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

SECTION 9.5.8 EMERGENCY DIESEL ENGINE COMBUSTION AIR INTAKE AND EXHAUST SYSTEM

REVIEW RESPONSIBILITIES

Primary - Auxiliary and Power Conversion Systems Branch (APCSB)

Secondary - Reactor Systems Branch (RSB)
Structural Engineering Branch (SEB)
Mechanical Engineering Branch (MEB)
Materials Engineering Branch (MTEB)
Electrical, Instrumentation and Control Systems Branch (EICSB)

I. AREAS OF REVIEW

The emergency diesel generator combustion air intake and exhaust system (EDGCAIES) supplies combustion air of reliable quality to the diesel engines, and exhausts the products of combustion from the diesel engines to the atmosphere. The APCSB reviews the system from the outside air intake to the combustion air supply lines connected to the diesel engines, and from the exhaust connections at the diesel engines to the discharge point outside the building.

1. The APCSB reviews the EDGCAIES to verify that:

   a. The system design meets appropriate seismic design classification requirements and the components are designed, fabricated, erected, and tested to acceptable quality standards.

   b. The essential portions of the system are housed in or on a seismic Category I structure that is capable of protecting the system from extreme natural phenomena and external missiles.

   c. Each diesel engine has an independent combustion air intake and exhaust system.

   d. The consequenes of a single active failure in an engine combustion air intake or exhaust system will not lead to the loss of function of more than one diesel generator.

2. The applicant's proposed technical specifications are reviewed for operating license applications, as they relate to areas covered in this plan.

Secondary reviews will be performed by other branches and the results used by the APCSB to complete the overall evaluation of the system. The secondary reviews are as follows. The SEB will determine 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. The MEB will review the seismic qualification of components and confirm that system components, piping, and structures are designed in accordance with applicable codes and standards. The RSB will determine that the seismic and quality group classifications for system components are acceptable. The MTEB will verify that inservice inspection requirements are met for system components and, upon request, will verify the compatibility of the materials of construction with service conditions. The EICSB will verify the adequacy of the design, installation, inspection, and testing of all electrical systems (sensing, control, and power) required for proper system operation.

II. ACCEPTANCE CRITERIA

Acceptability of the design of the emergency diesel generator combustion air intake and exhaust system, as described in the applicant's safety analysis report (SAR), is based on specific general design criteria and regulatory guides. An additional basis for determining the acceptability of the EDGCAIES will be the degree of similarity of the design with that for previously reviewed plants with satisfactory operating experience.

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

1. General Design Criterion 2, as related to the ability of structures housing the system and system components to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, and floods.

2. General Design Criterion 4, with respect to structures housing the systems and the system components being capable of withstanding the effects of external missiles and internally generated missiles, pipe whip, and jet impingement forces associated with pipe breaks.

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

4. Regulatory Guide 1.26, as related to quality group classification of the system components.

5. Regulatory Guide 1.29, as related to the seismic design classification of system components.

6. Each emergency diesel engine should be provided with an independent and reliable combustion air intake and exhaust system. The system should be sized and physically

arranged such that no degradation of engine function will be experienced when the diesel generator set is required to operate continuously at the maximum rated power output.

7. The combustion air intake system shall be provided with a means of reducing airborne particulate material over the entire time period that emergency power is required assuming the maximum airborne particulate concentration at the combustion air intake.

8. Suitable design precautions have been taken to preclude degradation of the diesel engine power output due to exhaust gases and other dilutents that could reduce the oxygen content below acceptable levels.

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 Section II of this plan. 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 review procedures for OL applications 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 staff's review.

The reviewer will select and emphasize material from the paragraphs below, as may be appropriate for a particular case.

1. The SAR is reviewed to determine that the EDGCAIES description and related diagrams clearly delineate the system components and the modes of system operation. The reviewer verifies that essential portions of the EDGCAIES are designed to appropriate seismic and quality group classification standards.

2. The SAR is reviewed to ascertain that sufficient space has been provided around the components to permit inspection of the system components.

3. The SAR is reviewed to assure that the arrangement and location of the combustion air intake and exhaust are such that dilution or contamination of the intake air by exhaust products or other gases that may intentionally or accidentally be released on site will not preclude operation of the diesel engines at rated power output.

4. The SAR is reviewed to verify that if the intake air flow or engine exhaust is dependent upon the actuation of flow control devices (louvers, dampers), the EDGCAIES will function if there is a failure of an active component.

5. The SAR is reviewed to assure that system components exposed to atmospheric conditions (ice, snow) are protected from possible clogging during standby or operation of the system.

6. The review verifies that the system will function as required in the event of other adverse natural phenomena. The reviewer evaluates the system, using engineering judgment and failure modes and effects analyses to determine that:

   a. The failure of non-essential portions of the system or of other systems not designed to seismic Category I requirements and located close to essential portions of the system, or of non-seismic Category I structures that house, support, or are close to essential portions of the EDGCAIES, will not preclude operation of the system. 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 that verify 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 or externally generated missiles. Flood protection and missile protection criteria are discussed and evaluated in detail under the standard review plans for Chapter 3 of the SAR. The location and the design of the systems and structures are reviewed to determine that the degree of protection provided is adequate. 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.

   c. The essential portions of the system are protected from the effects of high and moderate energy line breaks. Layout drawings are reviewed to assure that no high or moderate energy piping systems are close to the essential portions of the system, or that protection from the effects of failure will be provided. The means of providing such protection will be given in Section 3.6 of the SAR and procedures for reviewing this information are given in the corresponding review plans.

7. The descriptive information, P&IDs, EDGCAIES layout drawings, and failure modes and effects analyses in the SAR are reviewed to assure that functional requirements of the system will be met following design basis accidents assuming a concurrent single active component failure. The reviewer evaluates the effects of failure of components, traces the availability of redundant components on system drawings, and checks that the SAR contains verification that the system functional requirements are met.

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 generator combustion air intake and exhaust system (EDGCAIES) includes all components and piping of the air intake system from the atmospheric air intake to its connection to the engine and all components and piping of the exhaust

system from its connection to the engine to the point where it exhausts to the atmosphere. The scope of the review of the EDGCAIES for the _____ plant included layout drawings, piping and instrumentation diagrams, and descriptive information for the system and auxiliary supporting systems that are essential to its safe operation. [The review has determined the adequacy of the applicant's proposed design criteria and bases for the emergency diesel generator combustion air intake and exhaust system and requirements for safe operation of the system during normal, abnormal and accident conditions. (CP)] [The review has determined that the design of the emergency diesel generator combustion air intake and exhaust system and auxiliary supporting systems is in conformance with the design criteria and bases. (OL)]

"The basis for acceptance in the staff review has been conformance of the applicant's designs, design criteria, and design bases for the emergency diesel generator combustion air intake and exhaust system and its supporting systems to the Commission's regulations as set forth in the general design criteria, and to applicable regulatory guides, branch technical positions, and industry standards.

"The staff concludes that the design of the emergency diesel generator combustion air intake and exhaust system conforms to all applicable regulations, guides, staff positions, and industry standards, and is acceptable."

V. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."

2. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Missile Design Bases."

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

4. Regulatory Guide 1.26, "Quality Group Classifications and Standards For Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," Revision 1.

5. Regulatory Guide 1.29, "Seismic Design Classification," Revision 1.

6. Regulatory Guide 1.68, "Preoperational and Initial Startup Test Programs for Water-Cooled Power Reactors."

7. Branch Technical Positions APCSB 3-1, "Protection Against Postulated Piping Failures in Fluid Systems Outside Containment," attached to Standard Review Plan 3.6.1, and MEB 3-1, "Postulated Break and Leakage Locations in Fluid System Piping Outside Containment," attached to Standard Review Plan 3.6.2.

8. Branch Technical Position EICSB Diesel-Generator Protective Trip Circuit Bypasses.

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