ~~PSB~~EELB[43] acceptance criteria for the integrated design of the offsite power system are based on meeting the relevant requirements and guidelines of the following:

1. General Design Criterion 5 (GDC 5)[44] as it relates to sharing of structures, systems, and components of the preferred power systems; and guidelines of Regulatory Guide 1.32 as related to its endorsement of Section 8.1 of IEEE ~~Standard~~Std 308~~-1974~~ (Reference 21),[45] relating to sharing of structures, systems, and components of the preferred offsite power system.

2. General Design Criterion 17 (GDC 17)[46] as it relates to the preferred power system's (i) capacity and capability to permit functioning of structures, systems, and components important to safety; (ii) provisions to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit or loss of power from the onsite electric power supplies; (iii) physical independence; (iv) availability and the guidelines of Regulatory

Guide 1.32 (see also IEEE Std 308-1974[47]) as related to the availability and number of immediate access circuits from the transmission network; and (v) capability to meet the guidelines of Appendix A to SRP Section 8.2 as related to acceptability of generator circuit breakers and generator load break switches.

For new applications, the design should provide at least one offsite circuit to each redundant safety division that is supplied directly from an offsite power source with no intervening nonsafety buses, thereby permitting the offsite source to supply power for safety buses in the event the nonsafety bus(es) fail. The design should also include an alternate power source to nonsafety loads, unless it can be demonstrated that existing design margins will result in transients for loss of nonsafety power events that are no more severe than those associated with the turbine-trip-only event specified in plant designs. These issues are reviewed in detail in SRP Section 8.3.1.[48]

3. General Design Criterion 18 (GDC 18)[49] as it relates to the offsite power system.

4. The design requirements for an offsite power supply for systems covered by General Design Criteria 33, 34, 35, 38, 41, and 44 are encompassed in ~~General Design Criterion~~ GDC 17.

5. 10 CFR 50.63 as it relates to an AAC power source (as defined in 10 CFR 50.2) provided for safe shutdown (non-DBA) in the event of a station blackout, and the guidelines of Regulatory Guide 1.155 as they relate to the adequacy of the AAC source and the independence of the AAC power source from the offsite power system and onsite power system and sources.

For new applications, an adequate AAC source of diverse design (with respect to ac onsite emergency sources) that is consistent with the guidance in Regulatory Guide 1.155 must be provided, with sufficient capacity and capability for powering at least one complete set of normal safe shutdown loads.[50]

<u>Technical Rationale</u>[51]

The technical rationale for application of these acceptance criteria to reviewing offsite power systems is discussed in the following paragraphs:[52]

1. Compliance with GDC 5 requires that structures, systems, and components important to safety shall not be shared among nuclear power units, unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units.

This criterion requires that component parts of the offsite power system not be shared among units without sufficient justification, thereby ensuring that an accident in one unit of a multiple-unit facility can be mitigated using an available compliment of mitigative features, including required ac power, irrespective of conditions in the other units and without giving rise to conditions unduly adverse to safety in another unit. SRP

Section 8.2 cites Regulatory Guide 1.32 to establish acceptable guidance related to the sharing of structures, systems, and components of the preferred offsite power system.

Meeting the requirements of GDC 5 provides assurance that an accident within any one unit of a multiple-unit plant may be mitigated irrespective of conditions in other units without affecting the overall operability of the offsite power system.[53]

2. Compliance with GDC 17 requires that onsite and offsite electrical power be provided to facilitate the functioning of structures, systems, and components important to safety. Each electric power system, assuming the other system is not functioning, must provide sufficient capacity and capability to ensure that specified acceptable fuel design limits and the design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and that the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents.

GDC 17 further requires that electric power from the transmission network to the onsite electric distribution system be supplied by two physically independent circuits designed and located so as to minimize the likelihood of their simultaneous failure under operating, postulated accident, and postulated environmental conditions. Each of these circuits is required to be designed to be available in sufficient time following a loss of all onsite alternating current power supplies and the other offsite electric power circuit, to assure that specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. One of these circuits is also required to be designed to be available within a few seconds following a loss-of-coolant accident to assure that core cooling, containment integrity, and other vital safety functions are maintained.

Provisions must also be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies.

GDC 17 also requires that the onsite power supplies and the onsite electrical distribution system have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure. Therefore, no single failure will prevent the onsite power system from supplying electric power, thereby permitting safety functions and other vital functions requiring electric power to be performed in the event of any single failure in the power system.

SRP Section 8.2 cites IEEE Std 308 as modified/supplemented by the regulatory positions of Regulatory Guide 1.32 as establishing acceptable guidance for meeting the requirements of GDC 17.

Meeting the requirements of GDC 17 provides assurance that a reliable electric power supply will be provided for all facility operating modes, including anticipated operational occurrences and design basis accidents to permit safety functions and other vital functions to be performed, even in the event of a single failure.[54]

3. Compliance with GDC 18 requires that electric power systems important to safety be designed to permit appropriate periodic inspection and testing of key areas and features to assess their continuity and the condition of their components. These systems shall be designed to test periodically (1) the operability and functional performance of the components of the systems, such as onsite power sources, relays, switches, and buses, and (2) the operability of the systems as a whole and, under conditions as close to design as practical, the full operation sequence that brings the systems into operation, including operation of applicable portions of the protection system, and the transfer of power among the nuclear power unit, the offsite power system, and the onsite power system.

   This criterion requires that the ac power system provide the capability to perform integral testing on a periodic basis.

   Meeting the requirements of GDC 18 provides assurance that, when required, offsite power systems can be appropriately and unobtrusively accessed for required periodic inspection and testing, enabling verification of important system parameters, performance characteristics, and features and detection of degradation and/or impending failure under controlled conditions.[55]

4. General Design Criteria 33, 34, 35, 38, 41, and 44 set forth requirements for the safety systems for which the access to both offsite and onsite power sources must be provided. Compliance with these criteria requires that capability be provided for reactor coolant makeup during small breaks, residual heat removal, emergency core cooling, containment heat removal, containment atmosphere cleanup, and cooling water for structures, systems, and components important to safety. These systems must be available during normal and accident conditions, as required by the specific system.

   General Design Criteria 34, 35, 38, 41, and 44 require that safety system redundancy shall be such that, for preferred power system operation (if standby power is not available), the system safety function can be accomplished assuming a single failure. GDC 33 requires that system design shall be such that, for preferred power system operation (if standby power is not available), the system safety function can be accomplished using the piping, pumps, and valves to maintain coolant inventory during normal reactor operations. For the offsite power system, these requirements are met if the minimum design required by GDC 17 is provided.

   Meeting the requirements of these criteria as encompassed by GDC 17 provides assurance that required electric power will be provided for all facility operating modes, including transients and design basis accidents so that the safety functions required in these criteria may be performed, even in the event of any single failure.[56]

5. Compliance with 10 CFR 50.63 requires that each light-water-cooled nuclear power plant be able to withstand or cope with, and recover from a station blackout. As required by 10 CFR 50.63, electrical systems that are necessary support systems for station blackout must be of sufficient capability and capacity to ensure that core cooling and appropriate containment integrity are maintained in the event of a station blackout. One acceptable means of complying with 10 CFR 50.63 requirements involves the provision of an

alternate ac (AAC) source (as defined in 10 CFR 50.2) of sufficient capacity, capability, and reliability for operation of all systems required for coping with station blackout and for the time required to bring and maintain the plant in safe shutdown (non-design basis accident) that will be available on a sufficiently timely basis.

10 CFR 50.63 also requires (through citation of the definition of AAC source in 10 CFR 50.2) minimum potential for common mode failure (i.e., acceptable independence) between any AAC power source used for station blackout and the offsite power system or onsite power sources. Electrical ties between these systems, as well as the physical arrangement of their interface equipment, must not prevent the use of any AAC power source during loss of the offsite power system and/or onsite power sources. It is also important that provisions for an AAC source will not adversely affect performance of offsite or onsite power system functions. AAC power sources located at or near the plant should conform to guidance provided in Regulatory Guide 1.155 concerning their capacity, capability, and physical independence from onsite safety-related systems and the preferred power system.

Meeting the requirements of 10 CFR 50.63 provides assurance that the nuclear power plant will be able to withstand or cope with, and recover from a station blackout and will ensure that core cooling and appropriate containment integrity are maintained.[57]

III. REVIEW PROCEDURES

The primary objective in the review of the preferred power system is to determine that this system satisfies the acceptance criteria stated in subsection II and will perform its design functions during plant normal operation, anticipated operational occurrences, and accident conditions. In the CP review, the descriptive information, including the design bases and their relation to the acceptance criteria, preliminary analyses, electrical single-line diagrams, and preliminary physical arrangement and layout drawings, are examined to determine that the final design will meet this objective if properly implemented. During the OL review, this objective is verified by examination of final electrical schematics, physical arrangement and layout drawings, and equipment ratings identified in the SAR and confirmed during a visit to the site (SRP ~~Section 8.1~~ Chapter 8,[58] Appendix 8-B). To ~~assure~~ ensure that acceptance criteria stated in subsection II are satisfied, the review of the proposed design is performed as described below.

The primary reviewer will coordinate this review with the other branch areas of review as stated in subsection I. The primary reviewer obtains and uses such input as required to ~~assure~~ ensure that this review procedure is complete.

1. To ~~assure~~ verify that the requirements of ~~General Design Criterion~~ GDC 17 are satisfied, the following review steps should be taken ~~(as applicable for a CP or OL review)~~[59]:

    (a) The electrical drawings should be examined to ~~assure~~ ensure that at least two separate circuits from the transmission network to the onsite power distribution system buses are provided (a single switchyard may be common to these paths).

For new applications, the design should include at least one offsite circuit to each redundant safety division that is supplied directly from an offsite power source with no intervening nonsafety buses, thereby permitting the offsite source to supply power for safety buses in the event the nonsafety bus(es) fail. See SRP Section 8.3.1 for further details.[60]

For new applications, the electrical drawings should also be examined to ensure that the design includes an alternate power source to nonsafety loads, unless it is demonstrated that existing design margins will result in transients for loss of nonsafety power events that are no more severe than those associated with the turbine-trip-only event specified in plant designs. See SRP Section 8.3.1 for further details.[61]

(b) The routing of transmission lines should be examined on the station layout drawings and verified during the site visit to ~~assure~~ ensure that at least two ~~independent~~[62] circuits from the offsite grid to the onsite distribution buses are physically separate and independent. No other lines should cross above these two circuits. Attention should be directed toward~~s assuring~~ ensuring that no single event such as a tower falling or a line breaking can simultaneously affect both circuits in such a way that neither can be returned to service in time to prevent fuel design limits or design conditions of the reactor coolant pressure boundary from being exceeded. In addition, if an AAC source is provided for station blackout, the reviewer should verify that no single-point vulnerability exists whereby a weather-related event could disable any portion of the preferred power sources and simultaneously cause failure to supply AAC power.[63]

(c) As the switchyard may be common to both offsite circuits, the electrical schematics of the switchyard breaker control system, its power supply and the breaker arrangement itself should be examined for the possibility of simultaneous failure of both circuits from single events such as a breaker not operating during fault conditions, spurious relay trip, loss of a control circuit power supply, or a fault in a switchyard bus or transformer.

(d) The design is examined to determine that at least one of the two required circuits can, within a few seconds, provide power to safety-related equipment following a loss-of-coolant accident. ~~General Design Criterion~~GDC 17 does not require these circuits in themselves to be single-failure-proof for this accident. However, it is required that each circuit have the capability to be available in sufficient time to prevent fuel design limits and design conditions of the reactor coolant pressure boundary from being exceeded. Therefore, the design is examined to determine that the period of time that the station can remain in a safe condition assuming no ac power is available is greater than the time required to reestablish ac power from the offsite grid to the onsite Class 1E distribution buses for each single failure event.

The switchyard circuit breaker control scheme should be such that any incoming transmission line, switchyard bus, or any path to the onsite safety-related distribution buses can be isolated so that ac power can be reestablished to the onsite Class 1E buses through its redundant counterpart. This should be achieved with separate and redundant breaker tripping and closing devices that are actuated by redundant dc battery supplies. Air stored under pressure in accumulators or spring energy should be used to open and/or close breakers independent of ac power.

For those designs that utilize a backfeed path through the main generator step-up transformer, the reviewer must first ascertain if this path is required to satisfy the GDC 17 requirement for an immediate or delayed access circuit. If the circuit is for delayed access only, then the same determination (as discussed in the previous paragraph) must be made, i.e., there is sufficient time to make this circuit available (assuming the availability of the grid itself but the unavailability of the immediate access circuit and the onsite power supplies) such that the reactor remains in a safe condition. If the circuit is required for immediate access or utilizes generator circuit breakers or generator load break switches, then the reviewer should use the guidelines contained in Appendix A to this SRP section.

(e) Each of the circuits from the offsite system to the onsite distribution buses should have the capacity and capability to supply the loads assigned to the bus or buses it is connected to during normal or abnormal operating conditions, accident conditions, or plant shutdown conditions. Therefore, the loads to be supplied during these conditions should be determined from information obtained in coordination with other branches. The capacity and electrical characteristics of transformers, breakers, buses, transmission lines, and the preferred power source for each path should be evaluated to ~~assure~~ ensure that there is adequate capability to supply the maximum connected load during all plant conditions. The design should also be examined to ~~assure~~ ensure that during transfer from one power source to another the design limits of equipment are not exceeded.

(f) The results of the grid stability analysis must show that loss of the largest single supply to the grid does not result in the complete loss of preferred power. The analysis should consider the loss, through a single event, of the largest capacity being supplied to the grid, removal of the largest load from the grid, or loss of the most critical transmission line. This could be the total output of the station, the largest station on the grid, or possibly several large stations if these use a common transmission tower, transformer, or a breaker in a remote switchyard or substation. The station layout and the grid system layout drawings are reviewed to determine that all the above events were included in the analysis. Branch Technical Position ICSB-11 (PSB) provides further information regarding stability studies of offsite power systems.[64]

The applicant should include in the grid stability analysis the consideration of failure modes that could result in frequency variations exceeding the maximum rate of change determined in the accident analysis for loss of reactor coolant flow.

(g) During the review of the electrical schematics, it should be determined that loss of standby power will not result in loss of preferred power, loss of one preferred power circuit will not result in loss of the other circuit, and loss of the main generator will not result in loss of either preferred power circuit, and loss of any combination of these power sources will not prevent the use of AAC power.[65]

(h) The reviewer verifies that the preferred power system must be is independent of the onsite power system.[66] The basis for acceptance is that no single event, including a single protective relay, interlock, or switchgear failure, in the event of loss of all standby power sources, will prevent the separation of the preferred power system from the onsite power distribution system or prevent the preferred power system from accomplishing its intended functions. In addition, the preferred and standby power supplies should not have common failure modes. An acceptable design must be capable of restoring the preferred power supply after the loss of either circuit in a time period such that the plant can be safely shutdown, taking into account the effects of a single failure in the onsite distribution system. This item is also addressed in SRP Section 8.3.1.

(i) The reviewer verifies that adequate provisions are made in the design of the plant and the offsite and onsite power systems for grounding, surge protection, and lightning protection. The reviewer evaluates the plant/station grounding systems, the methods of equipment and structural grounding, ac power system neutral grounding and ground fault current limiting features, surge and lightning protection features for outdoor equipment and circuits, and the measures for isolation of instrumentation grounding systems. The EPRI Evolutionary Plant Utility Requirements Document, Chapter 11, Section 9 (Reference 22) provides acceptable guidelines for the design and performance of station grounding systems and surge and lightning protection systems.[67]

2. To assure ensure that the requirements of General Design Criterion GDC 18 are satisfied, the electrical schematics should be examined to determine that the design includes provisions for testing the transfer of power to the onsite distribution system from the main generator supply to the preferred power system, or to any other supply. It should also be established that the circuitry required to perform these transfer functions has the capability of being tested during plant operation[68]. PTRBHQMB[69] will review preoperational and initial startup test procedures. QABHQMB[70] will also[71] review the periodic test procedures.

3. General Design Criteria 33, 34, 35, 38, 41, and 44 set forth requirements for the safety systems whose source of power is the preferred power system. These criteria state that safety system redundancy shall be such that, for preferred power system operation (assuming standby power is not available), the system safety function can be accomplished assuming a single failure.

To assure ensure that these requirements of the General Design Criteria identified above are satisfied, the electrical schematics of the systems required for reactor coolant makeup, residual heat removal, emergency core cooling, containment heat removal, containment atmosphere cleanup, and cooling water should be examined to assure ensure that the circuits from the preferred power system can supply redundant portions of these systems. If the minimum design required by General Design Criterion GDC 17 is provided, the immediately available preferred circuit must be made available to the redundant portions of these systems.

4. It should be determined that all equipment from and including the switchyard to the onsite Class 1E system are is appropriately[72] included in the quality assurance program. The QABHQMB[73] will determine the adequacy of the quality assurance program.

5. To assure ensure that the requirements (excluding seismic, tornado, and floods) of General Design Criterion 2 (GDC 2)[74] are satisfied for the facility being considered, the Environmental and Hydrologic Engineering Branch (EHEBECGB)[75] will provide to PSBEELB[76] upon request information on the design basis, high and low atmospheric temperatures, high wind, rain, ice, and snow conditions. This information will be considered during the review to assure ensure that the design minimizes in accordance with GDC 17 the effects of these conditions. Items such as switchyard and transformer locations and associated transmission lines could be affected by these conditions.

6. To assure ensure that the requirements of General Design Criterion 4 are satisfied, the ASBSPLB,[77] on request, will review the location of structures, systems, and components of the preferred power system to determine the protection provided against dynamic effects, including effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the station. This information will be used to determine the possibility of simultaneous loss of both paths of preferred power.

7. To assure ensure that the requirements of General Design Criterion GDC 5 are satisfied, the structures, systems, and components of the preferred power systems will be examined to identify any that are shared between units of a multi-unit station. These will be reviewed to ascertain that they have sufficient capacity and capability of performing all required safety functions in the event of an accident in one unit, with a simultaneous orderly shutdown and cooldown of the remaining units. Review of the design criteria should establish that the capacity and capability of incoming lines, power sources, and transformers for each required circuit have margin to achieve this. Spurious or false accident signals should not overload these circuits. SRP Section 8.3.1[78] further discusses spurious or false accident signal considerations.

8. The preferred power system instrumentation provided to monitor variables and equipment status should be identified during the electrical schematic and system description review. It should be ascertained that these instruments present status information that can be used to determine the condition of the preferred power system at all times. Review of the electrical schematics should determine that controls (automatic, manual, or remote) are provided to maintain these variables and systems within prescribed operating ranges. It should also be determined during the review of the electrical schematics as to what effects failures of these controls and instruments might have on the preferred power system.

9. The review of any automatic load dispatch system should ascertain that load dispatch system actions (including normal and postulated failure modes of operation) will not interfere with safety actions that may be required of the reactor protection system. This system should also be reviewed to ~~assure~~ ensure that no failure mode of the load dispatch system will cause an incident at the generating station which would require protective action.

10. To verify that the relevant requirements of 10 CFR 50.63 are met, if an AAC source is proposed for safe shutdown in the event of a station blackout, the capacity, capability, reliability, and independence of the AAC power source is reviewed in accordance with Appendix B (attached to this SRP section).[79]

    For new applications, the reviewer verifies, using Appendix B of this SRP section, that the AAC for station blackout is of diverse design (with respect to onsite sources), is consistent with guidance in Regulatory Guide 1.155, has adequate capacity, and has capability for powering at least one complete set of normal safe shutdown loads.[80]

For standard design certification reviews under 10 CFR Part 52, the procedures above should be followed, as modified by the procedures in SRP Section 14.3 (proposed), to verify that the design set forth in the standard safety analysis report, including inspections, tests, analysis, and acceptance criteria (ITAAC), site interface requirements and combined license action items, meet the acceptance criteria given in subsection II. SRP Section 14.3 (proposed) contains procedures for the review of certified design material (CDM) for the standard design, including the site parameters, interface criteria, and ITAAC.[81]

IV. <u>EVALUATION FINDINGS</u>

The reviewer verifies that sufficient information has been provided and that the review supports conclusions of the following type, to be included in the staff's safety evaluation report:

> The offsite power system includes two or more identified circuits from the grid and its transmission lines[82] to the onsite distribution system. The review of the offsite power system for the ___________ plant covered single-line diagrams ~~(CP and OL)~~, station layout drawings ~~(CP and OL)~~ and schematic diagrams ~~(OL)~~[83], and descriptive information.
>
> The basis for acceptance of the offsite power system in our review was conformance of the design criteria and bases to the Commission's regulations as set forth in the General Design Criteria ~~(GDC)~~[84] of Appendix A to 10 CFR Part 50. The staff concludes that the plant design is acceptable and meets the requirements of ~~GDC~~ General Design Criteria[85] 5, 17, and 18; and [where applicable] also meets the requirements of 10 CFR 50.63 with regard to the alternate ac (AAC) power source provided for station blackout.[86] This conclusion is based on the following:
>
> 1. The applicant has met the requirements of GDC 5, "Sharing of Structures, Systems, and Components," with respect to sharing of circuits of the preferred

power system between units. Each circuit has sufficient capacity to operate the engineered safety features for a design basis accident on one unit and those systems required for concurrent safe shutdown on the remaining units.

2. The applicant has met the requirements of GDC 17, "Electric Power Systems," with respect to the offsite power system's (a) capacity and capability to permit functioning of structures, systems, and components important to safety; (b) provisions to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit or loss of power from the onsite electric power supplies; (c) physical independence of circuits; and (d) availability of circuits. The preferred power system consists of at least[87] two physically independent circuits routed from the electrical grid system by transmission lines to the onsite power distribution system. At least one circuit will be available within a few seconds following a loss of coolant accident and is considered an immediate access circuit. Each circuit is designed and located so as to minimize to extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. Each circuit has been sized with sufficient capacity to supply all connected loads. Each circuit can be made available to the onsite power system, assuming loss of the onsite ac standby power supplies and loss of the other offsite circuit, to ~~assure~~ ensure that fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. The switchyard is arranged such that each offsite circuit can be isolated from other circuits to permit reestablishment of offsite power to the onsite distribution system. The switchyard is also arranged such that single events (e.g., a spurious relay trip or a breaker not operating during fault conditions) will not cause simultaneous failure of all offsite circuits to the switchyard. The results of the applicant's grid stability analysis indicated that loss of the largest generating capacity being supplied to the grid, loss of largest load from the grid, loss of the most critical transmission line, or loss of the unit itself will not cause grid instability.

   This meets the guidelines of Regulatory Guide 1.32, "Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants."

3. The applicant has met the requirements of GDC 18, "Inspection and Testing of Electric Power Systems," with respect to the capability to test systems and associated components during normal plant operation[88] and the capability to test the transfer of power from the nuclear power unit, the offsite preferred power system, and the onsite power system.

4. The applicant's overall compliance with the requirements of 10 CFR 50.63 is discussed in Section 8.4 of the safety evaluation report (SER). (Use the following finding if an AAC source is proposed) The applicant has met the requirement of 10 CFR 50.63, "Loss of All Alternating Current Power," with respect to the adequacy of the AAC power source provided for safe shutdown (non-DBA) in the event of a station blackout and the independence of the AAC source from offsite

power systems and onsite power sources. In compliance with the relevant guidance of Regulatory Guide 1.155, the offsite AAC power source is located at or near the plant, has sufficient capacity, capability, and reliability to achieve and maintain safe shutdown (non-DBA), and is adequately independent from onsite safety-related and preferred power systems, and thus satisfies the definition for an acceptable AAC source as specified in 10 CFR 50.2.[89]

For design certification reviews, the findings will also summarize, to the extent that the review is not discussed in other safety evaluation report sections, the staff's evaluation of inspections, tests, analyses, and acceptance criteria (ITAAC), including design acceptance criteria (DAC), site interface requirements, and combined license action items that are relevant to this SRP section.[90]

V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP section.

This SRP section will be used by the staff when performing safety evaluations of license applications submitted by applicants pursuant to 10 CFR 50 or 10 CFR 52.[91] Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications docketed six months or more after the date of issuance of this SRP section.[92]

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guide, NUREG, and Revision O to Appendix A of this SRP section.

VI. REFERENCES

1. 10 CFR Part 50, §50.2, “Definitions.”[93]

2. 10 CFR Part 50, §50.63, "Loss of All Alternating Current Power."[94]

3. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."[95]

4. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Dynamic Effects Design Bases."[96]

~~1~~5.[97] 10 CFR Part 50, Appendix A, General Design Criterion 5, "Sharing of Structures, Systems, and Components."

~~2~~6. 10 CFR Part 50, Appendix A, General Design Criterion 17, "Electric Power Systems."

~~3~~7. 10 CFR Part 50, Appendix A, General Design Criterion 18, "Inspection and Testing of Electric Power Systems."

8. 10 CFR Part 50, Appendix A, General Design Criterion 33, "Reactor Coolant Makeup."[98]

9. 10 CFR Part 50, Appendix A, General Design Criterion 34, "Residual Heat Removal."[99]

10. 10 CFR Part 50, Appendix A, General Design Criterion 35, "Emergency Core Cooling."[100]

11. 10 CFR Part 50, Appendix A, General Design Criterion 38, "Containment Heat Removal."[101]

12. 10 CFR Part 50, Appendix A, General Design Criterion 41, "Containment Atmosphere Cleanup."[102]

13. 10 CFR Part 50, Appendix A, General Design Criterion 44, "Cooling Water."[103]

~~4~~14.[104] Regulatory Guide 1.32, "Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants."

15. Regulatory Guide 1.155, "Station Blackout."[105]

~~6~~16.[106] Branch Technical Position ICSB-11 (PSB), "Stability of Offsite Power Systems."

~~7~~17.[107] Standard Review Plan Section 8.1, Table 8-1, "Acceptance Criteria for Electric Power."

~~8~~18.[108] Standard Review Section 8.1, Appendix 8-B, "General Agenda, Station Site Visits."

~~9~~19.[109] Appendix A to SRP Section 8.2, "Guidelines for Generator Circuit Breakers/Load Break Switches."

20. Appendix B to SRP Section 8.2, "Guidelines for Review of Alternate AC Sources for Station Blackout at Nuclear Power Plants."[110]

~~5~~21.[111] IEEE Standard 308-1974,[112] "IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations."

22. EPRI ALWR Utility Requirements Document, Volume II, "Evolutionary Plants," Chapter 11, "Electric Power Systems," Revision 6, December 1993, Electric Power Research Institute.[113]

APPENDIX A to SRP Section 8.2

GUIDELINES FOR GENERATOR CIRCUIT BREAKERS/LOAD BREAK SWITCHES

A. Background

Generator circuit breakers have been used in recent nuclear generating station designs (McGuire, Catawba) as a means of providing immediate access of the onsite ac power systems to the offsite circuits by isolating the unit generator from the main step-up and unit auxiliary transformers and allowing backfeeding of power through these circuits to the onsite ac power system. Generator load break switches can be used as a means of providing access to the offsite circuits as described above, but only on a delayed basis. Since this is a new design feature, the staff made the use of generator circuit breakers and load break switches a generic item no. B-53. In the case of McGuire and Catawba, References 1, 2, and 3, an expert consultant was retained to evaluate the generator circuit breaker verification testing program and its results. These guidelines are formalization of the results of that extensive work. Also guidelines for the load break switches are incorporated, as these devices have some common functional requirements as generator breakers as described above.

The staff has made a determination that only devices which have the capability of interrupting the system maximum available fault current, i.e., circuit breakers will be approved as a means of isolating the unit generators from the offsite power system in order to provide immediate access in accordance with GDC 17. This is necessary because a non fault current interrupting device, i.e., load break switch, must delay its trip for electrical faults until the switchyard circuit breakers have interrupted the current. Following opening of the load break switch, the switchyard circuit breakers must then be reclosed to establish offsite power to the unit. A generator circuit breaker, however, could interrupt the fault current and isolate the unit generator at the same time, maintaining continuous power to the onsite ac power system.

B. Specific Guidelines

1. Only devices which have maximum fault current interrupting capability i.e., circuit breakers, can be used to isolate the unit generator from the offsite and onsite ac power systems in order to provide immediate access for the onsite ac power system to the offsite source. Generator load break switches can only be used for isolating the unit generator for the purpose of providing a delayed access offsite source.

2. Generator circuit breakers should be designed to perform their intended function during steady-state operation, power system transients and major faults; tests

should be performed on the circuit breaker to verify these capabilities. As a minimum, the following performance tests and capabilities should be demonstrated:

a. <u>Dielectric Tests</u>

The circuit breaker should be given dielectric strength tests in accordance with the requirements and ratings contained in the applicable ANSI C37 series standards (Ref~~s.~~erences[114] 4, 5, and 6).

b. <u>Load Current Switching</u>

For applications which use only one generator circuit breaker, the circuit breaker should be cycled through 40 load interruption operations (a lesser number requires suitable justification) at a current equal to the normal full load continuous current rating of the circuit breaker. For applications which utilize two generator circuit breakers in a parallel circuit, the circuit breaker should be given 40 load interruption operations (a lesser number requires suitable justification) at a current equal to <u>twice</u> the normal full load continuous current rating of the circuit breakers. The procedures and acceptance criteria utilized for this test should be based upon those given in ANSI C37.06 and C37.09.

c. <u>Fault Current Interrupting Capability</u>

The circuit breaker should have, as a minimum, the capability of interrupting the maximum asymmetrical and symmetrical fault current available at the instant of primary arcing contact separation. This current should be calculated by assuming a bolted three phase fault at a point on the system which causes the maximum amount of fault current flowing through the generator circuit breaker. The fault current interrupting capability (short circuit current rating) of the circuit breaker should be demonstrated by performing a series of tests similar to those called for in ANSI C37.04 and C37.09. The tests should include close/open (CO) operations and should be performed at the circuit breaker minimum rated air pressure and control voltage and with a rate of rise of recovery voltage not less than the following rated value.

d. <u>Maximum Rate of Rise of Recovery Voltage</u>

The rated maximum rate of rise of recovery voltage (RRRV) of the circuit breaker should not be less than the maximum RRRV imposed on the breaker in the circuit in which it is used.

e. Short-Time Current Carrying Capability

The circuit breaker should have the capability of carrying a fault current for the length of time that the fault exists assuming failure of the primary protective device to clear it. The fault current chosen should be that due to a fault on the system at a point which causes the largest I^2t heating of the circuit breaker. The short-time current carrying capability should be demonstrated with a current carrying test.

f. Momentary Current Carrying Capability

The circuit breaker should have the capability of carrying the maximum crest value of current calculated for the worst case bolted three phase fault on the system. This capability should be demonstrated by test.

g. Transformer Magnetizing Current Interruption

The circuit breaker interruption of an unloaded station main and/or auxiliary transformer magnetizing current should not generate excessively high surge voltages which could damage the connected bus and transformer insulation. This should be verified by test.

h. Thermal Capability

The thermal capability of the circuit breaker should be demonstrated by a test at its continuous current rating. The test should be in accordance with the requirements and ratings contained in ANSI C37.04 and C37.09. For applications which use two generator circuit breakers in a parallel circuit, a test should be conducted to determine the time to reach the maximum permissible temperature on the most limiting component of the breaker when going from the rated continuous current to twice rated continuous current.

i. Mechanical Operation Test

A sufficient number of no-load mechanical operations should be performed by the circuit breaker to provide a reasonable indication of its mechanical reliability and life. The demonstrated life should be adequate for the plant life expectancy.

3. The availability of offsite power to the onsite loads for designs utilizing generator circuit breakers should be no less than comparable designs which utilize separate offsite power transformers to supply offsite power to the station loads. In this regard the trip selectivity between the generator circuit breakers and the switchyard high voltage generator circuit breakers should insure against unnecessary tripping of the switchyard generator circuit breakers during abnormal events in order to maintain offsite power to the station loads.

4. Load break switches should be designed to perform their intended function during steady-state operation, power system transients, and major faults. Except for item 2.C, the switches should have the same capabilities as defined in guideline 2 for generator circuit breakers. In addition, the symmetrical interrupting capability of the load break switch should be at least equal to the maximum identified peak loading capability of the station generator.

C. Implementation

The guidelines will be applied in the review of ORs, OLs, COLs, and CPs in accordance with the following (see also subsection V of this SRP section):

1. Guidelines 1 through 4 of Revision O to Appendix A of this SRP section do not apply to operating reactors as a backfit item. Operating reactors which install generator circuit breakers or load break switches to meet the requirements of GDC 17 after July, 1983 must meet guidelines 1 through 4 of this appendix.

2. Guidelines 1 through 4 of Revision O to Appendix A of this SRP section have already been imposed (as applicable) on Operating License application reviews for which a Safety Evaluation Report has been issued but have not received their full power license as of yet.

3. Guidelines 1 through 4 of Revision O to Appendix A of this SRP section are applied to all current and future OL and CP application reviews (as applicable).

D. References

1. Safety Evaluation Report related to operation of McGuire Nuclear Station, Units 1 and 2, NUREG-0442, dated March 1978.

2. FSAR McGuire Nuclear Station Docket 50-396/370.

3. FSAR Catawba Nuclear Station Docket 50-413/414.

4. ANSI Standard C37.04-1979 (Reaffirmed 1989)[115], Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.

5. ANSI Standard C37.06-1979[116], Preferred Ratings and Related Required Capabilities for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.

6. ANSI Standard C37.09-1979 (Reaffirmed 1989)[117], Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.

APPENDIX B to SRP Section 8.2

GUIDELINES FOR REVIEW OF ALTERNATE AC SOURCES FOR STATION BLACKOUT AT NUCLEAR POWER PLANTS[118]

A. Background

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."

The concern about station blackout arose because of the accumulated experience regarding the reliability of ac power supplies. The issue of station blackout involves the likelihood of a loss of offsite power and its duration, the redundancy and reliability of the onsite emergency ac power systems, and the potential for severe accident sequences after a loss of all ac power. The results of risk studies indicate that estimated core meltdown frequencies from station blackout vary considerably for different plants and that station blackout could be a significant risk contributor for some plants. In order to reduce this risk and resolve the safety concerns stemming from station blackout events, the Nuclear Regulatory Commission (NRC) has promulgated 10 CFR 50.63, "Loss of All Alternating Current Power," and issued a supporting Regulatory Guide 1.155, "Station Blackout." Regulatory Guide 1.155 endorses NUMARC-8700 (Reference 6) as supplemented by its regulatory positions and describes a means acceptable to the staff for meeting the requirements of 10 CFR 50.63.

The overall review of compliance with station blackout requirements is described in SRP Section 8.4 (proposed).

One option for meeting the requirements of 10 CFR 50.63 involves the provision of an alternate ac (AAC) source (an adequate AAC source is mandatory based upon the staff's position for new applications) as defined in 10 CFR 50.2 and described further in 10 CFR 50.63. This appendix describes the staff's review of proposed AAC sources.[119]

B. Staff Review Process

All licensees/applicants are required to determine by analysis (1) an acceptable minimum time for which a plant can withstand or cope with a station blackout (station blackout duration) and (2) the plant's capability for maintaining adequate core cooling and appropriate containment integrity for the station blackout duration and subsequent recovery from the event. In addition, all licensees and applicants are required to have procedures and training for the station blackout event for the specified duration and recovery therefrom. The reviews of the plant's capability to withstand or cope with a station blackout event are performed under other SRP sections (e.g., by EELB under SRP Section 8.4). Refer to the Review Interfaces subsection of SRP Section 8.4 (proposed) for other designated branches and SRP section reviews.

The licensee/applicant may choose an alternate ac power (AAC) source (such a source is required for new applications) and demonstrate the ability of the plant to withstand the event until the source can be brought online to support safe shutdown (non-DBA) as defined in 10 CFR 50.2 in lieu of performing a coping analysis provided the AAC is available in 10 minutes and meets the specific requirements of 10 CFR 50.63 and the guidelines of Regulatory Guide 1.155. Safe shutdown (non-DBA) is defined for station blackout as bringing the plant to those shutdown conditions specified in plant technical specifications as Hot Standby or Hot Shutdown, as appropriate. Where the licensee/applicant so elects, the review conducted herein must establish that the information submitted and commitments made regarding the AAC source provide reasonable assurance of its conformance with the rule. This is to be accomplished by verifying that the relevant guidance of Regulatory Guide 1.155, as supplemented by the guidance and criteria herein, is being implemented.

To assure that the requirements of 10 CFR 50.63 regarding the AAC source are satisfied, the licensee's submittal on station blackout is evaluated and verified to address the following issues:[120]

1. If an alternate ac power source (AAC) is selected specifically for satisfying the requirements for station blackout, the design should meet the criteria of Positions C.3.2.5, C.3.3, C.3.5 and Appendices A and B of Regulatory Guide 1.155. AAC power sources may be emergency diesel generators (EDG) in excess of minimum redundancy requirements for nuclear power plant onsite power systems; nearby or onsite gas turbine generators; portable or other available compatible diesel generators; hydrogenerators; or black-start-capable fossil fuel power plants. In general, equipment required to cope with a station blackout during the first 8 hours should be available onsite. Consideration should be given to the availability and accessibility of offsite equipment in the time required, including consideration of weather conditions likely to prevail during a loss of offsite power.

   In accordance with Regulatory Guide 1.155 Position C.3.3.5.3, 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. Where an AAC is demonstrated by test to be available within 10 minutes of the onset of a station blackout event, no coping analysis is required; however, supporting information should show that the AAC has the capability, capacity, independence, and reliability to bring and maintain the plant in safe shutdown (non-DBA).[121]

2. The reviewer should verify that the provisions for the AAC source meet the following criteria, as applicable for the proposed AAC source:[122]

   a. In accordance with Position C.3.3.5 of Regulatory Guide 1.155, the AAC power source should be capable of supplying power, as required, to all loads that are necessary for safe shutdown (non-DBA) in the event of a station blackout at any nuclear unit it is credited to serve. 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. The plant systems, functions, and features discussed in Regulatory Guide 1.155 Positions C.2 and C.3.3.1 to C.3.3.4 should be appropriately addressed as safe shutdown non-DBA loads (including loads associated with any alternative or added capacity battery charging, water, or air sources to address station blackout). For new applications, the AAC source must be of diverse design (with respect to onsite sources), be consistent with guidance described in this Appendix, have adequate capacity, independence, and reliability, and have capability for powering at least one complete set of normal safe shutdown loads. 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 (non-DBA).

b. The AAC power source(s) is not automatically loaded for station blackout but should have provisions to be manually connected to one or all of the redundant safety buses as required.

c. The performance of the AAC power source is monitored in the control room. As a minimum, monitoring should include the voltage, current, frequency, and circuit breaker position.

d. The AAC source components are enclosed within structures that conform to the Uniform Building Code. Electrical cables connecting the AAC power source to the shutdown buses are protected against the events that affect the preferred ac power system. This may be accomplished by use of buried cables or by other appropriate methods.

e. Nonsafety-related AAC power source(s) and associated dedicated dc system(s) should meet the quality assurance guidance of Position 3.5, Appendix A, and the specifications identified in Appendix B of Regulatory Guide 1.155.

f. The AAC power system is equipped with a dedicated dc power system that is electrically independent from the blacked-out unit's preferred and Class 1E power systems during station blackout and is of sufficient capability and capacity for operation of dc loads associated with the AAC source for the maximum required duration of AAC source operation.

g. The AAC power system is equipped with a starting system (and motive energy source for starting) that is independent from the blacked-out unit's preferred and Class 1E ac power systems during station blackout.

h. The AAC power system is provided with a fuel supply that is separate from the fuel supply for the onsite emergency ac power system. A separate day tank, supplied from a common storage tank, is acceptable, if the fuel is sampled and analyzed using methods consistent with applicable standards prior to its transfer to the day tank.

i. If the AAC power source and an emergency onsite ac power source are identical, procedures are provided to assure that active failures of each identical power source will be evaluated for common cause applicability and that corrective action has been taken to reduce subsequent failures.

j. The AAC power system is capable of operating during and after a station blackout without any support system being powered from the preferred power supply or the blacked-out unit's emergency ac power sources.

k. The portions of the AAC power system subjected to maintenance activities are/will be tested prior to returning the AAC power system to service.

l. Plant-specific technical guidelines and emergency operating procedures will be implemented (or are in place, as applicable) that identify those actions necessary for placing the AAC power source in service.

m. The AAC power system will 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 (Reference 5) or equivalent methodology.

n. Use of EDGs for AAC Power Sources: Where EDGs are identified as AAC power sources, they should meet the criteria listed below:

(1) At single unit sites, any emergency ac power source(s) in excess of the number required to meet the minimum redundancy requirements (i.e., single failure) for safe shutdown may be assumed to be available. These emergency ac power sources may be designated as AAC power sources, provided the criteria identified in Position C.3.3.5 of Regulatory Guide 1.155 are met.

(2) A single unit that requires one emergency ac source to place the plant in safe shutdown requires one redundant emergency ac power source. For station blackout, both the emergency ac power source and the redundant emergency ac power source are unavailable. An EDG may be designated as an AAC power source only if that EDG is neither the required emergency ac power source nor the redundant emergency ac power source. Therefore, a single unit requiring one emergency ac source for safe shutdown should have at least three EDGs, with one EDG that may be designated as the AAC power source meeting Regulatory Guide 1.155 guidance for AAC power sources.

(3) At multi-unit sites, where the combination of emergency ac sources exceeds the minimum redundancy requirements (on a per nuclear unit basis) for normal safe shutdown of all units, the excess emergency ac power sources may be used as alternate ac power sources, provided they meet the AAC power source criteria of Regulatory Guide 1.155, Position

C.3.3.5. If no emergency ac power source in excess of the minimum redundancy requirements remains, the occurrence of station blackout must be assumed for all of the units.

(4) When a station blackout occurs at one unit of a multi-unit site, the emergency ac power source(s) and the redundant emergency ac power source(s) are unavailable. A station blackout on one unit does not assume a concurrent single failure; however, the remaining unit(s) must still meet the normal operating single failure criteria. Therefore, an EDG could be designated as an AAC only if (a) the EDG is neither the required emergency ac power source nor the redundant emergency ac power source for the unit experiencing the station blackout and (b) the EDG is not required as an emergency or redundant emergency ac power source for the remaining units. Where an EDG is used as an AAC, it is desirable that the EDG be connectable to all buses essential for normal safe shutdown. Review of the licensee's or applicant's station onsite ac power system should determine whether such a capability exists.

(5) Table 1 provides guidance for determining the availability of an EDG for use as an AAC power source.

(6) 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 at multi-unit sites.

(7) For emergency diesel generators used as an AAC source, the engine support systems should conform with the relevant criteria used to evaluate them under SRP Sections 9.5.4 through 9.5.4.[123]

Table 1. USE OF EDGs FOR SINGLE UNIT AND MULTI-UNIT SITES

Emergency AC Power Sources Available	Emergency AC Power** Sources Required for Safe Shutdown	Units Blacked Out*	EDGs Available for AAC Power Sources
2 dedicated	1	One unit	None
3 dedicated	1	One unit	One EDG
2 shared	1	All units	None
3 shared	1	All units	None
3 dedicated/shared	2	All units	None
4 dedicated/shared	1	One unit	One EDG

4 dedicated/shared	2	One unit	None
4 dedicated/shared	3	All unit	None
5 dedicated/shared	2	One unit	One EDG
5 dedicated/shared	3	All unit	None

* If there are no remaining emergency ac power sources in excess of the minimum redundancy requirements, station blackout must be assumed to occur at all of the units.

** For all units at a site.

Dedicated--Emergency ac power sources not shared with other units at a site.

Shared--Emergency ac power sources, of which some number are capable of concurrently providing ac power to safe shutdown equipment at more than one unit at a site.

3. The reviewer verifies that sufficient information has been provided to address the following considerations and demonstrate adequate AAC source independence as follows:

   a. With respect to independence between the AAC power source used for station blackout and the preferred and onsite power systems, electrical ties between these systems and the physical arrangement of the interface equipment should minimize the potential for the loss of any system (i.e., preferred, onsite, or AAC) preventing access to any other system and the potential for such a loss to cause further failures in other systems.[124]

   b. An acceptable design should not have the AAC power source normally directly connected to the preferred power system or the blacked-out unit's onsite emergency ac power system. No single point vulnerability should exist whereby a single active failure or weather-related event could simultaneously fail the AAC and preferred power sources or simultaneously fail the AAC and onsite sources. The power sources should have minimum potential for common failure modes.[125]

   c. The AAC components should be physically separated and electrically isolated from safety-related components or equipment as specified in the separation and isolation criteria applicable to the unit's licensing basis and the criteria of Appendix B of Regulatory Guide 1.155. Based upon compliance with all relevant independence criteria and guidelines, it should be demonstrated that provisions for the AAC source will not, at any time, adversely affect the functioning of offsite and/or Class 1E onsite power systems. Also, failure of the AAC power components must not adversely affect the Class 1E ac power systems.[126]

d. The reviewer verifies that provisions for an AAC source meet the relevant criteria specified in Regulatory Guide 1.155 Appendix B, satisfy Regulatory Guide 1.155 Positions C.3.3.5.1 and C.3.3.5.2, will not adversely affect the preferred power system or its specified functions, and will not adversely affect the onsite power system or its specified safety functions. Careful examination should be made of the physical arrangement of circuits and incoming source breakers [to the affected Class 1E bus(es)], separation and isolation provisions (control and main power), permissive and interlock schemes proposed for source breakers, source initiation/transfer logic, Class 1E load shedding and sequencing schemes that could affect AAC source ability to power safe shutdown loads, source lockout schemes, and bus lockout schemes in arriving at the determination that the independence of the AAC source is acceptable.[127]

C. References[128]

1. 10 CFR Part 50, §50.2, Definitions.

2. 10 CFR Part 50, §50.63, "Loss of All Alternating Current Power."

3. Regulatory Guide 1.155, "Station Blackout," U.S. Nuclear Regulatory Commission.

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

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

6. NUMARC-8700, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," November 1987, Nuclear Management and Resources Council (NUMARC).

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Attachment A - Proposed Changes in Order of Occurrence

Item numbers in the following table correspond to superscript numbers in the redline/strikeout copy of the draft SRP section.

Item	Source	Description
1.	Current PRB name and abbreviation	Changed PRB to Electrical Engineering Branch (EELB).
2.	Editorial modification	Changed "GDC" to "General Design Criteria" to accommodate plural usage.
3.	Integrated Impact No. 366	Added review of the AAC source for station blackout, if/when provided, as an Area of Review.
4.	Current PRB name and abbreviation	Changed PRB to EELB.
5.	Editorial modification	Deleted unnecessary "and."
6.	Integrated Impact No. 366	Added discussion of AAC source-related independence reviews and allusion to 10 CFR 50.63 requirements.
7.	Editorial modification	Changed "assure" to "ensure" (global change for this section).
8.	Integrated Impact No. 366	Added reference to 10 CFR 50.63.
9.	Editorial modification	Changed from plural to singular to correct sentence construction.
10.	Integrated Impact No. 366	Added reference to 10 CFR 50.63.
11.	SRP-UDP format item	Added "Review Interfaces" to AREAS OF REVIEW and provided numbered paragraphs to describe how the offsite site power system is reviewed under other SRP sections and how various branches support that review. Also added "power system" to improve clarity.
12.	Editorial	Added a review interface to reflect that the onsite power system (which is extensively discussed in relation to the offsite power system in this SRP section) is reviewed in greater detail in SRP Sections 8.3.1 and 8.3.2.
13.	**Integrated Impact 366**, SRP-UDP Integration of SBO Issues	Added an interface reflecting reviews under new SRP Section 8.4.
14.	Current PRB name and abbreviation	Changed PRB to EELB.
15.	SRP-UDP format item	Added item number (where indicated by redline throughout this subsection) to reflect current SRP format for numbering of review interfaces.
16.	Current PRB abbreviation	Changed PRB to Reactor Systems Branch (SRXB).
17.	Current review branch responsibility	Changed to reflect current SRP Sections relevant to the described interface for which SRXB is the PRB.

Item	Source	Description
18.	Current PRB name and abbreviation	Changed PRB to Plant Systems Branch (SPLB).
19.	Current review branch responsibility	Changed to reflect current SRP Sections relevant to the described interface for which SPLB is the PRB.
20.	Current PRB name and abbreviation	Changed PRB to SPLB.
21.	Editorial	Added improved description of the system discussed.
22.	Current PRB name and abbreviation	Changed PRB to SPLB.
23.	Current SPLB review responsibility	Changed to indicate review responsibility for SRP Section 9.5.1.
24.	Current PRB review responsibility	Changed to indicate that the Materials and Chemical Engineering Branch (EMCB) has PRB review responsibility for SRP Chapter 9.0.
25.	Current PRB name and abbreviation	Changed PRB to Civil Engineering and Geosciences Branch (ECGB).
26.	Current PRB name and abbreviation	Changed PRB to Instrumentation and Controls Systems Branch (HICB).
27.	Current PRB abbreviation	Changed PRB to HICB.
28.	SRP-UDP format item	Moved content to items 11 and 14 to reflect current SRP format.
29.	SRP-UDP format item	Added item number to reflect current SRP format.
30.	Current SPLB review responsibility	Changed to indicate current review responsibility for SRP Section 16.0.
31.	Current PRB name and abbreviation	Changed PRB to Containment Systems and Severe Accident Branch (SCSB).
32.	Editorial	Since secondary containment features may contain valves or ventilation systems requiring electric power, add SRP Section 6.2.3 to the list.
33.	SRP-UDP format item	Moved content to item 5 to reflect current SRP format.
34.	Current PRB name and abbreviation	Changed PRB to Quality Assurance and Maintenance Branch (HQMB).
35.	Editorial	Changed "and test" to "tests and" to improve clarity and changed "Section 14.0" to "Section 14.2" to reflect the SRP reference more accurately.

Item	Source	Description
36.	Current PRB review responsibilities, also see ROC 855 for SRP Section 8.3.1	Changed to indicate review responsibility for SRP Chapter 17. RG 1.160 provides guidance to include certain switchyard maintenance activities in the maintenance effectiveness monitoring program required by 10 CFR 50.65 (the maintenance rule). Coverage of power system SSCs subject to monitoring or evaluation under the maintenance rule is to be verified in SRP Chapter 13 and/or 17. Compliance with the maintenance rule, including verification that appropriate maintenance activities are covered therein, is reviewed under SRP Chapter 17. Programs for incorporation of requirements into appropriate procedures are reviewed under SRP Sections 13.5.x.x. Thus added a review interface reflecting review of appropriate controls over procedure development activities.
37.	SRP-UDP format item	Moved content to item 6 to reflect current SRP format.
38.	Editorial, See ROC 855 for SRP Section 8.3.1	RG 1.160 provides guidance to include certain switchyard maintenance activities in the maintenance effectiveness monitoring program required by 10 CFR 50.65 (the maintenance rule). Coverage of power system SSCs subject to monitoring or evaluation under the maintenance rule is to be verified in SRP Chapter 13 and/or 17. Compliance with the maintenance rule, including verification that appropriate maintenance activities are covered therein, is reviewed under SRP Chapter 17. Programs for incorporation of requirements into appropriate procedures are reviewed under SRP Sections 13.5.x.x. Thus added a review interface reflecting review of appropriate controls over procedure development activities.
39.	SRP-UDP format item	Revised to cover interfaces with other sections, regardless of whether EELB or another PRB is responsible for them since both types of interfaces are covered herein.
40.	Proper punctuation	Added a comma to punctuate the sentence correctly.
41.	Editorial	Added location of Table 8-1.
42.	Editorial	Revised for consistency with items presented in table 8-1.
43.	Current PRB name and abbreviation	Changed PRB to EELB.
44.	Editorial modification	Provided initialism for General Design Criterion 5 (global change for this section).

Item	Source	Description
45.	Integrated Impact No. 365, SRP-UDP format item	Revision 2 of RG 1.32 endorses IEEE 308-1974 rather than IEEE 308-1991. An IPD 7.0 form has been initiated in connection with SRP Section 8.1 to revise RG 1.32 to endorse the current version. This reference should be updated to IEEE 308-1991 if RG 1.32 is revised to endorse the current version. Also revised for consistency with other Chapter 8 standards citations and added identification by reference number in accordance with SRP-UDP format guidelines. Note that the relevant versions of standards applicable to Chapter 8 are comprehensively identified in Table 8-1 in SRP Section 8.1.
46.	Editorial modification	Provided initialism for General Design Criterion 17 (global change for this section).
47.	SRP-UDP format item, Editorial	Revised for consistency with other Chapter 8 standards citations. Note that the relevant versions of standards are identified in Table 8-1 in SRP Section 8.1.
48.	Integrated Impacts 369 and 370, SRP-UDP Integration of Evolutionary Plant Issues	Added applicable regulations from ABWR and CE System 80+ FSERs as acceptance criteria for new applications.
49.	Editorial modification	Provided initialism for General Design Criterion 18 (global change for this section).
50.	Integrated Impact No. 366, SRP-UDP Integration of SBO Issues	Added reference to 10 CFR 50.63. Also added reference to RG 1.155, which provides guidance for meeting the requirements of 10 CFR 50.63. Added criteria description for consistency with terminology used in the explicit requirements and provisions of relevant regulations and regulatory guidance. Also added an applicable regulation requiring an AAC source that is described in evolutionary plant FSERs (CE System 80+ and ABWR).
51.	SRP-UDP format item	Added "Technical Rationale" to ACCEPTANCE CRITERIA and provided numbered paragraphs to describe the basis for referencing the GDC.
52.	SRP-UDP format item	Added lead-in sentence for "Technical Rationale."
53.	SRP-UDP format item	Added technical rationale for GDC 5.
54.	SRP-UDP format item	Added technical rationale for GDC 17.
55.	SRP-UDP format item	Added technical rationale for GDC 18.
56.	SRP-UDP format item	Added technical rationale for General Design Criteria 34, 35, 38, 41, and 44, which are encompassed by GDC 17.
57.	SRP-UDP format item	Added technical rationale for 10 CFR 50.63.

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Attachment A - Proposed Changes in Order of Occurrence

Item	Source	Description
58.	Editorial modification	Changed "Section 8.1" to "Chapter 8.0" to provide a more accurate citation of the appendix's applicability.
59.	Editorial, Incorporation of PRB Comment	Deleted references to CP and OL review stages at the request of the PRB (see February 29, 1996 Memorandum to R.W. Borchardt from J.A. Calvo (TAC NO. M88581) transmitting comments on draft revisions to SRP Section 8.3.1).
60.	Integrated Impact No. 370	Added reference to the staff policy stated in SECY-91-078 and subsequently approved in SRM dated August 15, 1991. The policy states, "plant design should include...at least one offsite circuit to each redundant safety division supplied directly from one of the offsite power sources with no intervening non-safety buses in such a manner that the offsite source can power the safety buses upon failure of any non-safety bus."
61.	Integrated Impact No. 369	Added reference to the staff policy stated in SECY-91-078.
62.	Editorial	Deleted to eliminate redundancy in the sentence.
63.	Integrated Impact No. 366	Added reference to 10 CFR 50.63.
64.	Integrated Impact 367	Added reference to Branch Technical Position ICSB-11, "Stability of Offsite Power Systems," to provide consistency between SRP Section 8.2 and Table 8-1 of SRP Section 8.1. The BTP is currently included in the list of references for SRP Section 8.2.
65.	Integrated Impact No. 366	Added reference to 10 CFR 50.63.
66.	Editorial	Revised to reflect a review procedure rather than a statement of criteria.
67.	**Integrated Impact 368**	Added review procedure and reference to an acceptable source of guidelines for new plant grounding and lightning protection.
68.	No change	The PRB should consider clarifying the basis, intent, and methods for review of electric power system testability when the reactor is in operation since GDC 18 does not explicitly require testability when the reactor is in operation and since many system features are not testable and/or are not normally tested while in operation.
69.	Current PRB abbreviation	Changed PRB to HQMB.
70.	Current PRB abbreviation	Changed PRB to HQMB.
71.	Editorial	Added "also" since the same PRB currently performs both discussed reviews.

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Attachment A - Proposed Changes in Order of Occurrence

Item	Source	Description
72.	Editorial modification	Changed "are" to "is" to provide noun/verb agreement (i.e., equipment...is).
73.	Current PRB abbreviation	Changed PRB to HQMB.
74.	Editorial modification	Provided initialism for General Design Criterion 2 (global change for this section).
75.	Current PRB name and abbreviation	Changed PRB to ECGB.
76.	Current PRB name and abbreviation	Changed PRB to EELB.
77.	Current PRB name and abbreviation	Changed PRB to SPLB.
78.	Editorial	Corrected reference to the SRP section providing this further review.
79.	Integrated Impact No. 366	Added review procedure addressing basic requirements of 10 CFR 50.63 and the 10 CFR 50.2 definition regarding AAC sources.
80.	Integrated Impact No. 366	Added reference to 10 CFR 50.63. Also added references to RG 1.155 and the requirements of SECY-90-016, which provide guidance for meeting the requirements of 10 CFR 50.63 for new applications. SECY-90-016 requires compliance with 10 CFR through the installation of a spare (full capacity) AAC of diverse design that is consistent with the guidance in RG 1.155 and that is capable of powering at least one complete set of normal safe shutdown loads.
81.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard paragraph to address application of Review Procedures in design certification reviews.
82.	Editorial modification	Changed to clarify that transmission lines to onsite distribution system are part of the offsite power system.
83.	Editorial, Incorporation of PRB Comment	Deleted references to CP and OL review stages at the request of the PRB (see February 29, 1996 Memorandum to R.W. Borchardt from J.A. Calvo (TAC NO. M88581) transmitting comments on draft revisions to SRP Section 8.3.1).
84.	Editorial modification	Deleted unnecessary initialism.
85.	Editorial modification	Changed "GDC" to "General Design Criteria" to accommodate plural usage.
86.	Integrated Impact No. 366	Added reference to 10 CFR 50.63.
87.	Editorial	Revised finding to be correct even in the event that more than 2 circuits are provided.

Item	Source	Description
88.	No change	The PRB should consider clarifying the basis, intent, and methods for review of electric power system testability when the reactor is in operation since GDC 18 does not explicitly require testability when the reactor is in operation and since many system features are not testable and/or are not normally tested while in operation.
89.	Integrated Impact No. 366	Added reference to 10 CFR 50.63. Also added reference to RG 1.155, which provides guidance for meeting the requirements of 10 CFR 50.63.
90.	SRP-UDP Format Item, Implement 10 CFR 52 Related Changes	To address design certification reviews a new paragraph was added to the end of the Evaluation Findings. This paragraph addresses design certification specific items including ITAAC, DAC, site interface requirements, and combined license action items relevant to this SRP section.
91.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard sentence to address application of the SRP section to reviews of applications filed under 10 CFR Part 52, as well as Part 50.
92.	SRP-UDP Guidance	Added standard paragraph to indicate applicability of this section to reviews of future applications.
93.	**Integrated Impact 366**	Since the independence requirements for AAC sources are only explicitly described in the 10 CFR 50.2 definition of “Alternate ac source,” and since 10 CFR 50.2 is now cited in the technical rationale subsection, 10 CFR 50.2 is added as a reference.
94.	Integrated Impact No. 366	Added reference to 10 CFR 50.63.
95.	Editorial modification	Added General Design Criterion 2 to REFERENCES as an aid to the reviewer.
96.	Editorial modification	Added General Design Criterion 4 to REFERENCES as an aid to the reviewer.
97.	Editorial modification	Provided consecutive numbering.
98.	Editorial modification	Added General Design Criterion 33 to REFERENCES as an aid to the reviewer.
99.	Editorial modification	Added General Design Criterion 34 to REFERENCES as an aid to the reviewer.
100.	Editorial modification	Added General Design Criterion 35 to REFERENCES as an aid to the reviewer.
101.	Editorial modification	Added General Design Criterion 38 to REFERENCES as an aid to the reviewer.
102.	Editorial modification	Added General Design Criterion 41 to REFERENCES as an aid to the reviewer.

Item	Source	Description
103.	Editorial modification	Added General Design Criterion 44 to REFERENCES as an aid to the reviewer.
104.	Editorial modification	Provided consecutive numbering.
105.	Integrated Impact No. 366	Added reference to Regulatory Guide 1.155.
106.	Editorial modification	Provided consecutive numbering.
107.	Editorial modification	Provided consecutive numbering.
108.	Editorial modification	Provided consecutive numbering.
109.	Editorial modification	Provided consecutive numbering.
110.	Integrated Impact No. 366	Added reference to new Appendix B to SRP Chapter 8.2, which provides additional guidance for meeting requirements of 10 CFR 50.63 relative to AAC power sources.
111.	Editorial modification	Provided reflect consecutive numbering.
112.	Integrated impact No. 365	Revision 2 of RG 1.32 endorses IEEE 308-1974 rather than IEEE 308-1991.
113.	**Integrated Impact 368**	Added reference to an acceptable source of criteria and guidelines for new plant grounding and lightning protection.
114.	SRP-UDP format item	Spelled out "References" consistent with SRP-UDP format guidance.
115.	Integrated Impact No. 664	This reference was updated to cite the current revision of ANSI C37.04 which has only been reaffirmed since it was originally cited by NRC.
116.	Integrated Impact No. 1451	This reference was updated to reflect that ANSI C37.06-1979 was in effect at the time NRC cited this standard in the SRP.
117.	Integrated Impact No. 664	This reference was updated to cite the current revision of ANSI C37.04 which has only been reaffirmed since it was originally cited by NRC.
118.	Integrated Impact 1453	Added new Appendix B to provide integrated guidance in Regulatory Guide 1.155 and NUMARC-8700 for meeting the requirements of 10 CFR 50.63 and 10 CFR 50.2 regarding AAC sources.
119.	Integrated Impacts 366 and 1453	Added background information regarding resolution of the SBO Generic Issue and the purpose of this appendix.
120.	Integrated Impacts 366 and 1453	Added introduction to the staff's detailed review guidelines for review of proposed or required (for new applications) AAC sources.

Item	Source	Description
121.	Integrated Impacts 366 and 1453	Added the definition of minimum AAC source capabilities from 10 CFR 50.2 and related requirements of 10 CFR 50.63(c)(2) for timeliness of source availability.
122.	Integrated Impacts 366 and 1453	Added a review procedure, based largely upon Regulatory Guide 1.155 guidance, for verifying acceptable provisions for AAC sources and AAC source capabilities.
123.	SRP-UDP Integration of SBO Issues	Revised to reflect evaluation of EDG engine support systems under SRP Sections 9.5.4 to 9.5.8.
124.	Integrated Impacts 366 and 1453	Added review procedure addressing AAC source independence requirements of 10 CFR 50.63 and the 10 CFR 50.2 definition for AAC source.
125.	Integrated Impacts 366 and 1453	Added review procedure, based upon Regulatory Guide 1.155 Positions C.3.3.5.1 and C.3.3.2.1 addressing AAC source independence requirements of 10 CFR 50.63 and the 10 CFR 50.2 definition for AAC source.
126.	Integrated Impacts 366 and 1453	Added review procedure addressing AAC source independence requirements of 10 CFR 50.63 and the 10 CFR 50.2 definition for AAC source.
127.	Integrated Impacts 366 and 1453	Added review procedure addressing AAC source independence requirements of 10 CFR 50.63 and the 10 CFR 50.2 definition for AAC source.
128.	Integrated Impact 1453	Added a list of references cited in this Appendix.

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Attachment B - Cross Reference of Integrated Impacts

Integrated Impact No.	Issue	SRP Subsections Affected
366	Recommends adding reference to 10 CFR 50.63 and Regulatory Guide 1.155 for review of relevant station blackout issues.	AREAS OF REVIEW, first paragraph, Items 2 & 8, EELB Review Interface 2 ACCEPTANCE CRITERIA, Item 5 REVIEW PROCEDURES, Items 1(b), 1(g); and Item 10 EVALUATION FINDINGS, third paragraph; Item 4 REFERENCES, References 1, 2, 15, and 20 New Appendix B also added
367	Consider incorporating the staff position stated in BTP ICSB 11 (PSB) into SRP Section 8.2, Review Procedure III.1.(f) which addresses grid stability analyses.	REVIEW PROCEDURES, Item 1(f)
368	Recommends adding review procedures for plant grounding and lightning protection.	REVIEW PROCEDURES, Item 1(i) REFERENCES, Reference 22
369	Recommends adding review procedures for alternate source of power for nonsafety loads, SECY-91-078.	ACCEPTANCE CRITERIA, item 2 REVIEW PROCEDURES, Item 1(a)
370	Recommends adding review procedure for connection of offsite power sources to the safety buses, SECY-91-078.	ACCEPTANCE CRITERIA, item 2 REVIEW PROCEDURES, Item 1(a)
664	Recommends referencing reaffirmed versions of ANSI C37.04 and ANSI C37.09.	APPENDIX A, D (References 4 and 6)
1451	Recommends referencing the current version of ANSI C37-04.	APPENDIX A, D (Reference 5)
1453	Recommends adding new appendix to SRP Section 8.2 to provide guidance for reviewing AAC sources for station blackout.	APPENDIX B TO SRP Section 8.2