



U.S. NUCLEAR REGULATORY COMMISSION  
**STANDARD REVIEW PLAN**  
OFFICE OF NUCLEAR REACTOR REGULATION

## SECTION 8.1

## ELECTRIC POWER - INTRODUCTION

REVIEW RESPONSIBILITIES

Primary - Power Systems Branch (PSB)

Secondary - Auxiliary Systems Branch (ASB)  
Containment Systems Branch (CSB)  
Instrumentation and Control Systems Branch (ICSB)  
Reactor Systems Branch (RSB)

I. AREAS OF REVIEW

The PSB reviews the applicant's description of the offsite power grid and system with regard to the interrelationships between the nuclear unit, the utility grid and the interconnecting grids. PSB also reviews the identification of all safety-related electrical loads.

The review includes evaluation of the proposed technical specifications (SAR Chapter 16) to assure their adequacy with regard to limiting safety system settings, limiting conditions for operation, and periodic surveillance testing.

The secondary review branches (ASB, CSB, ICSB and RSB) review the listing of safety loads for completeness, i.e., to verify that all safety loads within their respective areas of primary review responsibility have been identified. If loads other than those identified are deemed to be safety-related, this information is transmitted to PSB.

II. ACCEPTANCE CRITERIA

The description of the power grid and offsite power system is acceptable when it can be concluded that the interrelationships between the nuclear unit, the utility grid, and the interconnecting grids are clearly defined. The identification of safety loads is acceptable when it can be concluded that all systems and devices that require electric power (a-c or d-c) to perform safety functions are identified.

Table 8-1, "Acceptance Criteria for Electric Power," lists the criteria currently applied by the staff to safety-related electric power systems. Implementation of these criteria will provide assurance that safety-related electric power systems will perform design safety functions as required. The applicant's list of design criteria for safety-related electric power systems is acceptable if it includes the items in Table 8-1, and if the SAR contains a statement to the effect that these criteria will

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**USNRC STANDARD REVIEW PLAN**

Standard review plans are prepared for the guidance of the Office of Nuclear Reactor Regulation staff responsible for the review of applications to construct and operate nuclear power plants. These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required. The standard review plan sections are keyed to Revision 2 of the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants. Not all sections of the Standard Format have a corresponding review plan.

Published standard review plans will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience.

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20545.

be implemented (at the construction permit stage) or are implemented (at the operating license stage) in the design of the electrical power systems.

For those areas of review identified in subsection I of this SRP section as being the responsibility of other branches, the acceptance criteria and their methods of application are contained in the SRP sections corresponding to those branches.

The fundamental bases for acceptance of the proposed technical specifications are that the limiting conditions for operation (LCOs) are such that sufficient equipment will be available for operation to meet the single failure criterion; that equipment outages, permissible for a short period of time, still leave available sufficient equipment to provide the protective function assuming no failures; and that the provisions of the technical specifications are compatible with the safety analyses. The operating procedures and restrictions which should be implemented if the available electric power sources are less than the LCO are discussed in Regulatory Guide 1.93.

### III. REVIEW PROCEDURES

The PSB reviews Section 8.1 of the SAR to assure the following items are included: a brief description of the utility grid and its interconnections to other grids and to the nuclear unit (referred to as the preferred power system); a brief general description of the onsite power system (referred to as the standby power system); identification of the safety loads (i.e., the systems and devices that require electric power to perform safety functions); identification of the function performed by each load (e.g., emergency core cooling, containment cooling); the type of electric power (a-c or d-c) required by each load; and the design bases, criteria, standards, regulatory guides, and technical positions that will be implemented in the design of the safety-related electric power systems, including a discussion describing the extent to which these criteria are followed and a positive statement with regard to conformance of the design to each of these criteria.

Upon request from the primary reviewer, the secondary review branches will provide input for the areas of review stated in subsection I. The primary reviewer obtains and uses such input as required to assure that this review procedure is complete.

The review is performed as follows:

1. PSB will establish that the utility grid is adequately described, and that the interconnections between the nuclear unit, the utility grid, and other grids are clearly defined. The descriptions should state whether facilities are existing or planned; if planned, the respective completion dates should be provided. The descriptions should not conflict with the more detailed information in subsequent sections of Chapter 8 of the SAR, and may reference these sections.

2. PSB confirms that the description of the onsite power system (standby power system) is not in conflict with the more detailed information on this system in subsequent sections of Chapter 8, and descriptions may reference these sections.
3. PSB will establish that all the devices and systems that require electric power to perform safety functions are identified, and that this identification does not conflict with the more detailed information provided in other sections of the SAR, particularly in Chapters 7 and 8. The definitions of safety-related systems in SRP Section 7.1 should be used as an aid in assessing the completeness of the identification of safety loads. Care should be exercised to assure that those loads required to maintain the plant within the envelope of operating conditions postulated in the accident analysis are identified as safety loads. Requests for evaluation should be made to the secondary review branches when there are novel designs or significant differences of opinion with regard to designations of safety loads.
4. The secondary review branches (ASB, CSB, ICSB and RSB) will confirm the identification of all safety loads within their respective areas of primary review responsibility. If loads other than those identified are deemed to be safety-related, this information should be transmitted to PSB.
5. PSB will confirm that the criteria identified as being applicable to the design of safety-related electric power systems include those listed in Table 8-1. This will assure that the identification requirements of General Design Criterion (GDC) 1 of Appendix A to 10 CFR Part 50 are met. GDC 1 also requires that "structures, systems and components important to safety shall be designed, fabricated, erected and tested to quality standards commensurate with the importance of the safety function to be performed." Therefore, the SAR should include a discussion regarding the applicability of the criteria listed and a statement to the effect that the criteria will be implemented (CP) or are implemented (OL) in the design of safety-related electrical power systems.
6. The proposed plant technical specifications (Chapter 16 of the SAR) are reviewed by PSB and the secondary review branches to:
  - a. Confirm the suitability of the limiting safety system settings and the limiting conditions for operation, including the proposed time limits and reactor operating restrictions for periods when system equipment is inoperable due to repairs and maintenance.
  - b. Verify that the frequency and scope of periodic surveillance testing is adequate.

For a construction permit (CP) review, it is only necessary to confirm that the applicant has identified those variables, conditions, or other items which have been determined to be probable subjects of the technical specifications (see 10 CFR 50.34(a)(5)). The applicant's justification for the selection of those items is evaluated, with special attention to any that may significantly influence the final design. The specific provisions of the proposed technical specifications are not approved during the CP review. However, any specific provisions which are known to be unacceptable or which may influence acceptance of the preliminary design of the plant should be brought to the applicant's attention and, if appropriate, included in that portion of the staff's evaluation findings pertaining to the design of the affected systems.

For an operating license (OL) review, the proposed technical specifications are reviewed and evaluated in depth in accordance with the requirements of 10 CFR 50.36. For the PSB areas of review, a check is made that the limiting conditions for operation (LCO) correspond to the surveillance requirements; i.e., for each system or component that is the subject of an LCO, there must be corresponding surveillance requirements. Each system or component that performs a function for which credit is taken in the accident analyses should be the subject of an LCO. The limiting safety system settings should agree with the values assumed in the accident analyses, including appropriate allowances for instrument error, drift, etc. If the acceptance of the design of a particular system is based upon required plant conditions or particular operating procedures, such requirements should be included in the final technical specifications and, if appropriate, noted in that portion of the staff's evaluation findings pertaining to the design of the affected system. Operating procedures and restrictions which should be implemented if the available electric power sources have less than the LCO are presented in Regulatory Guide 1.93.

#### IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information is presented in the SAR and that his review supports conclusions of the following type, to be included in the staff's Safety Evaluation Report:

"The applicant has identified safety-related electric power systems, safety loads, and applicable power system criteria, and has documented his intent to design and construct these systems in accordance with the criteria. It is concluded that design and construction of safety-related electric power systems in accordance with the criteria provide assurance that these systems will perform as designed."

#### V. REFERENCES: None

TABLE 8-1  
ACCEPTANCE CRITERIA FOR ELECTRIC POWER

Table 8-1 identifies the acceptance criteria and their applicability for the SRP sections of Chapter 8. These acceptance criteria include the applicable general design criteria, IEEE standards, regulatory guides, and branch technical positions (BTPs) used by the Power Systems Branch (PSB). The table was prepared for use in reviewing Chapter 8 of the SAR and for use by the secondary review branch reviewers. The BTPs listed in Table 8-1 are contained in Appendix 8-A to Chapter 8 of the SRP.

ACCEPTANCE CRITERIA FOR ELECTRIC POWER - TABLE 8-1

CRITERIA	TITLE	APPLICABILITY (SAR Section)				REMARKS
		8.1	8.2	8.3.1	8.3.2	
1. 10 CFR Part 50						
a. 10 CFR §50.34	Contents of Applications: Technical Information	X	X	X	X	
b. 10 CFR §50.36	Technical Specifications	X	X	X	X	
c. 10 CFR §50.55a	Codes and Standards	X	X	X	X	
2. General Design Criteria (GDC), Appendix A to 10 CFR Part 50						
a. GDC-1	Quality Standards and Records	X	X	X	X	
b. GDC-2	Design Bases for Protection Against Natural Phenomena	X	X	X	X	
c. GDC-3	Fire Protection	X	X	X	X	
d. GDC-4	Environmental and Missile Design Bases	X	X	X	X	
e. GDC-5	Sharing of Structures, Systems, and Components	X	X	X	X	
f. GDC-13	Instrumentation and Control	X	X	X	X	
g. GDC-17	Electric Power Systems	X	X	X	X	
h. GDC-18	Inspection and Testing of Electrical Power Systems	X	X	X	X	
i. GDC-21	Protection System Reliability and Testability	X	X	X	X	
j. GDC-22	Protection System Independence	X			X	

TABLE 8-1 (CONTINUED)

CRITERIA	TITLE	APPLICABILITY (SAR Section)				REMARKS
		8.1	8.2	8.3.1	8.3.2	
k. GDC-33	Reactor Coolant Makeup	X	X	X	X	
l. GDC-34	Residual Heat Removal	X	X	X	X	
m. GDC-35	Emergency Core Cooling	X	X	X	X	
n. GDC-38	Containment Heat Removal	X	X	X	X	
o. GDC-41	Containment Atmosphere Cleanup	X	X	X	X	
p. GDC-44	Cooling Water	X	X	X	X	
3. Institute of Electrical and Electronics Engineers (IEEE) Standards:						
a. IEEE Std 279 (ANSI N42.7)	Criteria for Protection Systems for Nuclear Power Generating Stations	X	X	X	X	See 10 CFR §50.55a(h) and Reg. Guide 1.62
b. IEEE Std 308	Criteria for Class 1E Electric Systems for Nuclear Power Generating Stations	X	X	X	X	See Reg. Guide 1.32
c. IEEE Std 317	Electric Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations	X	X	X	X	See Reg. Guide 1.63
d. IEEE Std 323	Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations	X	X	X	X	See Reg. Guide 1.89
e. IEEE Std 334	Standard for Type Test of Continuous Duty Class 1E Motors for Nuclear Power Generating Stations	X	X	X	X	See Reg. Guide 1.40
f. IEEE Std 336 (ANSI N45.2.4)	Installation, Inspection and Testing Requirements for Instrumentation and Electric Equipment During the Construction of Nuclear Power Generating Stations	X	X	X	X	See Reg. Guide 1.30
g. IEEE Std 338	Criteria for the Periodic Testing of Nuclear Power Generating Station Protection Systems	X	X	X	X	See Reg. Guide 1.118

TABLE 8-1 (CONTINUED)

CRITERIA	TITLE	APPLICABILITY (SAR Section)				REMARKS
		8.1	8.2	8.3.1	8.3.2	
h. IEEE Std 344 (ANSI N41.7)	Guide for Seismic Qualification of Class 1 Electrical Equipment for Nuclear Power Generating Stations	X		X	X	See Reg. Guide 1.100
i. IEEE Std 379 (ANSI N41.2)	Guide for the Application of the Single Failure Criterion to Nuclear Power Generating Station Protection Systems	X		X	X	See Reg. Guide 1.53
j. IEEE Std 382	Trial-Use Guide for the Type-Test of Class 1 Electric Valve Operators for Nuclear Power Generating Stations (ANSI N41.6)	X		X		See Reg. Guide 1.73
k. IEEE Std 383	Standard for Type Test of Class 1E Electric Cable Field Splices, and Connections for Nuclear Power Generating Stations	X		X	X	
l. IEEE Std 384 (ANSI N41.14)	Criteria for Separation of Class 1E Equipment and Circuits	X		X	X	See Reg. Guide 1.75
m. IEEE Std 387 (ANSI N41.13)	Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Stations	X		X		
n. IEEE Std 415	Planning of Pre-Operational Testing Programs for Class 1E Power Systems for Nuclear Power Generating Stations, IEEE Guide for	X		X	X	
o. IEEE Std 420	Trial-Use Guide for Class 1E Control Switchboards for Nuclear Power Generating Stations (ANSI N41.7)	X		X	X	
p. IEEE Std 450	Recommended Practice for Maintenance, Testing and Replacement of Large Stationary Type Power Plant and Substation Lead Storage Batteries	X			X	See Reg. Guide 1.129
q. IEEE Std 484	Recommended Practice for Installation Design and Installation of Large Lead Storage Batteries for Nuclear Power Plants	X			X	See Reg. Guide 1.128



TABLE 8-1 (CONTINUED)

CRITERIA	TITLE	APPLICABILITY (SAR Section)				REMARKS
		8.1	8.2	8.3.1	8.3.2	
4. Regulatory Guides (RG)						
a. RG 1.6	Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems	X		X	X	
b. RG 1.9	Selection of Diesel Generator Set Capacity for Standby Power Supplies	X		X		
c. RG 1.29	Seismic Design Classification	X		X	X	
d. RG 1.30	Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment	X	X	X	X	
e. RG 1.32	Use of IEEE Std 308, "Criteria for Class 1E Electric Systems for Nuclear Power Generating Stations"	X	X	X	X	
f. RG 1.40	Qualification Tests for Continuous-Duty Motors Installed Inside the Containment of Water Cooled Nuclear Power Plants	X		X		
g. RG 1.41	Preoperational Testing of Redundant Onsite Electric Power Systems to Verify Proper Load Group Assignments	X	X	X	X	
h. RG 1.47	Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems	X	X	X	X	
i. RG 1.53	Application of the Single-Failure Criterion to Nuclear Power Plant Protection Systems	X		X	X	
j. RG 1.63	Electric Penetration Assemblies in Containment Structures for Water-Cooled Nuclear Power Plants	X		X	X	
k. RG 1.68	Preoperational and Initial Startup Test Programs for Water-Cooled Power Reactors	X	X	X	X	

TABLE B-1 (CONTINUED)

CRITERIA		TITLE	APPLICABILITY (SAR Section)					REMARKS
			8.1	8.2	8.3.1	8.3.2		
1. RG 1.70		Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants	X	X	X		X	
m. RG 1.73		Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants	X		X			
n. RG 1.75		Physical Independence of Electric Systems	X		X		X	
o. RG 1.81		Shared Emergency and Shutdown Electric Systems for Multi-Unit Nuclear Power Plants	X		X		X	
p. RG 1.89		Qualification of Class 1E Equipment for Nuclear Power Plants	X		X		X	
q. RG 1.93		Availability of Electric Power Sources	X	X	X		X	
r. RG 1.100		Seismic Qualification of Electric Equipment for Nuclear Power Plants	X		X		X	
s. RG 1.106		Thermal Overload Protection for Electric Motors on Motor-Operated Valves	X		X			
t. RG 1.108		Periodic Testing of Diesel Generators Used As Onsite Power Systems at Nuclear Power Plants	X		X			
u. RG 1.118		Periodic Testing of Electric Power and Protection Systems		X	X		X	
v. RG 1.120		Fire Protection Guidelines for Nuclear Power Plants	X	X	X		X	
w. RG 1.128		Installation Design and Installation of Large Lead Storage Batteries for Nuclear Power Plants	X				X	
x. RG 1.129		Maintenance, Testing and Replacement of Large Lead Storage Batteries for Nuclear Power Plants	X				X	

TABLE 8-1 (CONTINUED)

CRITERIA	TITLE	APPLICABILITY (SAR Section)				REMARKS
		8.1	8.2	8.3.1	8.3.2	
5. Branch Technical Positions (BTP) ICSB						
a. BTP ICSB 2 (PSB)	Diesel-Generator Reliability Qualification Testing	X		X		
b. BTP ICSB 6 (PSB)	Capacity Test Requirements of Station Batteries-Technical Specifications	X			X	
c. BTP ICSB 8 (PSB)	Use of Diesel-Generator Sets for Peaking	X		X		
d. BTP ICSB 11 (PSB)	Stability of Offsite Power Systems	X	X			
e. BTP ICSB 15 (PSB)	Reactor Coolant Pump Breaker Qualification		X			
f. BTP ICSB 17 (PSB)	Diesel Generator Protective Trip Circuit Bypasses	X		X		
g. BTP ICSB 18 (PSB)	Application of the Single Failure Criterion to Manually-Controlled Electrically-Operated Valves			X		
h. BTP ICSB 21	Guidance for Application of RG 1.47	X	X	X	X	

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