U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

9.5.5 EMERGENCY DIESEL ENGINE COOLING WATER SYSTEM

REVIEW RESPONSIBILITIES

Primary - ~~Power Systems Branch (PSB)~~Plant Systems Branch (SPLB)[1]

Secondary - None

I. AREAS OF REVIEW

The emergency diesel engine cooling water system (EDECWS) provides cooling water to the station emergency diesel engines and is reviewed to assure conformance with General Design Criteria 2, 4, 5, 17, 44, 45, and 46. The ~~PSB~~SPLB[2] review includes those portions of the EDECWS that receive heat from components essential for proper operation of the diesel engines and that are housed within their respective diesel engine compartments, and those additional parts of the system that transfer the heat to a heat sink. The system includes all valves, heat exchangers, pumps, and piping up to the engine interface.(1)

1. The ~~PSB~~SPLB[3] reviews the functional performance characteristics of the EDECWS and the effects on those characteristics of adverse environmental occurrences, abnormal operational requirements, accident conditions, and loss of offsite power.

(1) As defined by the engine manufacturer.

2. The system is reviewed to determine that malfunction or single failure of a component, or the loss of a cooling source, will not reduce the safety-related functional performance capabilities of the system. The ~~PSB~~SPLB[4] verifies that:

   a. System components and piping have sufficient physical separation or shielding to protect the system from internally or externally generated missiles and from pipe whip and jet impingement caused by cracks or breaks in high- and moderate-energy piping.

   b. System components are designed in accordance with the design codes required by the assigned quality group and seismic category classifications.

   c. The system is housed in structures designed to seismic Category I requirements.

   d. Failures of nonseismic Category I structures and components would not affect the safety-related functions of the EDECWS.

3. The ~~PSB~~SPLB[5] reviews the design of the EDECWS with respect to the following:

   a. Functional capability during periods of abnormally high water levels (the probable maximum flood).

   b. Capability to detect and control system leakage, including isolating portions of the system in the event of excessive leakage or component malfunction.

   c. Measures to preclude long-term corrosion and organic fouling that would degrade system cooling performance, and the compatibility of any corrosion inhibitors or antifreeze compounds used with the materials of the system.

   d. The capacity of the EDECWS with regard to the manufacturer's recommended engine temperature differentials under adverse operating conditions.

   e. Provision of proper instruments and testing systems to permit operational testing of the system.

   f. Provisions to assure that normal protective interlocks do not preclude engine operation during emergency conditions.

4. For those plants that designate an emergency diesel engine as an alternate ac power source, the SPLB will determine the adequacy of the EDECWS to perform its function in the event of a station blackout.[6]

~~4. The PSB will determine the adequacy of the design installation, inspection, and testing of all electrical components (sensing, control, and power) required for proper operation of the system, including interlocks.~~[7]

Review Interfaces:[8]

SPLB also performs the following reviews under the SRP sections indicated:[9]

1. The SPLB determines that the EDECWS is protected against failures in high-energy and moderate-energy piping systems outside containment as part of its primary review responsibility for SRP Section 3.6.1; and[10]

2. The SPLB reviews the test program for monitoring the heat transfer capability of safety-related heat exchangers cooled by service water under SRP Section 9.2.1. If such tests indicate degradation in heat transfer capability that cannot be remedied by maintenance of the service water system, closed loop cooling systems such as the EDECWS reviewed under SRP 9.5.5 should be included in the scope of the inspection and maintenance program for service water systems, also reviewed under SRP 9.2.1.[11]

3. The SPLB reviews ~~for~~ the EDECWS to determine the adequacy of fire protection provisions ~~are coordinated and performed by the Chemical Engineering Branch~~as part of ~~their~~its primary review responsibility for SRP Section 9.5.1.[12]

In addition,~~the review of the emergency diesel engine cooling water system,~~[13] the ~~PSB~~SPLB[14] will coordinate other branches evaluations that interface with the overall review of the system as follows:

1. ~~Structural Engineering Branch (SEB)~~Civil Engineering and Geosciences Branch (ECGB)[15] determines the acceptability of the design analyses, procedures, and criteria used to establish the ability of Category I facility structures housing the system and supporting systems to withstand the effects of natural phenomena such as a safe shutdown earthquake (SSE), the probable maximum flood (PMF), and tornado missiles as part of its primary review responsibility for SRP Sections 3.3.1, 3.3.2, 3.5.3, 3.7.1 through 3.7.4, 3.8.4, and 3.8.5.

2. The Mechanical Engineering Branch ~~(MEB)~~(EMEB)[16] determines that components, piping, and structures are designed in accordance with applicable codes and standards as part of its primary review responsibility for SRP Sections 3.9.1 through 3.9.3.

3. The ~~(MEB)~~EMEB[17] also determines the acceptability of the seismic and quality group classifications for system components as part of its primary review responsibility for SRP Sections 3.2.1 and 3.2.2.

4. The ~~Materials Engineering Branch~~Materials and Chemical Engineering Branch (EMCB)[18] verifies, upon request of ~~PSB~~SPLB,[19] the compatibility of the materials of construction with service conditions.

~~The Auxiliary Systems Branch (ASB) determines that the EDECWS is in accordance with Branch Technical Positions ASB 3 and MEB 3-1 for cracks and breaks in high-energy and moderate-energy piping systems outside containment as part of its primary review responsibility for SRP Section 3.6.1.~~[20]

5. The ~~Procedures and Test Review Branch~~Quality Assurance and Maintenance Branch (HQMB)[21] determines the acceptability of the preoperational and start-up tests as part of its primary review responsibility for SRP Section 14.2[22]. The reviews for quality assurance are also coordinated and performed by the ~~Quality Assurance Branch~~HQMB as part of ~~their~~its primary review responsibility for SRP ~~Section~~Chapter 17.~~0~~.[23]

6. The reviews for technical specifications are coordinated and performed by the ~~Licensing Guidance Branch~~Technical Specifications Branch (TSB)[24] as part of ~~their~~its primary review responsibility for SRP Section 16.0.

7. The Electrical Engineering Branch (EELB) determines the adequacy of the design, installation, inspection, and testing of all electrical components required for proper operation of the system, including interlocks as part of its primary review responsibility for SRP Section 8.3.1.[25] The EELB also determines the adequacy of proposed alternate ac sources for station blackout as part of its primary review responsibility for SRP Sections 8.2 and 8.4 (proposed).[26]

For those areas of review identified above as being part of ~~the primary review responsibility of other branches~~reviews under other SRP sections, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP section ~~of the corresponding primary branches~~[27].

II. ACCEPTANCE CRITERIA

Acceptability of the emergency diesel engine cooling system design, as described in the applicant's safety analysis report (SAR), is based on specific regulations,[28] General Design Criteria, regulatory guides, and industry standards. Information obtained from other Federal agencies and reports, military specifications, available technical literature, and operational performance data obtained from similarly designed systems at other plants having satisfactory operational experience will also be utilized in determining EDECWS acceptability.

The EDECWS is acceptable if the integrated system design is in accordance with the following criteria:

1. General Design Criterion 2, as related to structures housing the system and the system itself being capable of withstanding the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, and floods, as established in Chapters 2 and 3 of the SAR. Acceptance is based on meeting Appendix Position 13 of Regulatory Guide 1.117 as related to the protection of structures, systems, and components (SSC)[29] important to safety from the effects of tornado missiles.

2. General Design Criterion 4, with respect to structures housing the system and the system itself being capable of withstanding the effects of external missiles and internally generated missiles, pipe whip, and jet impingement forces associated with pipe breaks. Acceptance is based on meeting Position C.1 of Regulatory Guide 1.115 as related to the protection of SSC important to safety from the effects of turbine missiles.

3. General Design Criterion 5, as related to the capability of shared systems and components important to safety being capable of performing required safety functions.

4. General Design Criterion 17, as related to the capability of the cooling water system to meet independence and redundancy criteria, and General Design Criterion 44, to assure:

   •~~a.~~[30] The capability to transfer heat from systems and components to a heat sink under transient or accident conditions.

   •~~b.~~[31] Redundancy of components so that under accident conditions the safety function can be performed assuming a single active component failure.

   •~~c.~~[32] The capability to isolate components of the system or piping, if required to maintain the system safety function.

   To meet the requirements of these regulations the following guidance and positions are used:

   a. Regulatory Guide 1.9, as related to the design of the diesel cooling water system.

   ~~b. Branch Technical Position ICSB-17 (PSB) as related to engine cooling water protective interlocks during accident conditions.~~[33]

   ~~c~~b.[34] NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability." (Reference 13)[35]

   ~~d~~c.[36] ANSI/IEEE Std~~andard~~[37] 387 as related to the design of the diesel engine cooling water system (Reference 14).[38]

   ~~e~~d.[39] Diesel Engine Manufacturers Association (DEMA) Standard (Reference 15)[40], as related to the design of the engine cooling water system.

5. General Design Criterion 45, as related to design provisions to permit periodic inspection of safety-related components and equipment of the system.

6. General Design Criterion 46, as related to design provisions to permit appropriate functional testing of safety-related systems or components to assure structural integrity and leaktightness, operability and performance of active components, and the capability of the system to function as intended under accident conditions.

Plants that have emergency ac sources in excess of minimum redundancy requirements for loss-of-offsite-power conditions may use one of the existing emergency sources as an alternate ac (AAC) power source for the purposes of coping with a station blackout, provided it meets the applicable criteria for an AAC source. For a plant relying on an emergency diesel engine as an AAC power source, the design of the cooling water system for that engine is acceptable if it meets 10 CFR Part 50.63, paragraph (a)(2), and Regulatory Guide 1.155, Position C.3.[41]

Technical Rationale:[42]

The technical rationale for application of the above acceptance criteria to the emergency diesel engine cooling water system is discussed in the following paragraphs.

1. GDC 2 requires that SSC important to safety be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform the safety function. Regulatory Guide 1.117 provides the methods acceptable to the staff for tornado design classification of structures, systems and components important to safety. Position 13 of the appendix to Regulatory Guide 1.117 identifies Class 1E electrical systems that must be protected from the effects of tornadoes. The safety function of the EDECWS is to provide cooling water for the EDE following an engine start signal. A reliable cooling water supply to the emergency diesel engine is necessary to ensure the prompt restoration of ac power to safety related components that are necessary to maintain the integrity of the reactor coolant pressure boundary, to safely shutdown the reactor and maintain it in a safe shutdown condition, and to prevent or mitigate the consequences of accidents. Compliance with the requirements of GDC 2 and Regulatory Guide 1.117 ensures that emergency ac power will be available to safety-related components in the event of a loss of offsite power resulting from natural phenomena events.

2. GDC 4 requires that SSC important to safety be designed to withstand the dynamic effects of pipe ruptures such as pipe whip and jet impingement, and externally or internally generated missiles. Regulatory Guide 1.115, Position C.1, identifies those essential systems that should be protected against low- trajectory turbine missiles. The safety function of the EDECWS is to provide cooling water to the EDE following an engine start signal. In order to ensure the availability of emergency ac power, the EDECWS must be capable of supplying cooling water to the engine under the expected operational and postulated accident conditions for the plant. These conditions include consideration of the dynamic effects of equipment failures such as pipe ruptures and turbine missiles, and events and conditions external to the plant. Compliance with GDC 4 and the applicable portion of Regulatory Guide 1.115 provides assurance that the dynamic effects of equipment failures, and events external to the plant, will not affect the capability of the EDECWS to provide cooling water to the emergency diesel engines.

3. GDC 5 prohibits the sharing of SSC important to safety among nuclear power units unless it can be demonstrated that such sharing will not significantly impair their ability to perform their safety functions, including in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining unit. The safety function of the EDECWS is to provide cooling water to the EDE following an engine start signal. In order to ensure the availability of emergency ac power to safety-related components, the EDECWS must be designed to perform this safety function in each unit regardless of events, failures, and conditions in the other unit(s). Compliance with GDC 5 provides assurance that equipment failures and events occurring in one unit of the site will not propagate to other units of the site.

4. GDC 17, in relevant part, requires provision of an onsite electric power system to permit the functioning of structures, systems and components important to safety. GDC 17 requirements include that the onsite electric power system have sufficient independence and redundancy to perform their safety functions assuming a single failure. Typically, the emergency diesel generator system is the onsite electric power system relied upon to meet these requirements. The diesel engine cooling water system is integral to the emergency diesel generator system. Regulatory Guide 1.9 provides regulatory positions with regard to EDE and cooling water system design criteria and features applicable to GDC 17 compliance. Meeting the GDC 17 requirements provides assurance that electric power will be available for systems necessary to: 1) prevent fuel damage in the event of anticipated operational occurrences; and 2) maintain core cooling and containment integrity in the event of postulated accidents.

6. GDC 44 requires a cooling system to transfer heat from SSC important to safety to an ultimate heat sink. Requirements include suitable redundancy, interconnections, leak detection and isolation capabilities to assure onsite power system operation if offsite power is not available. Typically, the emergency diesel generator system is the onsite electric power system relied upon when offsite power is unavailable. The diesel engine cooling water system is integral to the emergency diesel generator system and serves to transfer heat away from diesel engine components to the ultimate heat sink. Meeting GDC 44 provides assurance that important safety functions can be accomplished under normal operating and accident conditions.

7. GDC 45 establishes requirements regarding the design of cooling water systems to permit appropriate periodic inspection of important components, such as heat exchangers and piping, to assure the integrity and capability of the system. The EDECWS provides engine cooling for the emergency diesel generator which in turn provides emergency power to plant SSC important to safety. Periodic inspections/tests of the EDECWS provide assurance that the system will function as designed to support operation of the onsite emergency power supply.

8. GDC 46 establishes requirements regarding the design of cooling water systems to permit appropriate periodic pressure and functional testing under conditions as close to design as practical. The EDECWS provides engine cooling for the emergency diesel generators which in turn provide emergency power to plant SSC important to safety. Periodic inspections/tests of the EDECWS provide assurance that the system will function as designed to support operation of the onsite emergency power supply.

9. 10 CFR 50.63 requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout (i.e., loss of the offsite electric power system concurrent with reactor trip and unavailability of the onsite emergency ac electric power system). Paragraph (a)(2) of 50.63 establishes the conditions under which provision of an alternate ac (AAC) power source will constitute acceptable capability to withstand station blackout. Regulatory Guide 1.155 describes a method acceptable to the NRC staff for complying with 10 CFR 50.63. Plants that have emergency ac sources in excess of minimum redundancy requirements for loss-of-offsite-power conditions may use one of the existing emergency sources as an AAC power source for the purposes of

coping with a station blackout. Any emergency diesel engine designated as an AAC power source is dependent on support systems such as the engine cooling water system. Compliance with 10 CFR 50.63 and the positions of Regulatory Guide 1.155 regarding the ability to cope with a station blackout provides additional defense-in-depth against unacceptable offsite radiological consequences should both offsite and onsite emergency ac power systems fail concurrently.

III. REVIEW PROCEDURES

The procedures below are used during the construction permit (CP) review to determine that the design criteria and bases and the preliminary design as set forth in the preliminary safety analysis report meet the acceptance criteria given in subsection II of this SRP section. For the review of operating license (OL) applications, the procedures are used to verify that the initial design criteria and bases have been appropriately implemented in the final design as set forth in the final safety analysis report. The procedures for OL reviews include a determination that the content and intent of the technical specifications prepared by the applicant are in agreement with the requirements for system testing, minimum performance, and surveillance developed as a result of the ~~LGB~~TSB[43] review, as indicated in subsection I of this SRP section.

The design of the diesel engine cooling water system may vary considerably from plant to plant due to the requirements of various diesel engine manufacturers, the number and type of secondary cooling loops used for heat removal, and the number of intermediate cooling loops required to transfer the rejected heat to the ultimate heat sink. Variations in design may also occur due to performances of various architect-engineer firms. Therefore, for the purpose of this SRP section, a typical system is assumed. Any variance in the review procedure, to suit a particular design, will be such that the system review areas in sub-section I are covered, and the system will meet the criteria in subsection II of this SRP section.

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

1. The SAR is reviewed to establish that the EDECWS description and related diagrams clearly delineate system operation, individual and total heat removal rates required by components, and the margin in the design heat removal rate capability. The reviewer verifies the following:

   a. The ~~SEB~~ECGB[44] reviews the seismic design bases and the ~~MEB~~EMEB[45] reviews the quality and seismic classification as indicated in subsection I of this SRP section. The ~~PSB~~SPLB[46] assures that essential portions of the EDECWS including the isolation valves separating essential and non-essential portions are classified Quality Group C and seismic Category I. Components and system descriptions in the SAR that identify mechanical and performance characteristics are reviewed to verify that the above seismic and quality classification have been included and that the P&IDs indicate any points of change at the systems and/or systems components interfaces.

b. Failure of a piping interconnection, as shown on system piping and instrumentation diagrams (P&IDs), between subsystems does not cause total degradation of the EDECWS. The results of failure modes and effects analyses are used as a basis of acceptance.

c. Provisions have been made to permit inspection of components, as shown on system layout drawings.

d. The performance and water chemistry of the EDECWS is in conformance with the engine manufacturer's recommendations.

e. The engine "first try" starting reliability has been increased by providing an independent loop for circulating heated water while the engine is in the standby mode.

f. A three-way bypass-type thermostatically controlled valve has been provided to control water flow through the jacket water coolers or radiators so that proper coolant temperature is maintained at the engine inlet, as specified by the manufacturer.

g. Temperature sensors have been provided to alert the operator when cooling water temperatures exceed the limits recommended by the manufacturer. The EELB reviews protective interlocks as indicated in subsection I of this SRP section.[47] Protective interlocks in this system are acceptable if the SAR indicates that the interlocks are in conformance with ~~Branch Technical Position ICSB-17 (PSB).~~Position C.1.8 of Regulatory Guide 1.9.[48]

h. Adequate volume is available to maintain system water level and pump NPSH without refill assuming expected water loss over a 7-day period of engine operation.[49]

2. The reviewer verifies that the EDECWS can be vented to assure that all spaces are filled with water. Statements in the SAR to the effect that the system design satisfies the above requirement are acceptable.

3. The reviewer verifies that system function will be maintained in the event of adverse environmental phenomena and loss of offsite power. The reviewer evaluates the system, using engineering judgment and the results of failure modes and effects analyses to determine that:

a. Failure of nonessential portions of the system or the other systems not designed to seismic Category I requirements and located close to essential portions of the system, or of nonseismic Category I structures that house, support, or are close to essential portions of the EDECWS, will not preclude essential functions. Reference to SAR sections describing site features and the general arrangement and layout drawings will be necessary, as well as the SAR tabulation of seismic

design classifications for structures and systems. Statements in the SAR to the effect that the above conditions are met are acceptable.

b. The essential portions of the system are protected from the effects of floods, hurricanes, tornadoes, and internally and externally generated missiles. Flood protection and missile protection criteria are discussed and evaluated in detail under the SRP sections for Chapter 3 of the SAR. A statement to the effect that the system is located in a seismic Category I structure that is tornado missile and flood protected, or that components of the system will be located in individual cubicles or rooms that will withstand the effects of both flooding and missiles, is acceptable.

4. The reviewer verifies that there are no high- or moderate-energy piping systems located close to the EDECWS or that the EDECWS is protected from the effects of postulated breaks in these systems. The means of providing such protection are given in Chapter 3 of the SAR and procedures to review the information presented are given in the SRP sections for that chapter.

5. The descriptive information, P&IDs, onsite emergency power supply drawings, and system analyses are reviewed to assure that essential portions of the system will function following design basis accidents, assuming a concurrent single active component failure. The reviewer evaluates the results of failure modes and effects analyses presented in the SAR to ensure the functioning of required portions of the system.

6. The performance requirements of the diesel engine are reviewed to determine the time available to provide cooling water to the diesels and the other systems that have to operate to assure onsite power capability.

7. The reviewer verifies that the EDECWS and the diesel generator can perform for extended periods when less than full electrical power generation is required without degradation of performance or reliability. A statement to the effect that operating procedures will be provided requiring loading of the engine up to a minimum of 25% of full load or as specified by the manufacturers recommendation,[50] for 1 hour after 8 hours of continuous no-load operation or as recommended by the manufacturer will be acceptable.

8. For those plants that will use an emergency diesel generator as the alternate AC source in response to a station blackout event, the reviewer verifies the adequacy of the EDECWS to support this functional capability, independent of preferred and onsite emergency ac power, by comparing system design with regulatory position C.3.3.5 of Regulatory Guide 1.155.[51]

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

procedures for the review of certified design material (CDM) for the standard design, including the site parameters, interface criteria, and ITAAC.[52] For DC reviews, the diesel engine vendor may not have been selected; therefore, the interaction between the diesel engine and the support (auxiliary) systems may not be fully defined. Portions of the EDE and associated support systems design may be considered outside the scope of the design submitted by applicants for design certification (DC). Portions of the design determined not to be within the DC scope are the responsibility of the applicant referencing the certified design. The DC applicant's submittal should provide a conceptual design and interface requirements for that portion of the design outside the scope of the DC as required by 10 CFR 52.47(a)(1)(vi-ix).[53]

IV. EVALUATION FINDINGS

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

> The emergency diesel engine cooling water system (EDECWS) includes all piping, valves, heat exchangers, and pumps up to the points where the cooling water piping connects to the engine interfaces. The scope of review of the diesel engine cooling water system for the _____ plant included layout drawings, process flow diagrams, piping and instrumentation diagrams, and descriptive information for the system and auxiliary supporting systems that are essential to its operation. The essential portions of the EDECWS that are necessary to mitigate the consequences of an accident are designed to seismic Category I and Quality Group C.
>
> The basis for acceptance of the EDECWS in our review was conformance of the designs, 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 2, 4, 5, 17, 44, 45, and 46. This conclusion is based on the following:
>
> 1. The applicant has met the requirements of GDC 2, "Design Bases for Protection Against Natural Phenomena," with respect to the ability of structures housing the EDECWS and the system itself to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, and floods, and GDC 4, "Environmental and ~~Missile~~Dynamic Effects[54] Design Bases," with respect to structures housing the system and the system itself being capable of withstanding the effects of externally and internally generated missiles, pipe whip, and jet impingement forces associated with pipe breaks. The EDECWS is housed in a Seismic Category I structure which provides protection from the effects of tornado, tornado missiles, turbine missiles, and floods. This meets the positions of Regulatory Guide 1.115, "Protection Against Low-Trajectory Turbine Missiles," Position C.1, and 1.117 "Tornado Design Classification," Appendix Position 13.
>
> 2. The applicant has met the requirements of GDC 5, "Sharing of Structures, Systems, and Components," with respect to capability of shared systems and components important to safety to perform required safety functions. Each unit

of the _____ plant has its own emergency diesel generators whose EDECWS is not shared between the diesel generators.

3. The applicant as met the requirements of GDC 17, "Electric Power Systems," with respect to the capability of the cooling system to meet independence and redundancy criteria, and GDC 44 with respect to the following:

   a. The capability to transfer heat from systems and components to a heat sink under transient or accident conditions,

   b. Redundancy of components so that under accident conditions the safety function can be performed assuming a single active component failure, and

   c. The capability to isolate components of the system or piping, if required to maintain the system safety function.

   Each EDECWS is independent and physically separated from the other system serving the redundant diesel generator. A single failure in any one of the ~~two systems~~EDECWS[55] will affect only the associated diesel generator. The EDECWS transfers the heat generated by the diesel to the ultimate heat sink via the heat exchangers and the service water system. This meets the positions of Regulatory Guide 1.9, "Selection, Design, ~~and~~Qualification, and Testing of Diesel Generator Units Used As ~~Standby (Onsite)~~Class 1E Onsite Electric Power Systems At Nuclear Power Plants."[56] The applicant has also met the positions of ~~Branch Technical Position ICSB-17 (PSB), "Diesel Generator Protective Trip Circuit Bypasses," and~~ [57]NUREG/CR-0660, "Enhancement Of Onsite Emergency Diesel Generator Reliability." The applicant has met the requirements of the following industry standards: IEEE-Standard 387 "IEEE Standard Criteria For Diesel Generator Units Applied As Standby Power Supplies For Nuclear Power Generating Stations," and Diesel Engine Manufacturers Association (DEMA) Standard.

4. The applicant has met the requirements of GDC 45 with respect to design provisions to permit periodic inspections of safety-related components and equipment of the system and GDC 46 with respect to design provisions to permit appropriate functional testing of safety-related systems or components to assure structural integrity and leaktightness, operability and performance of active components, and the capability of the system to function as intended under accident conditions. To assure structural integrity and leaktightness, operability and performance of active components, and the capability of the system to function as intended, the diesel engine cooling water system has provisions to permit periodic inspection and functional testing during standby and normal modes of power plant operation.

The staff concludes that the design of the diesel engine cooling water system conforms to all applicable GDCs, positions of the regulatory guides cited, NUREG/CR-0660, staff positions, and industry standards, and is therefore acceptable.

If the applicant proposes to designate an emergency diesel generator as the alternate AC source in response to a station blackout event, the following finding should be included:

The applicant has met the requirements of 10 CFR Part 50.63, "Loss of All Alternating Current Power," relevant to the design of the EDECWS for the Alternate ac power source. The EDECWS for the Alternate ac power source can perform its cooling functions for its associated diesel generator independent of preferred and onsite emergency ac power for the specified duration of the station blackout. This meets the applicable positions of Regulatory Guide 1.155 "Station Blackout."[58]

For design certification reviews, the findings will also summarize, to the extent that the review is not discussed in other safety evaluation report sections, the staff's evaluation of inspections, tests, analyses, and acceptance criteria (ITAAC), including design acceptance criteria (DAC), site interface requirements, and combined license action items that are relevant to this SRP Section.[59]

V. IMPLEMENTATION

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

This SRP section will be used by the staff when performing safety evaluations of license applications submitted by applicants pursuant to 10 CFR 50 or 10 CFR 52.[60] Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications docketed six months or more after the date of issuance of this SRP section.[61]

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides and NUREG.

VI. REFERENCES

1. 10 CFR Part 50.63, "Loss of All Alternating Current Power."[62]

~~1~~2.[63] 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection against Natural Phenomena."

~~2~~3. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and ~~Missile~~ Dynamic Effects[64] Design Bases."

~~3~~4. 10 CFR Part 50, Appendix A, General Design Criterion 5, "Sharing of Structures, Systems, and Components."

~~4~~5. 10 CFR Part 50, Appendix A, General Design Criterion 17, "Electric Power Systems."

~~5~~6. 10 CFR Part 50, Appendix A, General Design Criterion 44, "Cooling Water ~~System~~."[65]

~~6~~7. 10 CFR Part 50, Appendix A, General Design Criterion 45, "Inspection of Cooling Water System."

~~7~~8. 10 CFR Part 50, Appendix A, General Design Criterion 46, "Testing of Cooling Water System."

~~8~~9.[66] Regulatory Guide 1.9, "Selection, Design, ~~and~~Qualification, and Testing of Diesel Generator Units Used As ~~Standby (Onsite)~~Class 1E Onsite Electric Power Systems At Nuclear Power Plants."[67]

~~9. Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants."[68]~~

~~10. Regulatory Guide 1.29, "Seismic Design Classification."[69]~~

~~11. Regulatory Guide 1.68, "Initial Test Programs for Water Cooled Reactor Power Plants."[70]~~

~~12~~10.[71] Regulatory Guide 1.115, "Protection Against Low-Trajectory Turbine Missiles."

~~13~~11.[72] Regulatory Guide 1.117, "Tornado Design Classification."

12. Regulatory Guide 1.155, "Station Blackout."[73]

~~14. Branch Technical Positions ASB 3-1, "Protection Against Postulated Piping Failures in Fluid Systems Outside Containment" (attached to SRP Section 3.6.1).[74]~~

~~15. Branch Technical Position MEB 3-1, "Postulated Break and Leakage Locations in Fluid System Piping Outside Containment" (attached to SRP Section 3.6.2).[75]~~

~~16. Branch Technical Position ICSB-17 (PSB), "Diesel-Generator Protective Trip Circuit Bypasses" (attached to SRP 8.3.2, Appendix 8A).[76]~~

~~17. Branch Technical Position ASB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants" attached to SRP Section 9.5.1.[77]~~

~~20~~13.[78] NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability." University of Dayton Research Institute; UDR-TR-79-07; February 1979.[79]

~~18~~14.[80] ANSI/IEEE Std~~andard~~ 387-1984 "IEEE Standard Criteria for Diesel Generator Units Applied As Standby Power Supplies for Nuclear Power Generating Stations." American National Standards Institute.[81]

~~19~~15.[82] Diesel Engine Manufacturers Association (DEMA) Standard 1974[83].[84]

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SRP Draft Section 9.5.5
Attachment A - Proposed Changes in Order of Occurrence

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

Item	Source	Description
1.	Current PRB names and abbreviations.	Updated the title and abbreviation for the SRP Section 9.5.5 Primary Review Branch.
2.	Current PRB names and abbreviations.	Updated the abbreviation for the SRP Section 9.5.5 Primary Review Branch.
3.	Current PRB names and abbreviations.	Updated the abbreviation for the SRP Section 9.5.5 Primary Review Branch.
4.	Current PRB names and abbreviations.	Updated the abbreviation for the SRP Section 9.5.5 Primary Review Branch.
5.	Current PRB names and abbreviations.	Updated the abbreviation for the SRP Section 9.5.5 Primary Review Branch.
6.	**Integrated Impact 259.**	Revised Areas of Review to include EDECWS reviews for station blackout for those plants that designate an EDE as providing Alternate ac power.
7.	SRP-UDP format item Reformat Areas of Review; Current PRB names and abbreviations.	Changed this scope to an interface item. The diesel generator (EDG) and the power and control circuits are now the responsibility of the Electrical Engineering Branch (EELB) under their review responsibility for SRP Section 8.3.1.
8.	SRP-UDP format item Reformat Areas of Review.	Reformatted review interfaces from a single paragraph to numbered paragraphs.
9.	SRP-UDP format item Reformat Areas of Review.	Reformatted existing description of review interfaces in numbered format to describe how the SPLB reviews the EDECWS under other SRP sections.
10.	SRP-UDP format item Reformat Areas of Review.	Responsibility to review for protection from cracks and breaks in high- and moderate-energy lines shifted from the old ASB to the new SPLB.
11.	Potential Impacts 1637 and 23844	Added a Review Interface to SRP 9.2.1 for review of the heat exchanger test, inspection and maintenance program in accordance with GL 89-13.
12.	SRP-UDP format item Reformat Areas of Review; Current PRB names and abbreviations.	Responsibility to review for fire protection per SRP Section 9.5.1 shifted from the old CMEB to the new SPLB.
13.	SRP-UDP format item.	Revised the lead-in sentence for the review interfaces between SRP Section 9.5.5 and other SRP sections to be consistent with the SRP-UDP guidance and changes to other SRP sections.
14.	Current PRB names and abbreviations.	Updated the abbreviation for the SRP Section 9.5.5 Primary Review Branch.

Item	Source	Description
15.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB name and responsibility for SRP Sections 3.3.1, 3.3.2, 3.5.3, 3.7.1 through 3.7.4, 3.8.4, and 3.8.5.
16.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB name and responsibility for SRP Sections 3.9.1 through 3.9.3.
17.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB name and responsibility for SRP Sections 3.2.1, and 3.2.2.
18.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB name and responsibilities.
19.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB name and abbreviation for the SRP Section 9.5.5 Primary Review Branch.
20.	Current PRB names and abbreviations.	Responsibility to review for protection from cracks and breaks in high- and moderate-energy lines shifted from the old ASB to the new SPLB. This text was moved to the first item under the "Review Interfaces" subsection heading.
21.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB name and responsibility for SRP Section 14.2.
22.	Editorial change.	Changed SRP Section reference from 14.0 to 14.2 to reflect correct SRP section and responsibilities.
23.	Current PRB name and abbreviations, Editorial.	Editorial change made to separate text and reflect current PRB name and responsibility for SRP Chapter 17. Note that "Section 17.0" is changed to "Chapter 17" since there is no SRP Section 17.0 and the Chapter encompasses the applicable SRP sections.
24.	Current PRB name and abbreviations.	Editorial change made to separate text and reflect current PRB name and responsibility for SRP Section 16.0.
25.	SRP-UDP format item Reformat Areas of Review.	Added EELB interface since the power and control circuits are now the responsibility of the Electrical Engineering Branch (EELB).
26.	SRP-UDP Integration of SBO Issues	Added interface describing reviews of AAC sources by EELB under SRP Section 8.2, Appendix 8-C and SRP Section 8.4.
27.	SRP-UDP format item	Revised using standard text to address both the interfaces listed with other SPLB reviews and with other PRBs.
28.	**Integrated Impact 259**.	Added "regulations" to the list of document types used as acceptance criteria.

Item	Source	Description
29.	Editorial.	Identified the acronym "SSC" for later use in place of "structures, systems, and components".
30.	Editorial change.	Items lettered a. through c. were redesignated with bullets to avoid confusion with subsequent items lettered a. through e.
31.	Editorial change.	Items lettered a. through c. were redesignated with bullets to avoid confusion with subsequent items lettered a. through e.
32.	Editorial change.	Items lettered a. through c. were redesignated with bullets to avoid confusion with subsequent items lettered a. through e.
33.	**Integrated Impact 257**.	Deleted reference to BTP ICSB 17 since Appendix 8-A of the SRP indicates that it was superseded by Reg. Guide 1.9.
34.	Editorial.	Renumbered to accommodate deletion of item II.4.b.
35.	SRP-UDP format item. Reformat reference citations.	Added parenthetical reference identification to the existing citation of NUREG/CR-0660.
36.	Editorial.	Renumbered to accommodate deletion of item II.4.b.
37.	**Integrated Impact 790.**	The reference was revised to include "ANSI" to be consistent with the update of the standard to the 1984 version and abbreviated "Standard" to be "Std" consistent with IEEE usage.
38.	SRP-UDP format item. Reformat reference citations.	Added parenthetical reference identification to the existing citation of IEEE 387.
39.	Editorial.	Renumbered to accommodate deletion of item II.4.b.
40.	SRP-UDP format item. Reformat reference citations.	Added parenthetical reference identification to the existing citation of the DEMA Standard.
41.	**Integrated Impact 259**.	For those plants that will use an emergency diesel generator as the alternate AC source in response to a station blackout event, the adequacy of the engine cooling capability, independent of preferred and onsite emergency ac power, needs to be reviewed.
42.	SRP-format item. Develop Technical Rationale.	Added technical rationale for acceptance criteria and guidance documents.
43.	Current PRB name and abbreviations.	Editorial change made to reflect current PRB name and responsibility for SRP Section 16.0.
44.	Current PRB name and abbreviations.	Editorial change made to reflect current PRB name and responsibility.
45.	Current PRB name and abbreviations.	Editorial change made to reflect current PRB name and responsibility.

Item	Source	Description
46.	Current PRB name and abbreviations.	Editorial change made to reflect current PRB name and responsibility.
47.	Editorial.	Revised the text to identify the EELB interface from subsection I since SRP Section 9.5.5 is now the responsibility of the SPLB and the power and control circuits are now the responsibility of the Electrical Engineering Branch (EELB).
48.	**Integrated Impact 257**.	Appendix 8-A of the SRP indicates that BTP ICSB 17 was superseded by Reg. Guide 1.9 (Rev. 2) Regulatory Position C.7. Reg. Guide 1.9 was revised (Rev. 3) and positions related to interlocks are now located in Regulatory Position C.1.8. Text was added to identify the interface with the EELB.
49.	**Integrated Impact 789**.	Provided a Review Procedure to verify that adequate water exist in the cooling water system to ensure cooling capacity and pump NPSH for seven days without filling the system assuming maximum expected leakage and evaporation rates.
50.	Disposition of PI 24308.	Revised Review Procedure III.7 to clarify that minimum loading may consider manufacturers recommendations. This change is based on staff acceptance of loading requirements in the ABWR FSER that differ from the minimum 25% stated in III.7.
51.	**Integrated Impact 259**.	Provides Review Procedure for those plants that will use an emergency diesel generator as the alternate AC source in response to a station blackout event.
52.	SRP Integration item	Added 10 CFR 52 boiler-plate statement to Review Procedures subsection.
53.	10 CFR 52 licensing process. Disposition of PIs 24314 and 24315.	Added a paragraph to address reviews for design certification applicants.
54.	SRP-UDP Reformat reference citations.	Updated the title of GDC 4
55.	Disposition of PI 24296.	The ABWR has three emergency diesel generators (EDGs). The staff, in the ABWR FSER, was not number specific in their statements of evaluation findings.
56.	SRP UDP format item Reformat reference citations.	Updated the title of Regulatory Guide 1.9.
57.	**Integrated Impact 257**.	BTP ICSB 17 was superseded by Reg. Guide 1.9 (Rev. 2). Reg. Guide 1.9 is already referenced.
58.	**Integrated Impact 259**.	Added an Evaluation Finding for those plants that will use an emergency diesel generator as the alternate AC source in response to a station blackout event.

Item	Source	Description
59.	SRP-UDP format, 10 CFR 52 Applicability.	Added an evaluation finding to address reviews for design certification applicants. For design certification applicants, the entire design is reviewed during the design certification phase.
60.	SRP-UDP Format Item	Added boiler-plate statement indicating the applicability of the SRP to 10 CFR 52 license applications.
61.	SRP-UDP Format Item	Added boiler-plate statement describing the applicability of the SRP to existing and new applications.
62.	**Integrated Impact 259**.	Added reference to 10 CFR 50.63 for those plants that will use an emergency diesel generator as the alternate AC source in response to a station blackout event.
63.	Editorial	Reordered and renumbered references in accordance with SRP-UDP guidance
64.	SRP-UDP format item Reformat reference citations.	Updated the title of GDC 4
65.	SRP-UDP format item Reformat reference citations.	Updated the title of GDC 44.
66.	Editorial.	Renumbered to accommodate new Reference No. 8.
67.	SRP-UDP format item Reformat reference citations.	Updated the title of Regulatory Guide 1.9.
68.	SRP-UDP format item.	Deletion of references not utilized elsewhere in the SRP section.
69.	SRP-UDP format item.	Deletion of references not utilized elsewhere in the SRP section.
70.	SRP-UDP format item. Verification of references.	Regulatory Guide 1.68 is not referenced or discussed within the text of the SRP section and therefore is deleted. Test program requirements are included as a review interface with SRP Section 14.2 which specifically addresses Regulatory Guide 1.68.
71.	Editorial.	Renumbered to accommodate new and deleted references.
72.	Editorial.	Renumbered to accommodate new and deleted references.
73.	**Integrated Impact 259**.	Added reference for Regulatory Guide 1.155.
74.	SRP-UDP format item.	Reference is deleted since it only appears in review interface portion of the SRP and the content of the reference is specifically addressed by reviews for other SRP sections.

Item	Source	Description
75.	SRP-UDP format item.	Reference is deleted since it only appears in review interface portion of the SRP and the content of the reference is specifically addressed by reviews for other SRP sections.
76.	**Integrated Impact 257**.	Removed reference to BTP ICSB 17 that was superseded by Reg. Guide 1.9.
77.	SRP-UDP format item.	Deletion of references not utilized elsewhere in the SRP section.
78.	Editorial.	Renumbered to accommodate new and deleted references.
79.	SRP-UDP format item Reformat reference citations.	Updated the reference for NUREG/CR-0660.
80.	Editorial.	Renumbered to accommodate new and deleted references.
81.	**Integrated Impact 790**.	Updated the title and added the current revision to the reference item for IEEE-387.
82.	Editorial.	Renumbered to accommodate new and deleted references.
83.	**Integrated Impact 674.**	Added specific date for applicable version of the DEMA Standard.
84.	SRP-UDP Reference Verification	The DEMA organization is inactive. Based on information available from technical resources, the DEMA standard has not been revised since 1974. A copy of the standard was not available and the continued applicablility of the standard could not be verified.

Integrated Impact No.	Issue	SRP Subsections Affected
257	Deletion of references to BTP ICSB-17, which was superseded by Regulatory Guide 1.9.	II.4, III.1, IV.3, and VI.
259	Incorporated 10 CFR 50.63 and Regulatory Guide 1.155 with regard to station blackout requirements for emergency diesel engines and associated support systems designated as alternate ac sources.	I, II, III, IV, and VI.
674	Added the applicable date to the DEMA Standard reference.	VI.
789	Added a review procedure to address cooling system expected water loss over 7 days.	III.
790	Updated the citation and reference for IEEE Std 387.	II, and VI.