U.S. NUCLEAR REGULATORY COMMISSION

# STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

## 8.2 OFFSITE POWER SYSTEM

REVIEW RESPONSIBILITIES

Primary - Power Systems Branch (PSB)

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 5, 17, and 18, and will perform its design functions during all plant operating and accident conditions.

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 PSB 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 the disconnect control system and power supply, and generator circuit breakers/load break switches.

2. The independence of the preferred power system with respect to the onsite power system is evaluated. 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 that loss of one preferred system circuit will not cause or result in loss of the redundant counterpart, nor any 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 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; 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 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.

In the review of other areas associated with the offsite, the PSB will coordinate other branches' evaluations that interface with the overall review of the system as follows:

The Reactor Systems Branch (RSB) 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 5.4.6, 5.4.7, and 6.3.

The Auxiliary Systems Branch (ASB) 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 6.7, 9.1.3, 9.1.4, 9.2, 9.3, 9.4, 9.5.1, 10.4.7, and 10.4.9. The ASB 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 sytems 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, electro-hydraulic system, and air supply system. The ASB verifies, on request, the physical arrangements of components and structures of the preferred power system to assure 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.

The Environmental and Hydrologic Engineering Branch (EHEB) 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.

The Instrumentation and Control Systems Branch (ICSB) 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 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.

The Containment Systems Branch (CSB) 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, 6.2.4, and 6.2.5.

The Effluent Treatment 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.

The Procedures and Test Review Branch (PTRB) determines the acceptability of the preoperational and initial startup and test programs as part of its primary review responsibility for SRP Section 14.0.

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.

For those areas of review identified above as being reviewed as part of the primary review responsibility of other branches, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP section of the corresponding primary branch.

## 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 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 lists General Design Criteria, regulatory guides, and staff technical positions utilized as the bases for arriving at this conclusion.

The PSB 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 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 308-1974, relating to sharing of structures, systems, and components of the preferred offsite power system.

2. General Design Criterion 17 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 308-1974) 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.

3. General Design Criterion 18 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 17.

## III. REVIEW PROCEDURES

The primary objective in the review of the preferred power system, is to determine that this sytem 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, Appendix 8-B). To assure 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 that this review procedure is complete.

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

   (a) The electrical drawings should be examined to assure 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).

   (b) The routing of transmission lines should be examined on the station layout drawings and verified during the site visit to assure that at least two independent 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 towards assuring 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.

   (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 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 that there is adequate capability to supply the maximum connected load during all plant conditions. The design should also be examined to assure 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.

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.

(h) The preferred power system must be independent of the onsite power system. 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.

2. To assure that the requirements of General Design Criterion 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. PTRB will review preoperational and initial startup test procedures. QAB will 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 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 that the circuits from the preferred power system can supply redundant portions of these systems. If the minimum design required by General Design Criterion 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 included in the quality assurance program. The QAB will determine the adequacy of the quality assurance program.

5. To assure that the requirements (excluding seismic, tornado, and floods) of General Design Criterion 2 are satisfied for the facility being considered, the Environmental and Hydrologic Engineering Branch (EHEB) will provide to PSB 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 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 that the requirements of General Design Criterion 4 are satisfied, the ASB, 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 that the requirements of General Design Criterion 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 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 that no failure mode of the load dispatch system will cause an incident at the generating station which would require protective action.

## IV. EVALUATION FINDINGS

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 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), 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) of Appendix A to 10 CFR Part 50. The staff concludes that the plant design is acceptable and meets the requirements of GDC 5, 17 and 18. 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 featues 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 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 a-c standby power supplies and loss of the other offsite circuit to assure 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 and the capability to test the transfer of power from the nuclear power unit, the offsite preferred power system, and the onsite power system.

## V. IMPLEMENTATION

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

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.

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guide, NUREG, and Revision 0 to Appendix A of this SRP section.

## VI. REFERENCES


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

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

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

4. Regulatory Guide 1.32, "Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants."

5. IEEE Standard 308-1974, "IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations."

6. Branch Technical Position ICSB-11 (PSB), "Stability of Offsite Power Systems."

7. Standard Review Plan Section 8.1, Table 8-1, "Acceptance Criteria for Electric Power."

8. Standard Review Section 8.1, Appendix 8-B, "General Agenda, Station Site Visits."

9. Appendix A to SRP Section 8.2, "Guidelines for Generator Circuit Breakers/ Load Break Switches."

# 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. Dielectric Tests

   The circuit breaker should be given dielectric strength tests in accordance with the requirements and ratings contained in the applicable ANSI C37 series standards (References 4, 5, and 6).

b. Load Current Switching

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 twice 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. Fault Current Interrupting Capability

The circuit breaker should have, as a minimum, the capability of interrupting the maximum assymetrical and symmetrical fault current availble 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 capabiltiy (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. Maximum Rate of Rise of Recovery Voltage

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. Mechnical Operation Test

A sufficient number of no-load mechnical 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 all ORs, OLs and CPs in accordance with the following (see also subsection V of this SRP section):

1. Guidelines 1 thru 4 of Revision 0 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 thru 4 of this appendix.

2. Guidelines 1 thru 4 of Revision 0 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 thru 4 of Revision 0 to Appendix A of this SRP section are applied to all current and future OL and CP application reviews (as applicable).

D. <u>References</u>


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, Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.

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

6. ANSI Standard C37.09, Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.