U.S. NUCLEAR REGULATORY COMMISSION

DESIGN-SPECIFIC REVIEW STANDARD FOR mPOWER^{TM} iPWR DESIGN

8.4 STATION BLACKOUT

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the electrical engineering review

Secondary - None

I. AREAS OF REVIEW

The term “station blackout“ (SBO) refers to the complete loss of alternating current (ac) electric power to the essential and nonessential switchgear buses in a nuclear power plant (NPP). An SBO, therefore, involves the loss of the offsite electric power system (referred to in industry standards and regulatory guides (RGs) as the ”preferred power system“ concurrent with a turbine trip and unavailability of any emergency ac (EAC) power system. An SBO does not include the loss of available ac power to buses fed by station batteries through inverters or by any alternate ac (AAC) sources specifically provided for SBO mitigation.

The information presented in the safety analysis report (SAR) should be sufficient to support the conclusion that the plant is capable of withstanding and recovering from a complete loss of ac electric power to the essential and nonessential switchgear buses for a minimum of 72 hours. The staff will perform the review to ensure conformance with the requirements of Title of the *Code of Federal Regulations* (CFR), Section 50.63, 10 CFR 50.65, and General Design Criteria (GDCs) 17 and 18 in Appendix A to 10 CFR Part 50, by verifying that the licensee is implementing the relevant guidance of RG 1.155, as supplemented by the guidance and criteria herein.

The analyses performed to demonstrate compliance with 10 CFR 50.63 should remain valid for the life of the NPP. Therefore, if the underlying assumptions change during the life of the NPP, licensees are expected to reevaluate the specified coping duration for their NPPs and the accompanying coping analyses using RG 1.155 or NUMARC-8700, Revision 0, as endorsed by RG 1.155.

The specific areas of review are as follows:

1. SBO Coping Duration. The SBO rule requires each plant to specify an SBO coping duration that is justified by an analysis of site- and plant-specific factors that contribute to the likelihood and duration of an SBO. Sincepassive plants do not have EAC power sources, applicants for such plants need not evaluate SBO coping duration, as long as they are able to demonstrate that the design is capable of performing safety-related functions for a minimum of 72 hours without operator intervention. The 72-hour approach is consistent with the duration proscribed by the U.S. Nuclear Regulatory Commission (NRC) in SECY-90-016 (Reference 23).

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The SBO analysis presented in Chapter 15 of the applicant's SAR should demonstrate that the plant can cope with the effects of an SBO for 72 hours and describe long-term actions following an extended SBO beyond 72 hours. After 72 hours, continued operation of safety systems may rely on nonsafety structures, systems, and components (SSCs), such as ancillary or standby generators (e.g., diesel or gas-turbine driven).

2. SBO Coping Capability. The review should determine that the capability to achieve and maintain safe-shutdown and containment integrity (non-design-basis accident (DBA)) during an SBO conforms to the guidance provided in Section C.3.2 of RG 1.155. The review should also ensure that appropriate procedures and training have been developed to implement this capability, including long-term actions following an extended SBO beyond 72 hours.

3. AAC Power Sources. The mPower^{TM} passive plant design need not include an AAC power source if it can be demonstrated that all safety-related functions can be performed without reliance on ac power for 72 hours after the initiating event and the applicant has implemented a regulatory treatment of non-safety system (RTNSS) process that conforms to Standard Review Plan (SRP) Chapter 19.3.

4. Procedures and Training. The review should determine that procedures and training conform to the guidance in Sections C.1.3, C.2, and C.3.4 of RG 1.155. Procedures and training should address all operator actions necessary to (1) restore/activate ac power, (2) cope with battery power and possible load shedding on the occurrence of an SBO for any mode of plant operation, (3) restore offsite power or use of nearby power sources, and (4) restore/assure normal long-term core cooling/decay heat removal once normal power is restored.

   The review should determine that communication agreements and protocols between the plant and its transmission system operator provide assurance that the NPP operator will be kept aware of (1) changes in the plant switchyard and offsite power grid and (2) local power sources and transmission paths that could be made available to resupply the plant following a loss of offsite power (LOOP) (Reference 15).

5. Quality Assurance (QA) and Specifications for Nonsafety-Related Equipment. The review should determine that QA activities and specifications for nonsafety-related equipment used to meet the requirements of 10 CFR 50.63 conform to the recommendations in Section C.3.5 and Appendix A to RG 1.155. The review should also determine that systems and equipment used to meet the requirements of 10 CFR 50.63 conform to the system and station equipment specification recommendations of Appendix A to RG 1.155. Additionally, the review should ensure that nonsafety equipment installed to meet the SBO rule does not degrade the existing safety-related systems. This is accomplished by ensuring that the nonsafety equipment is as independent as practicable from existing safety-related systems.

6. Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC). For design certification (DC) and combined license (COL) reviews, the staff reviews the applicant's proposed ITAAC associated with the SSCs related to this design-specific review standard (DSRS) section in accordance with SRP Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria." The staff recognizes that the review of ITAAC cannot be completed until after the rest of this portion of the application has been reviewed against

acceptance criteria contained in this DSRS section. Furthermore, the staff reviews the ITAAC to ensure that all SSCs in this area of review are identified and addressed as appropriate in accordance with SRP Section 14.3.

7. COL Action Items and Certification Requirements and Restrictions. For the mPower™ DC application, the review will also address COL action items, as well as requirements and restrictions (e.g., interface requirements and site parameters).

   For subsequent COL applications referencing the mPower™ DC, COL applicants must address COL action items included in the mPower™ DC. Additionally, COL applicants must address requirements and restrictions (e.g., interface requirements and site parameters) included in the DC.

Review Interfaces

Other SRP and DSRS sections interface with this section as follows:

1. The adequacy of the onsite power system, including standby diesel generators (SDGs), ac distribution systems, Class 1E station batteries and associated direct current (dc) systems, and related instrumentation and control systems, is reviewed by the organization responsible for electrical engineering as part of its primary review responsibility for DSRS Sections 8.3.1 and 8.3.2.

2. The adequacy of the offsite power system, including necessary preferred power circuits to the onsite power system and independence of the preferred power system and SDGs power source(s) provided for SBO, is reviewed by the organization responsible for electrical engineering as part of its primary review responsibility for DSRS Section 8.2.

3. The organization responsible for the review of DSRS Sections 4.6, 5.4.7 and 9.3.6, and SRP Section 6.3 determines those system components needing electric power as a function of time for each mode of reactor operation entering an SBO event.

4. The organization responsible for the review of DSRS Sections 9.1.3, 9.1.4, 9.2.1, 9.2.2, 9.2.4, 9.2.5, 9.2.6, 9.3.3, 9.4.1 through 9.4.3, 9.4.5, 10.4.5, and 10.4.7, and SRP Sections 9.3.1, 9.4.4 and 9.5.1 determines those system components needing electric power as a function of time for each mode of reactor operation entering an SBO event.

5. The organization responsible for the review of DSRS Sections 9.1.3, 9.2.1, 9.2.2, 9.2.4, 9.2.5, 9.2.6, 9.3.3, 9.4.1 through 9.4.3, and 9.4.5, and SRP Sections 9.1.4 and 9.3.1 also verifies, on request, the design adequacy and capability of systems and equipment needed to cope with an SBO for the required duration and recovery period.

6. The organization responsible for the review of DSRS Chapter 7 determines those system components needing electric power as a function of time for each mode of reactor operation and accident condition and, upon request, also verifies the adequacy of the instrumentation and controls used to cope with and recover from an SBO condition.

7. The organization responsible for the review of DSRS Section 16.0 coordinates and performs reviews of technical specifications.

8. The organization responsible for the review of DSRS Sections 6.2.2, 6.2.4 and 6.2.5 determines those system components needing electric power as a function of time for each mode of reactor operation entering an SBO event.

9. The organization responsible for the review of DSRS Section 14.2 determines the acceptability of the preoperational and initial startup tests and programs.

10. The organization responsible for the review of SRP Sections 13.5.2.2 evaluates the adequacy of administrative, maintenance, testing, and operating procedure programs. In addition, on request, the organization responsible for SRP Sections 13.5.1.1 and 13.5.2.1 reviews potential habitability concerns for those areas that would need operator access during the SBO and recovery period.

11. The organization responsible for the review of SRP Chapter 17 evaluates the design, construction, and operations phases of QA programs, including the general methods for addressing periodic testing and RTNSS in passive plant designs. In addition, while conducting regulatory audits in accordance with Office Instructions NRR-LIC-111 or NRO-REG-108, "Regulatory Audits," the technical staff may identify quality-related issues. If this occurs, the technical staff should contact the organization responsible for quality assurance to determine if an inspection should be conducted

12. Review of RTNSS is coordinated and performed under SRP Chapter 19 that provides the probabilistic risk assessment for potential risk significance of SSCs.

II. ACCEPTANCE CRITERIA

Requirements

Acceptance criteria are based on meeting the relevant requirements of the following Commission regulations:

1. GDC 17, as it relates to (1) the independence of the SBO-related power sources (Class 1E batteries, SDGs) from the onsite and offsite power distribution systems and (2) the capacity/capability to perform their intended functions.

2. GDC 18, as it relates to periodic testing and inspection of SBO-related onsite power systems important to safety.

3. 10 CFR 50.63, as it relates to the capability to withstand and recover from an SBO.

4. 10 CFR 50.65(a)(4), as it relates to the assessment and management of the increase in risk that may result from proposed maintenance activities before performing the maintenance activities. These activities include, but are not limited to, surveillances, post-maintenance testing, and corrective and preventive maintenance. 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 Chapter 13.

5. 10 CFR 52.47(b)(1), which requires that a DC application contain the proposed ITAAC that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a facility

that incorporates the DC has been constructed and will be operated in conformity with the DC, the provisions of the Atomic Energy Act (AEA), and the NRC's regulations;

6. 10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the AEA, and the NRC's regulations.

DSRS Acceptance Criteria

Specific DSRS acceptance criteria acceptable to meet the relevant requirements of the NRC's regulations identified above are set forth below. The DSRS is not a substitute for the NRC's regulations, and compliance with it is not required. Identifying the differences between this DSRS section and the design features, analytical techniques, and procedural measures proposed for the facility, and discussing how the proposed alternative provides an acceptable method of complying with the regulations that underlie the DSRS acceptance criteria, is sufficient to meet the requirements in 10 CFR 52.47(a)(9), "Contents of applications; technical information." The same approach may be used to meet the requirements of 10 CFR 52.79(a)(41) for COL applications.

1. The guidelines of RG 1.155, as they relate to compliance to 10 CFR 50.63 for the mPower™ design. NUMARC-8700, Revision 0, also provides guidance acceptable to the staff for meeting these requirements. Table 1 of RG 1.155 provides a cross-reference to NUMARC-8700, Revision 0, and notes when the RG takes precedence.

2. The guidelines and criteria of SECY-90-016 and SECY-94-084 (Referece 25), as they relate to the use of AAC power sources and RTNSS at plants provided with passive safety systems.

3. The guidelines of RG 1.75 (Reference 6), as they relate to the independence of the SBO-related power sources from the onsite and offsite ac power distribution systems. Specifically the isolation capability of the battery chargers for the dc system and the adequacy of the isolation provided for the SDGs.

Technical Rationale

The technical rationale for application of these acceptance criteria to the areas of review addressed by this DSRS section is discussed in the following paragraphs:

1. Compliance with GDC 17 with respect to SBO focuses on the independence of the SBO-related power sources and their capacity/capability to perform their required functions. GDC 17 assures independence by requiring the inclusion of 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, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies. For passive designs, this independence is provided by the Class 1E battery chargers for the Class 1E dc power system and by the normally open manual

circuit breakers that isolate the SDGs from the ac distribution system, as well as other features such as normally open manual circuit breakers.

Meeting the independence and capacity/capability requirements of GDC 17 provides assurance that a reliable electric power supply will be provided to fully respond to an SBO.

2. Compliance with GDC 18 with respect to SBO 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 the operability and functional performance of the components of the systems.

   Meeting the requirements of GDC 18 provides assurance that, when necessary, onsite 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.

3. Compliance with 10 CFR 50.63 requires that each light-water-cooled NPP be able to withstand and recover from an SBO of specified duration. As required by 10 CFR 50.63, electrical systems must be of sufficient capacity and capability to ensure that the core is cooled and that appropriate containment integrity is maintained in the event of an SBO.

   The capacity of any onsite dc sources required for SBO response must be verified as adequate to address the worst-case SBO load profile and specified duration. For new advanced light-water reactor (ALWR) applications such as mPower™, that use passive safety systems and do not include a spare, full-capacity alternate ac power source for coping with an SBO, the reviewer should ensure that (1) all safety-related functions can be performed without relying on ac power for 72 hours after the initiating event, and (2) the applicant has implemented an RTNSS process that conforms to Chapter C.IV.9 of RG 1.206. For COL applicants who reference the mPower™ certified design, that application will address the implementation of the RTNSS process. RG 1.155 and DSRS Section 8.4 describe guidance acceptable to the staff for meeting the requirements of 10 CFR 50.63.

   Meeting the requirements of 10 CFR 50.63 provides assurance that nuclear power plants will be able to withstand or cope with, and recover from, an SBO by providing capability for maintaining core cooling and an appropriate level of containment integrity. The SBO coping capability is reviewed in Chapter 15 of the DSRS.

III. REVIEW PROCEDURES

These review procedures are based on the identified DSRS acceptance criteria. For deviations from these acceptance criteria, the staff should review the applicant's evaluation of how the proposed alternatives provide an acceptable method of complying with the relevant NRC requirements identified in Subsection II.

1. In accordance with 10 CFR 52.47(a)(8),(21), and (22), for new reactor license applications submitted under Part 52, the applicant is required to (1) address the proposed technical resolution of unresolved safety issues and medium- and high-priority

generic safety issues that are identified in the version of NUREG-0933 current on the date 6 months before application and that are technically relevant to the design; (2) demonstrate how the operating experience insights have been incorporated into the plant design; and, (3) provide information necessary to demonstrate compliance with any technically relevant portions of the Three Mile Island requirements set forth in 10 CFR 50.34(f), except paragraphs (f)(1)(xii), (f)(2)(ix), and (f)(3)(v). These cross-cutting review areas should be addressed by the reviewer for each technical subsection and relevant conclusions documented in the corresponding safety evaluation report (SER) section.

2. GDC 17 places requirements on the offsite power system and the onsite emergency ac and dc power systems. With respect to SBO, only the emergency dc power system is considered available. Therefore, the GDC 17 specific requirements that pertain to this DSRS section are (1) independence of the SBO-related power sources and (2) their capability/capacity to perform their intended functions. Independence of the dc power system from the ac systems can be achieved by battery chargers. If so, the battery chargers must be fully qualified as Class 1E, especially with their ability to perform as isolation devices in accordance with RG 1.75. Independence of the SDGs from the ac power systems is achieved by normally open circuit breakers. The reviewer should assure that this isolation scheme is also in accordance with RG 1.75. In terms of capability/capacity for the Class 1E batteries, the review must assure that there is sufficient battery capacity to supply all SBO loads for a minimum of 72 hours with margin. For the SDGs, the review must assure that they are sized to power all SBO-related loads (which after 72 hours may include additional loads) while simultaneously recharging the batteries.

3. GDC 18 places testability requirements on all of the SBO-related power sources. For the Class 1E dc power system, this verification is performed under DSRS Section 8.3.2. For the SDGs, the reviewer should verify that the SDGs can be tested (both starting and manual loading) without interfering with normal plant operations.

4. The SBO rule (10 CFR 50.63) requires each plant to demonstrate the capability to withstand (cope with) and recover from an SBO condition lasting for a specified duration (coping duration). Specifically, applicants should do the following:

   A. Establish the duration of an SBO that the plant will be able to withstand (coping duration). For passive designs, this should be a minimum of 72 hours without operator intervention.

   B. Evaluate the plant's capability to withstand and recover from an SBO (coping capability).

   C. Develop the necessary procedures and training to cope with and recover from an SBO.

5. To ensure that the requirements of 10 CFR 50.63 are satisfied, the staff should take the following review steps:

   A. <u>SBO Coping Duration</u>. The SBO rule requires each plant to justify its specified coping duration by an analysis of site- and plant-specific factors that contribute to the likelihood and duration of an SBO. Because passive plants will not have EAC power sources, the applicant need not evaluate SBO coping duration, as

long as they are able to demonstrate that the design is capable of performing safety-related functions (i.e., core cooling and containment integrity) for a minimum of 72 hours without operator intervention. The staff will review the SBO analysis to determine that the selected coping duration conforms to the guidance provided in Section C.3.1 of RG 1.155, as supplemented by the criteria contained herein.

B. SBO Coping Capability. The staff will review the SAR to determine that the capability to cope with an SBO lasting for 72 hours conforms to the guidance in Section C.3.2 of RG 1.155. The review should ensure that the capability to maintain adequate core cooling and appropriate containment integrity for this specified coping duration is adequately demonstrated and appropriate procedures and training are implemented to withstand (cope with) the event. Passive designs employ an ac-independent approach to cope with SBO. The plant relies on available sources of energy that are independent of ac power (e.g., process steam, dc power, and compressed air). Therefore, the reviewer should determine that an analysis conforming to the guidance in Sections C.3.2.1 to C.3.2.4 of RG 1.155 demonstrates the capability to achieve and maintain safe-shutdown for a minimum of 72 hours without operator intervention.

6. The reviewer should verify that the applicant's determination of the plant's ability to cope with an SBO should be based on the following general criteria, initial conditions and baseline assumptions (References 7 and 38):

A. Because of the presence of substantial decay heat, events initiated from 100-percent power bound the potential for core damage from an SBO. Therefore, the coping analysis should be performed assuming that the SBO event occurs while the reactor is operating at 100-percent rated thermal power and has been at this power level for at least 100 days.

B. Immediately before the postulated SBO event, the reactor and supporting systems are within normal operating ranges for pressure, temperature, and water level. All plant equipment is either normally operating or available from the standby state.

C. It is assumed that a reasonable set of operator actions will occur to mitigate the effects of an SBO and recover from the event. Operator actions are assumed to follow plant operating procedures for the underlying symptoms or identified event scenario associated with an SBO.

D. Actions specified in procedures for SBO are predicated on the use of instrumentation and controls powered by vital buses supplied by station batteries.

E. The dc power needs for SBO may be estimated using the same methodology for which the plant is licensed; Institute for Electrical and Electronics Engineers (IEEE) Standard (Std.) 485 (Reference 14) describes the generally accepted methodology. For passive plant designs, the staff considers the steady-state loading condition to be the governing factor for determining the Class 1E battery size (References 28 and 34). This should be verified to be part of the applicant's analysis.

F. Since the capacity of battery storage varies with electrolyte temperature, calculations should assume the lowest temperature normally expected of the battery.

G. The capability of all systems and components necessary to provide core cooling and decay heat removal following an SBO should be identified along with their required and available capacities. (Note: The nonsafety systems identified in Appendix A to RG 1.155 are acceptable to the NRC staff for responding to an SBO.)

H. The ability to maintain adequate reactor coolant system inventory to ensure that the core is cooled should be demonstrated, taking into consideration any possible pathways for inventory to escape.

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

   i. Potential environmental effects on the operability and reliability of equipment necessary to cope with the SBO, including possible effects of fire protection systems

   ii. Potential habitability concerns for those areas that would need operator access during the SBO and recovery period

J. Equipment will be considered acceptable for SBO temperature environments if an assessment has been performed by the applicant that provides reasonable assurance that the necessary equipment will remain operable.

K. The ability to maintain appropriate containment integrity should be addressed. Appropriate containment integrity for SBO means that adequate containment integrity is ensured by providing the capability, independent of ac power supplies, for valve position indication and closure for containment isolation valves that may be in the open position at the onset of an SBO. This does not include the following valves:

   i. Valves normally locked closed during operation

   ii. Valves that fail closed on a loss of power

   iii. Check valves

   iv. Valves in nonradioactive closed-loop systems not expected to be breached in an SBO (not including lines that communicate directly with containment atmosphere)

7. AAC Power Sources. For new ALWR plants, the Commission has established a policy (Reference 23) that such plants should have an AAC power source of diverse design and capable of powering at least one complete set of normal shutdown loads. In SECY-94-084 and SECY-95-132 (Reference 26), the Commission modified these

criteria for ALWRs that use passive safety systems. Specifically, an AAC power source is not necessary for passive plant designs that (1) do not need ac power to perform safety-related functions for 72 hours following the onset of an SBO and (2) meet the guidelines in SRP Section 19.3 regarding RTNSS.

8. Procedures and Training. The staff will review the applicant's procedures and training programs to ensure that they conform to the guidance in Sections C.1.3, C.2, and C.3.4 and Appendix B to RG 1.155 and include all operator actions necessary to do the following:

   A. Cope with the occurrence of an SBO occurring during any mode of plant operation. Procedures developed to cope with an SBO should be integrated with the plant-specific technical guidelines and emergency operating procedures developed using the emergency operating procedure upgrade program established in response to Supplement 1 of NUREG-0737. The task analysis portion of the emergency operating procedure upgrade program should include an analysis of instrumentation adequacy during an SBO.

   B. Monitor plant conditions over the first 72 hours and prepare for longer term actions, such as starting and loading the SDGs to power the necessary loads and recharge the batteries.

   C. Restore offsite power sources or use any nearby power sources (which may include nearby or onsite gas turbine generators, portable generators, hydrogenerators, and black start fossil power plants) in the event of a LOOP.

   D. Actions necessary to restore normal power supply to the long-term core cooling/decay heat removal loads once ac power is restored.

9. In addition, the reviewer should determine that plant operating procedures developed to respond to an SBO event are consistent with the following general guidelines:

   A. Plant operating procedures should identify any sources of potential inventory loss and specify actions to prevent or limit significant loss.

   B. Plant operating procedures should specify clear criteria for transferring to the next preferred source of water should such need arise.

   C. The procedure should identify any individual loads that need to be stripped from the plant dc buses to conserve dc power.

   D. Plant operating procedures should specify any actions necessary to permit appropriate containment isolation and safe-shutdown valve operations beyond 72 hours if normal ac power is still unavailable.

   E. Plant operating procedures should identify any portable lighting necessary for ingress and egress to plant areas containing shutdown equipment requiring manual operation.

F. Plant operating procedures should consider the effects of ac power loss on area access, as well as any need to gain entry to locked areas where remote equipment operation may become necessary.

G. Plant operating procedures should consider the effects of a loss of ac power on communications capabilities, including the potential for a loss of communications with offsite agencies.

H. Plant operating procedures should consider the loss of any heat tracing that would affect equipment necessary to cope with an SBO.

I. Plant operating procedures should contain appropriate communication protocols between the NPP and its transmission system operator (Reference 15). With regard to SBO, these protocols should aid the operator in determining the Availability of local power sources and transmission paths that could be made available to resupply the plant following a LOOP event.

10. QA and Specification Guidance for SBO Equipment that is not Safety-Related. The staff will review QA activities and specifications for nonsafety-related equipment used to meet the requirements of 10 CFR 50.63 to ensure that they conform to the recommendations in Section C.3.5 and Appendix A to RG 1.155. The review should also determine that systems and equipment used to meet the requirements of 10 CFR 50.63 conform to the system and station equipment specification recommendations of Appendix B to RG 1.155. The NRC staff will accept the nonsafety systems identified in Appendix B to RG 1.155 for responding to an SBO.

    For the passive mPower™ design, the applicant should define any active systems that are relied upon for defense-in-depth purposes and that are necessary to meet passive ALWR plant safety and investment protection goals. The staff reviews QA controls applicable to the SSCs within the RTNSS process under SRP Section 19.3.

11. For review of a DC application, the reviewer should follow the above procedures to verify that the design, including requirements and restrictions (e.g., interface requirements and site parameters), set forth in the final safety analysis report (FSAR) meets the acceptance criteria. DCs have referred to the FSAR as the design control document (DCD). The reviewer should also consider the appropriateness of identified COL action items. The reviewer may identify additional COL action items; however, to ensure these COL action items are addressed during a COL application, they should be added to the DC FSAR.

    For review of both DC and COL applications, SRP Section 14.3 should be followed for the review of ITAAC. The review of ITAAC cannot be completed until after the completion of this section.

IV. EVALUATION FINDINGS

The reviewer verifies that the applicant has provided sufficient information and that the review and calculations (if applicable) support conclusions of the following type to be included in the staff's SER. The reviewer also states the bases for those conclusions.

On the basis of the staff's detailed review and evaluation of the SBO capability described in the SAR for DCD/COL (Facility), the staff concludes that the applicant has appropriately evaluated the facility against the guidelines of RG 1.155 and this DSRS section. The SAR DCD/COL acceptably demonstrates that the plant is in compliance with the applicable provisions of GDCs 17 and 18 and 10 CFR 50.63, as they relate to the capability to achieve and maintain safe-shutdown (non-DBA) in the event of an SBO.

Accordingly, the staff concludes that the plant design is acceptable and meets the requirements of GDCs 17 and 18 of Appendix A to 10 CFR Part 50, as they relate to the requirements of 10 CFR 50.63 and 10 CFR 50.65.

For DC and COL reviews, the findings will also summarize the staff's evaluation of requirements and restrictions (e.g., interface requirements and site parameters) and COL action items relevant to this DSRS section.

In addition, to the extent that the review is not discussed in other SER sections, the findings will summarize the staff's evaluation of the ITAAC, including design acceptance criteria, as applicable.

V. IMPLEMENTATION

The staff will use this DSRS section in performing safety evaluations of mPower™-specific DC, or COL, applications submitted by applicants pursuant to 10 CFR Part 52. The staff will use the method described herein to evaluate conformance with Commission regulations.

Because of the numerous design differences between the mPower™ and large light-water nuclear reactor power plants, and in accordance with the direction given by the Commission in SRM-COMGBJ-10-0004/COMGEA-10-0001, "Use of Risk Insights to Enhance the Safety Focus of Small Modular Reactor Reviews," dated August 31, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML102510405), to develop risk-informed licensing review plans for each of the small modular reactor reviews, including the associated pre-application activities, the staff has developed the content of this DSRS section as an alternative method for mPower™-specific DC, or COL submitted pursuant to 10 CFR Part 52 to comply with 10 CFR 52.47(a)(9), "Contents of applications; technical information."

This regulation states, in part, that the application must contain "an evaluation of the standard plant design against the Standard Review Plan (SRP) revision in effect 6 months before the docket date of the application." The content of this DSRS section has been accepted as an alternative method for complying with 10 CFR 52.47(a)(9), as long as the mPower™ DCD FSAR does not deviate significantly from the design assumptions made by the NRC staff while preparing this DSRS section. The application must identify and describe all differences between the standard plant design and this DSRS section, and discuss how the proposed alternative provides an acceptable method of complying with the regulations that underlie the DSRS acceptance criteria. If the design assumptions in the DC application deviate significantly from the DSRS, the staff will use the SRP as specified in 10 CFR 52.47(a)(9). Alternatively, the staff may supplement the DSRS section by adding appropriate criteria in order to address new design assumptions. The same approach may be used to meet the requirements of 10 CFR 52.79(a)(41), for COL applications.

VI. REFERENCES

1. 10 CFR 50.2, “Definitions.”

2. 10 CFR 50.63, “Loss of All Alternating Current Power.”

3. 10 CFR Part 50, Appendix A, GDC 17, “Electric Power Systems.”

4. 10 CFR Part 50, Appendix A, GDC 18, “Inspection and Testing of Electric Power Systems.”

5. 10 CFR Part 52, “Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants.”

6. RG 1.75, “Criteria for Independence of Electrical Safety Systems.”

7. RG 1.155, “Station Blackout.”

8. RG 1.160, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.”

9. RG 1.182, “Assessing and Managing Risk Before Maintenance Activities at Nuclear Power Plants.”

10. SRP Section 8.1, Table 8-1, “Acceptance Criteria for Electric Power.”

11. SRP Section 8.2, “Offsite Power.”

12. SRP Section 8.3.1, “AC Power Systems (Onsite).”

13. SRP Section 8.3.2, “DC Power Systems (Onsite).”

14. IEEE Standard 485-1987, “Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications.”

15. Generic Letter 2006-02, “Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power,” February 1, 2006.

16. Information Notice 97-05, “Offsite Notification Capabilities,” February 27, 1997.

17. Information Notice 97-21, “Availability of Alternate AC Power Source Designed for Station Blackout Event,” April 18, 1997.

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21. Intentionally left blank.

22. Intentionally left blank.

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25. SECY-94-084, “Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems in Passive Plant Designs,” March 28, 1994. Approved in the SRM, dated June 30, 1994.

26. SECY-95-132, “Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems (RTNSS) in Passive Plant Designs.” Approved in the SRM, dated June 28, 1995.

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