



U.S. NUCLEAR REGULATORY COMMISSION

# STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

## 9.5.7 EMERGENCY DIESEL ENGINE LUBRICATION SYSTEM

### REVIEW RESPONSIBILITIES

Primary - ~~Power Systems Branch (PSB)~~ Plant Systems Branch (SPLB)<sup>1</sup>

Secondary - None

### I. AREAS OF REVIEW

The emergency diesel engine lubrication system (EDELS) provides essential lubrication to the components of the emergency diesel engines. The ~~PSB~~SPLB<sup>2</sup> reviews the EDELS and associated auxiliary systems to assure conformance with the requirements of GDC 2, 4, 5, and 17. The review includes system piping, pumps, components, and associated auxiliary equipment essential for system operation up to the engine interface.<sup>(1)</sup>

1. The ~~PSB~~SPLB<sup>3</sup> reviews the characteristics of the EDELS and system components with respect to the effect on functional performance of adverse environmental occurrences, abnormal operational requirements, and accident conditions.
2. The ~~PSB~~SPLB<sup>4</sup> determines that a malfunction or failure of a component, or the loss of a cooling source does not reduce the safety-related functional performance capabilities of the ~~emergency powered~~ systems<sup>5</sup>. Further, the ~~PSB~~SPLB<sup>6</sup> review assures that:
  - a. System components and piping have sufficient physical-separation or barriers to protect the system from internally and externally generated missiles.

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(1)As defined by the engine manufacturer.

DRAFT Rev. 3 - April 1996

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### USNRC STANDARD REVIEW PLAN

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

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

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20555.

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- b. The system is protected from the effects of pipe cracks or breaks in high- and moderate-energy piping.
  - c. System components are designed in accordance with the design codes required by the assigned quality group and seismic category classifications.
  - d. The system is housed in structures designed to seismic Category I requirements.
  - e. Failure of nonseismic Category I structures or components will not affect the safety-related functions of the system.
3. The ~~PSB~~**SPLB**<sup>7</sup> will also review the design of the EDELS with respect to the following:
- a. Functional capability during abnormally high site water levels (probable maximum flood).
  - b. Capability for detection and control of system leakage.
  - c. Measures to assure the quality of the lubricating oil.
  - d. Capability for isolating portions of the system in the event of excessive leakage or component malfunction.
  - e. Instrumentation and control features provided to permit operational testing of the system and to assure that normal protective interlocks do not preclude engine operation during emergency conditions.
  - f. Measures are provided for cooling the system and removing system heat load.
- ~~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.<sup>8</sup>~~
4. For those plants that designate an emergency diesel engine as an alternate ac power source, the SPLB will determine the adequacy of the EDELS to perform its function in the event of a station blackout.<sup>9</sup>

#### Review Interfaces:<sup>10</sup>

SPLB also performs the following reviews under the SRP sections indicated:<sup>11</sup>

- 1. ~~The Auxiliary Systems Branch (ASB)~~**SPLB** determines that the EDELS is **protected from in accordance with Branch Technical Position ASB 3-1 and MEB 3-1** for breaks in high-energy and cracks in moderate-energy piping systems outside containment as part of its primary review responsibility for SRP Section 3.6.1.<sup>12</sup>

2. The SPLB performs the reviews for fire protection ~~are coordinated and performed by the Chemical Engineering Branch as part of their~~ primary review responsibility for SRP Section 9.5.1.<sup>13</sup>

In addition, ~~the review of the diesel engine lubrication system,~~<sup>14</sup> the PSBSPLB<sup>15</sup> will coordinate the evaluations of other branches that interface with the overall review of the system as follows:

1. The ~~Structural Engineering Branch (SEB)~~ Civil Engineering and Geosciences Branch (ECGB)<sup>16</sup> determines the acceptability of the design analyses, procedures, and criteria used to establish the ability of seismic Category I structures housing the system and supporting systems to withstand the effects of natural phenomena such as the 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 (E<sup>17</sup>MEB) determines that the 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 E<sup>18</sup>MEB 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 and Chemical Engineering Branch ~~(MTEB)~~(EMCB)<sup>19</sup> verifies, upon request, the compatibility of the materials of construction with service conditions.
5. The ~~Procedures and Test Review~~Quality Assurance and Maintenance Branch (HQMB) determines the acceptability of the preoperational and startup tests as part of its primary review responsibility for SRP Section 14.0<sup>20</sup>. The HQMB also performs the reviews for quality assurance ~~are coordinated and performed by the Quality Assurance Branch as part of their~~ primary review responsibility for SRP ~~Section~~Chapter 17.0.<sup>21</sup>
6. The Technical Specifications Branch (TSB) performs the reviews for technical specifications ~~are coordinated and performed by the Licensing Guidance Branch as part of their~~ primary review responsibility for SRP Section 16.0.<sup>22</sup>
47. The PSBElectrical Engineering Branch (EELB) 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 as part of its responsibility for SRP Section 8.3.1.<sup>23</sup> 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).<sup>24</sup>

For<sup>25</sup> 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~~<sup>26</sup>.

## II. ACCEPTANCE CRITERIA

Acceptability of the emergency diesel engine lubrication system, as described in the applicant's safety analysis report (SAR), is based on specific regulations,<sup>27</sup> general design criteria and regulatory guides. The reviewer will also utilize information obtained from other sources such as other Federal agencies, published reports, industry standards, military specifications, and technical literature on commercially available products. An additional basis for the acceptability of the system will be the degree of similarity with systems in previously reviewed plants with satisfactory operating experience.

The design of the EDELS is acceptable if the integrated design of the system 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 Position 13 of the appendix to Regulatory Guide 1.117, as related to the protection of structures, systems, and components (SSC)<sup>28</sup> 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 ~~structures, systems, and components~~ SSC<sup>29</sup> important to safety from the effects of turbine missiles.
3. General Design Criterion 5, as related to 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 diesel engine lubrication system to meet independence and redundancy criteria. Acceptance is based on meeting the following specific criteria:
  - a. Regulatory Guide 1.9, as related to the design of the diesel engine systems.
  - ~~b. Branch Technical Position ICSB-17 (PSB), as related to diesel engine lubrication systems' protective interlocks during accident conditions.<sup>30</sup>~~
  - eb<sup>31</sup>. NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability" (Reference 10)<sup>32</sup>.
  - dc<sup>33</sup>. ANSI/IEEE Standard<sup>34</sup> 387 (Reference 11)<sup>35</sup>, as related to the design of the diesel engine lubrication system.

- ed<sup>36</sup>. Diesel Engine Manufacturers Association (DEMA) Standard (Reference 12)<sup>37</sup>, as related to the design of the diesel lubrication system.
- fe<sup>38</sup>. The operating pressure, temperature differentials, flow rate, and heat removal rate of the system external to the engine are in accordance with recommendations of the engine manufacturer.
- gf<sup>39</sup>. The system has been provided with sufficient protective measures to maintain the required quality of the oil during engine operation.
- hg<sup>40</sup>. Protective measures (such as relief ports) have been taken to prevent unacceptable crankcase explosions and to mitigate the consequences of such an event.
- ih<sup>41</sup>. The temperature of the lubricating oil is automatically maintained above a minimum value by means of an independent recirculation loop including its own pump and heater, to enhance the "first-try" starting reliability of the engine in the standby condition.
- ji<sup>42</sup>. The diesel engine is provided with a dedicated lube oil system design which includes measures to provide lubrication to the diesel engine wearing parts during standby conditions and/or normal and emergency starts.

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 lubrication system for that engine is acceptable if it meets 10 CFR Part 50.63, "Loss of All Alternating Current Power," paragraph (a)(2), and Regulatory Guide 1.155, Position C.3.<sup>43</sup>

#### Technical Rationale:<sup>44</sup>

The technical rationale for application of the above acceptance criteria to the emergency diesel engine lubrication 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, tsunamis, 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. The safety function of the EDELS is to provide essential lubrication to the emergency diesel engine. Proper lubrication of the emergency diesel engine is necessary to ensure engine availability for 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 provides

assurance 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. The safety function of the EDELS is to provide essential lubrication to the emergency diesel engines under standby and operating conditions, such as following a loss of offsite power. In order to ensure the availability of emergency ac power, the EDELS must be capable of performing the engine lubrication function 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 provides assurance that the dynamic effects of equipment failures, and events external to the plant, will not affect the capability of the EDELS to provide lubrication 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 EDELS is to provide essential lubrication to the emergency diesel engines under standby and operating conditions. In order to ensure the availability of emergency ac power to safety-related components, the EDELS 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 lubricating system is integral to the emergency diesel generator system. Regulatory Guide 1.9 provides regulatory positions with regard to EDE and lubricating 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.
5. 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 lubricating 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 utilized 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 OL review includes 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 ~~LGBT~~TSB<sup>45</sup> review, as indicated in subsection I 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.

The reviewer will select and emphasize material from this SRP section as may be appropriate for a particular case.

1. The SAR is reviewed to establish that the EDELS is a dedicated system and that the description and related diagrams clearly delineate system operation, including the means provided for indicating and monitoring oil levels, temperatures, and pressures required for continuous operation of the system. The reviewer verifies the following:
  - a. The ~~SEBEC~~GCB<sup>46</sup> reviews the seismic design bases and the ~~EMEB~~<sup>47</sup> reviews the quality and seismic classification as indicated in subsection I of this SRP section. The ~~PSBS~~PLB<sup>48</sup> assures that essential portions of the EDELS including the isolation valves separating essential and nonessential 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 classifications 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 the system piping and instrumentation diagrams (P&IDs) between subsystems will not cause total degradation of the lube oil system function. The results of failure modes and effects analyses will be used in this determination.
- c. The system layout drawings are examined to ascertain that sufficient space has been provided to permit inspection of components.
- d. The system has been designed to preclude the entry of deleterious material into the system due to operator error or extreme natural phenomena during recharging or normal operation. The system is acceptable if it is shown in the SAR that the system is locked closed, or if entry is administratively controlled.
- e. The design contains an independent circulation loop to maintain the temperature of the crankcase oil above a minimum value during the standby mode.
- f. The system P&IDs indicate the temperature, pressure, and level sensors which alert the operator when these parameters exceed the ranges recommended by the engine manufacturer.
- g. The system has been designed to minimize the potential fire hazard from lube oil leaking and accumulating on the engine exhaust manifold and in the turbocharger housing as a result of excessively long prelubrication of the engine prior to starting. The prelube time interval prior to manual starting of the engine should be limited to 3 to 5 minutes unless otherwise recommended by the diesel engine manufacturer.
- h. The system has been designed to preclude dry starting of the diesel engine during emergency starts, that is, the momentary lack of lubrication at the various moving parts or bearing surfaces resulting from the tendency for the lube oil system to drain during long periods of standby. It is necessary for the system to establish as quickly as possible an oil film on the wearing parts of the diesel engine; otherwise, damage to the bearing surface will result causing unavailability of the engine. To remedy this situation, any one of the following may be used and should be confirmed with the diesel engine manufacturer:
  - (1) An electrically driven lubricating oil pump powered from a reliable DC power supply, and installed to operate in parallel with the engine-driven main lube oil pump. The electric-driven prelube pump should operate only during the engine cranking cycle or until satisfactory lube oil pressure is established in the engine main lube oil distribution header.
  - (2) Installation of a continuously operated prelube system which would provide lube oil to all moving parts and bearing surfaces during the standby condition of operation. Appropriate alarms should be provided to alert operators to pump failure or low system pressure.



- (3) Installation of an intermittently operated prelube system which would provide lube oil to all moving parts and bearing surfaces during the standby condition of operation. This system would operate automatically for a minimum of 5 minutes per day to prelube the moving parts. Appropriate alarms should be provided to alert operators of pump failure to start.
  - i. The design provides for the total heat removal rates required by the system and the margin in the design heat removal rate capability.
  - j. The system inventory, including the engine sump and onsite storage capacity, is designed with sufficient volume to support continuous full-load operation of the diesel engine for a period of 7 days.<sup>49</sup>
2. The reviewer determines that the system is designed to maintain its function under adverse environmental phenomena. The reviewer, using engineering judgment and the results of failures modes and effects analyses, determines that:
  - a. The failure of systems not designed to seismic Category I requirements or of nonseismic Category I structures that house, support, or are close to the EDELS, will not preclude functioning of the system. Chapters 2 and 3 of the SAR describe related site features and provide the general structural arrangement and layout drawings and a tabulation of seismic design classifications for the structures and systems. Statements in the SAR to the effect that the above design requirements 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.
3. The reviewer verifies that the EDELS is protected from the effects of breaks in high- and moderate-energy lines. The system description in the SAR is reviewed to verify that there are no high- or moderate-energy piping systems close to the lube oil system or that protection from effects of failure will be provided. 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 corresponding SRP sections.
4. The descriptive information, P&IDs, related system drawings, and system analyses in the SAR 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 assure functioning of required components, traces the availability of these components on system drawings, and checks that minimum system requirements are met for each degraded situation over required time spans. For each case, the design is acceptable if minimum system requirements are met.
5. For those plants that will use an emergency diesel generator as the AAC source in response to a station blackout event, the reviewer verifies the adequacy of the EDELS 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.<sup>50</sup>

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.<sup>51</sup> At the time of DC reviews the diesel engine vendor may not have been selected; therefore, the interfaces 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. 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).<sup>52</sup>

#### 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 lubrication system (EDELS) includes the pumps, heat exchangers, valves, piping, makeup piping, and the points of connection or interfaces with other systems. The scope of review of the emergency diesel engine lubrication system for the \_\_\_\_\_ plant included layout drawings, flow diagrams, piping and instrumentation diagrams, and descriptive information for the system and supporting systems that are essential to its operation. The essential portions of the EDELS that are necessary for the safe shutdown of the reactor or necessary to mitigate the consequences of an accident are designed to seismic Category I and Quality Group C.

The staff concludes that the design of the emergency diesel engine lubrication system is acceptable and meets the requirements of GDC 2, 4, 5, and 17. 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 EDELS 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<sup>53</sup> 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 EDELS 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 Guides

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 the 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 EDELS is not shared between the diesel generators.
3. The applicant has met the requirements of GDC 17, "Electric Power Systems," with respect to the capability of the lubrication system to meet independence and redundancy criteria. Each EDELS is independent and physically separated from the other system serving the redundant diesel generator. A single failure in any one of the systems will affect only the associated diesel generator. The EDELS for each diesel engine provides the necessary engine lubrication during operation and maintains the lube oil at a temperature that improves first-start reliability. This meets the positions of Regulatory Guide 1.9, "Selection, Design, and Qualification and Testing of Emergency Diesel Generator Units Used as Standby Class 1E (Onsite)"<sup>54</sup> Electric Power Systems at Nuclear Power Plants." The applicant has also met the positions of ~~Branch Technical Position ICSB-17 (PSB), "Diesel Generator Protective Trip Circuit Bypasses," and~~<sup>55</sup> 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 Manufacturer Association (DEMA) Standard.

If the applicant proposes to designate an emergency diesel generator as the AAC 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 EDELS for the Alternate ac power source. The EDELS for the Alternate ac power source can perform its lubrication 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."<sup>56</sup>

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.<sup>57</sup>

## 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.<sup>58</sup> 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.<sup>59</sup>

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 50.63, "Loss of all alternating current power."<sup>60</sup>
- 12.<sup>61</sup> 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."
23. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and ~~Missile~~Dynamic Effects"<sup>62</sup> Design Bases."
34. 10 CFR Part 50, Appendix A, General Design Criterion 5, "Sharing of Structures, Systems, and Components."
45. 10 CFR Part 50, Appendix A, General Design Criterion 17, "Electric Power Systems."
56. Regulatory Guide 1.9, "Selection, Design, ~~and~~ Qualification and Testing of Emergency Diesel Generator Units Used as ~~Standby~~Class 1E (Onsite) Electric Power Systems at Nuclear Power Plants."<sup>63</sup>
6. ~~Regulatory Guide 1.68, "Initial Test Programs for Water-Cooled Reactor Power Plants."~~<sup>64</sup>
7. Regulatory Guide 1.115, "Protection Against Low-Trajectory Turbine Missiles."
8. Regulatory Guide 1.117, "Tornado Design Classification."
9. Regulatory Guide 1.155, "Station Blackout."<sup>65</sup>
9. ~~Branch Technical Position ASB 3-1, "Protection Against Postulated Piping Failures in Fluid Systems Outside Containment," attached to SRP Section 3.6.1.~~<sup>66</sup>
10. ~~Branch Technical Position MEB 3-1, "Postulated Break and Leakage Locations in Fluid System Piping Outside Containment," attached to SRP Section 3.6.2.~~<sup>67</sup>

- ~~11. Branch Technical Position ASB-9.5-1, "Guidelines for Fire Protection for Nuclear Power Stations," attached to SRP Section 9.5.1.~~<sup>68</sup>
- ~~12. Branch Technical Position ICSB-17 (PSB), "Diesel-Generator Protective Trip Circuit Bypasses," attached to SRP Section 8.3.2, Appendix 8A.~~<sup>69</sup>
- ~~1510~~<sup>70</sup>. NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Operating Reliability," University of Dayton Research Institute; UDR-TR-79-07; February 1979.<sup>71</sup>
- ~~1311~~<sup>72</sup>. ANSI/IEEE Standard 387-1984, "IEEE Standard Criteria for Diesel Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations," American National Standards Institute.<sup>73</sup>
- ~~1412~~<sup>74</sup>. Diesel Engine Manufacturers Association (DEMA) Standards 1974<sup>7576</sup>.

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**SRP Draft Section 9.5.7**  
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.	Editorial change to reflect current PRB names and responsibilities for SRP Section 9.5.7.
2.	Current PRB names and abbreviations.	Editorial change to reflect current PRB names and responsibilities for SRP Section 9.5.7.
3.	Current PRB names and abbreviations.	Editorial change to reflect current PRB names and responsibilities for SRP Section 9.5.7.
4.	Current PRB names and abbreviations.	Editorial change to reflect current PRB names and responsibilities for SRP Section 9.5.7.
5.	Editorial.	The wording was changed to be improve the clarity of the sentence and to be consistent with the wording in SRP Section 9.5.5.
6.	Current PRB names and abbreviations.	Editorial change to reflect current PRB names and responsibilities for SRP Section 9.5.7.
7.	Current PRB names and abbreviations.	Editorial change to reflect current PRB names and responsibilities for SRP Section 9.5.7.
8.	Editorial.	The review of electrical components including interlocks was moved to a Review Interface. The responsibility for SRP Section 9.5.7 was previously assigned to the Power Systems Branch (now the Electrical Engineering Branch). Although the SPLB now has responsibility for diesel engine support systems, the EELB maintains responsibility for the review of the emergency diesel generator and associated control circuitry including the interlocks.
9.	<b>Integrated Impact 253.</b>	Added provisions to review the EDELS with regard to station blackout requirements for those plants that designate an EDE as an alternate ac power source.
10.	SRP-UDP format item. Reformat Areas of Review.	Added "Review Interfaces" heading to Areas of Review. Reformatted existing description of review interfaces in numbered format to describe how the SPLB reviews aspects of the Lubrication System under other SRP sections and how other branches support the review.
11.	SRP-UDP format item.	Added lead-in sentence for SRP section interfaces that are also reviewed by the Primary Review Branch for SRP Section 9.5.7.

**SRP Draft Section 9.5.7**  
Attachment A - Proposed Changes in Order of Occurrence

Item	Source	Description
12.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB names and responsibilities for SRP Section 3.6.1. References to BTPs were deleted to simplify the text. The BTPs will be reviewed as part of the review interface for the associated SRP Section ,and therefore there is no need to specify them separately.
13.	Current PRB names and abbreviations.	Editorial change to reflect current PRB names and responsibilities for SRP section 9.5.1.
14.	Editorial.	Revised the lead-in sentence for those areas of review for which the PRB for SRP Section 9.5.7 must interface with other PRBs. This change is consistent with SRP-UDP format guidance.
15.	Current PRB names and abbreviations.	Editorial change to reflect current PRB names and responsibilities for SRP section 9.5.7
16.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB names and responsibilities 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.
17.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB names and responsibilities for SRP sections 3.9.1 through 3.9.3.
18.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB names and responsibilities for SRP sections 3.2.1 and 3.2.2.
19.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB names and responsibilities.
20.	Current PRB names and abbreviations and Editorial changes.	Editorial change to separate text, revise the reference to SRP Section 14.0 to 14.2, and reflect current PRB names and responsibilities for SRP Section 14.2.
21.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB names and responsibilities for SRP Chapter 17. Note that "Section 17.0" was changed to "Chapter 17" since there is no Section 17.0 and the review interface encompasses the entire Chapter.
22.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB names and responsibilities for SRP Section 16.0.



**SRP Draft Section 9.5.7**  
Attachment A - Proposed Changes in Order of Occurrence

Item	Source	Description
23.	Editorial, Current PRB names and abbreviations.	The review of electrical components including interlocks was moved from the Areas of Review for the PRB responsible for SRP Section 9.5.7 to a Review Interface. The responsibility for SRP Section 9.5.7 was previously assigned to the Power Systems Branch (now the Electrical Engineering Branch). Although the SPLB now has responsibility for diesel engine support systems, the EELB maintains responsibility for the review of the emergency diesel generator and associated control circuitry including the interlocks.
24.	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.
25.	Editorial change.	"For" was inserted at the beginning of the sentence. It appears to have been previously omitted.
26.	SRP-UDP format item	Revised using standard text to address both the interfaces listed with other SPLB reviews and with other PRBs.
27.	<b>Integrated Impact 253.</b>	Added "regulations" to the list of document types used for acceptance criteria to accommodate the addition of 10 CFR 50.63.
28.	Editorial.	Added the "SSC" acronym for structures, systems and components to simplify the text.
29.	Editorial.	Added the "SSC" acronym for structures, systems and components to simplify the text.
30.	<b>Integrated Impact 251.</b>	Deleted Acceptance Criteria associated with BTP ICSB-17 which has been superseded by Regulatory Guide 1.9.
31.	Editorial item.	Renumbered Acceptance Criteria as a result of deleted text.
32.	SRP-UDP format item. Reformat reference citations.	Added parenthetical reference identification to the existing citation of NUREG/CR 0660.
33.	Editorial item.	Renumbered Acceptance Criteria as a result of deleted text.
34.	<b>Integrated Impact 794.</b>	Revised the title of IEEE 387 to add the ANSI designation and to abbreviate the term "Standard" as "Std" to be consistent with IEEE usage.
35.	SRP-UDP format item. Reformat reference citations.	Added parenthetical reference identification to the existing citation of IEEE 387.
36.	Editorial item.	Renumbered Acceptance Criteria as a result of deleted text.

**SRP Draft Section 9.5.7**  
Attachment A - Proposed Changes in Order of Occurrence

Item	Source	Description
37.	SRP-UDP format item. Reformat reference citations.	Added parenthetical reference identification to the existing citation of DEMA Standard.
38.	Editorial item.	Renumbered Acceptance Criteria as a result of deleted text.
39.	Editorial item.	Renumbered Acceptance Criteria as a result of deleted text.
40.	Editorial item.	Renumbered Acceptance Criteria as a result of deleted text.
41.	Editorial item.	Renumbered Acceptance Criteria as a result of deleted text.
42.	Editorial item.	Renumbered Acceptance Criteria as a result of deleted text.
43.	<b>Integrated Impact 253.</b>	Revised Acceptance Criteria to include 10 CFR 50.63 and Regulatory Guide 1.155 regarding station blackout.
44.	SRP-UDP format item.	Technical Rationale were developed for the Acceptance Criteria in accordance with the format requirements for the SRP-UDP.
45.	Current PRB names and abbreviations.	Editorial change to reflect current PRB names and responsibilities.
46.	Current PRB names and abbreviations.	Editorial change to reflect current PRB names and responsibilities.
47.	Current PRB names and abbreviations.	Editorial change to reflect current PRB names and responsibilities.
48.	Current PRB names and abbreviations.	Editorial change to reflect current PRB names and responsibilities for SRP section 9.5.7.
49.	<b>Integrated Impact 797.</b>	Added a review procedure to address lubrication system volume requirements necessary to support operation of the diesel engine for 7 days.
50.	<b>Integrated Impact 253.</b>	Revised Review Procedures to include review for 10 CFR 50.63 and Regulatory Guide 1.155 requirements with regard to lubrication systems on emergency diesel generators used as alternate ac power sources for coping with station blackout.
51.	SRP integration format item	Added boiler-plate statement regarding reviews conducted in accordance with 10 CFR 52.

**SRP Draft Section 9.5.7**  
Attachment A - Proposed Changes in Order of Occurrence

Item	Source	Description
52.	10 CFR 52 applicability changes. Potential Impact Nos. 24316 and 24317.	Added a paragraph to address reviews for design certification applicants. Some portions of the design and interface between the diesel engine and the support systems are dependent on the selection of the diesel engine vendor. Since these design and interface criteria may not be available as part of the DC review, they are the responsibility of the applicant referencing the certified design.
53.	SRP-UDP format item. Verification of references.	Updated the title for GDC 4.
54.	Editorial Item.	Updated title of Regulatory Guide 1.9.
55.	<b>Integrated Impact 251.</b>	Deleted text in Evaluation Findings associated with BTP ICSB-17 which was superseded by Regulatory Guide 1.9.
56.	<b>Integrated Impact 253.</b>	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.
57.	10 CFR 52 applicability related editorial change.	Design Certification is mentioned as appropriate in those paragraphs of the SRP which discuss Construction Permit or Operating License reviews, in accordance with SRP-UDP requirements.
58.	SRP-UDP Format Item	Added boiler-plate statement indicating the applicability of the SRP to 10 CFR 52 license applications.
59.	SRP-UDP Format Item	Added boiler-plate statement describing the applicability of the SRP to existing and new applications.
60.	<b>Integrated Impact 253.</b>	Added reference to 10 CFR 50.63.
61.	Editorial	Reordered and renumbered references in accordance with SRP-UDP guidance.
62.	Editorial item.	Updated title of GDC 4.
63.	Editorial item.	Renumbered reference and updated title of Regulatory Guide 1.9.
64.	Editorial item.	Deleted reference to Regulatory Guide 1.68 which is not mentioned in the text of the SRP Section.
65.	<b>Integrated Impact 253.</b>	Added reference to Regulatory Guide 1.155.
66.	Editorial.	The Branch Technical Position is only cited in the Areas of Review portion of SRP Section 9.5.7. This BTP will be reviewed through the interface with SRP Section 3.6.1, and therefore there is no need to cite or reference the BTP separately.

**SRP Draft Section 9.5.7**  
Attachment A - Proposed Changes in Order of Occurrence

Item	Source	Description
67.	Editorial.	The Branch Technical Position is only cited in the Areas of Review portion of SRP Section 9.5.7. This BTP will be reviewed through the interface with the SRP Section 3.6.1 , and therefore there is no need to cite or reference the BTP separately.
68.	Editorial item.	Deleted reference to BTP ASB 9.5-1. This BTP will be reviewed through the interface with the SRP Section 9.5.1 , and therefore there is no need to cite or reference the BTP separately.
69.	<b>Integrated Impact 251.</b>	Deleted reference to BTP ICSB-17 which has been superseded by Regulatory Guide 1.9.
70.	Editorial.	Renumbered the reference due to the additiona and deletion of preceding references.
71.	SRP-UDP format item. Reference verification.	Updated the reference to NUREG/CR-0660.
72.	Editorial.	Renumbered the reference due to the additiona and deletion of preceding references.
73.	<b>Integrated Impact 794.</b>	Added the 1984 date to identify the applicable version and revised the title to include the ANSI designator and to abbreviate the term "Standard" to "Std" to be consistent with IEEE usage.
74.	Editorial.	Renumbered the reference due to the additional and deletion of preceding references.
75.	<b>Integrated Impact 675.</b>	Added the applicable date to the reference for the DEMA Standard. The 1974 version of the Standard was in effect at the time the SRP was published and has not been updated.
76.	SRP-UDP format item. Reference verification.	The DEMA Standard could not be obtained from available sources and the DEMA organization is listed as inactive. Therefore this reference could not be verified.

**SRP Draft Section 9.5.7**  
Attachment B - Cross Reference of Integrated Impacts

<b>Integrated Impact No.</b>	<b>Issue</b>	<b>SRP Subsections Affected</b>
251	Deletion of reference to BTP ICSB-17 which was superseded by Regulatory Guide 1.9.	II.4, IV.3, and VI.
253	Incorporates the Station Blackout requirements of 10 CFR 50.63 and Regulatory Guide 1.155 with regard to EDGs as alternate ac sources.	I.4, II, III.5, IV, and VI.
675	Added date to DEMA Standard reference.	VI.
794	Updated the IEEE Std 387 reference.	II, and VI.
797	Added Review Procedure to verify lubrication system capacity is sufficient to support 7 days of full load operation of the diesel engine.	III.1