U.S. NUCLEAR REGULATORY COMMISSION

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Proposed Revision 5 to Regulatory Guide 1.9

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APPLICATION AND TESTING OF ONSITE EMERGENCY ALTERNATING CURRENT POWER SOURCES IN PRODUCTION AND UTILIZATION FACILITIES

A. INTRODUCTION

Purpose

This regulatory guide (RG) provides guidance that the staff of the U.S. Nuclear Regulatory Commission (NRC) considers acceptable to comply with the NRC regulations for onsite emergency alternating current (AC) power sources, including emergency diesel generators (EDGs) and combustion turbine generators (CTGs), in production and utilization facilities. This RG may also be used for other types of onsite emergency AC power sources. Subject to the conditions described in section C of this RG, it endorses the International Electrotechnical Commission (IEC)/Institute of Electrical and Electronics Engineers (IEEE) Standard (Std) 63332-387:2024, "Nuclear facilities—Electrical power systems—Diesel generator units applied as standby power sources" (Ref. 1), and IEEE Std 2420-2019, "IEEE Standard Criteria for Combustion Turbine-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations" (Ref. 2).

Applicability

This RG applies to applicants and licensees subject to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities" (Ref. 3), or 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants" (Ref. 4). Under 10 CFR Part 50, this RG applies to applicants for and holders of licenses, as defined in 10 CFR 50.2, "Definitions." Under 10 CFR Part 52, this RG applies to applicants for and holders of combined licenses, standard design approvals, and manufacturing licenses, and applicants for standard design certifications, as defined in 10 CFR 52.1, "Definitions."

Applicable Regulations

- 10 CFR Part 50 contains the following applicable regulations:

    - 10 CFR 50.48, "Fire protection," requires, in part, each operating nuclear power plant to have a fire protection plan that satisfies General Design Criterion (GDC) 3, "Fire protection," of

This RG is being issued in draft form (as a draft regulatory guide (DG)) to involve the public in the development of regulatory guidance in this area. It has not received final NRC staff review or approval and does not represent a final staff position. Public comments are being solicited on this DG and its associated regulatory analysis. Comments should be accompanied by appropriate supporting data. Comments may be submitted through the Federal-rulemaking website, http://www.regulations.gov, by searching for draft regulatory guide DG-1477. Alternatively, comments may be submitted to the Office of Administration, Mailstop: TWFN 7A-06M, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, ATTN: Program Management, Announcements and Editing Staff. Comments must be submitted by the date indicated in the *Federal Register* notice.

Electronic copies of this DG, and other issued regulatory guides are available through the NRC's public website under the Regulatory Guides document collection of the NRC Library at https://nrc.gov/reading-rm/doc-collections/reg-guides/index.html. The DG is also available through the NRC's Agencywide Documents Access and Management System (ADAMS) at https://www.nrc.gov/reading-rm/adams.html, under Accession No. ML26007A205. The regulatory analysis may be found in ADAMS under Accession No. ML26007A215.

Appendix A, “General Design Criteria for Nuclear Power Plants,” to 10 CFR Part 50. The regulation specifies what a fire protection plan should contain and lists the basic fire protection guidelines for the plan.10 CFR 50.48(c) incorporates National Fire Protection Association (NFPA) Standard 805, “Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants,” 2001 Edition (Ref. 5), by reference with certain exceptions and allows licensees to voluntarily adopt and maintain an fire protection plan that meets the requirements of NFPA 805 as an alternative to meeting the requirements of 10 CFR 50.48(b) or the plant-specific fire protection license conditions.

- 10 CFR 50.49, “Environmental qualification of electric equipment important to safety for nuclear power plants,” requires that holders or applicants for an operating license for a nuclear power plant issued under 10 CFR Part 50 shall establish a program for the environmental qualification of electric equipment, as defined in 10 CFR 50.49. Under 10 CFR 50.49, holders of a combined license or a manufacturing license issued under 10 CFR Part 52 are also required to establish a program for the environmental qualification of electric equipment, as defined in 10 CFR 50.49.

- 10 CFR 50.55a, “Codes and standards,” and 10 CFR 50.55(i), “Conditions of construction permits, early site permits, combined licenses, and manufacturing licenses,” require, in part, that systems, structures, and components (SSCs) be designed, fabricated, erected, constructed, tested, and inspected to quality standards commensurate with the importance of the safety function to be performed. Furthermore, 10 CFR 50.55a(h) provides requirements for protection and safety systems and incorporates by reference IEEE Std 279-1968, “Proposed IEEE Criteria for Nuclear Power Plant Protection Systems” (Ref. 6); IEEE Std 279-1971, “Criteria for Protection Systems for Nuclear Power Generating Stations” (Ref. 7); and IEEE Std 603-1991, “Standard Criteria for Safety Systems for Nuclear Power Generating Stations” (including the correction sheet dated January 30, 1995) (Ref. 8). The applicability of each of these standards to a given nuclear power plant depends on the plant’s licensing date and other criteria.

- 10 CFR 50.63, “Loss of all alternating current power,” requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout (i.e., loss of offsite and onsite emergency AC power systems) for a specified duration.

- 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," provides minimum requirements for the principal design criteria that establish the necessary design, fabrication, construction, testing, and performance requirements for SSCs important to safety to provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. The GDC in 10 CFR Part 50, Appendix A are considered to be generally applicable to other types of nuclear power units and are intended to provide guidance in establishing the principal design criteria for such other units. The general design criteria (GDC) applicable to this RG include the following:

- GDC 2, “Design bases for protection against natural phenomena,” requires that SSCs 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 their safety functions.

- GDC 3, “Fire protection,” requires that SSCs important to safety be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

- GDC 4, “Environmental and dynamic effects design bases,” relates to the capability of SSCs of the AC power system to withstand the effects of missiles and environmental conditions associated with normal operation, maintenance, testing, and postulated accidents.

- GDC 5, “Sharing of structures, systems, and components,” requires that SSCs important to safety not be shared among nuclear power units unless such sharing will not significantly impair the SSCs’ ability to perform their safety functions, including an orderly shutdown and cooldown of the remaining units if there is an accident in one unit.

- GDC 17, “Electric power systems,” requires that onsite electric power systems have sufficient independence, capacity, capability, redundancy, and testability to ensure that (1) specified acceptable nuclear fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences, and (2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents, assuming a single failure.

- GDC 18, “Inspection and testing of electric power systems,” requires that electric power systems important to safety be designed to permit appropriate periodic inspection and testing to assess the continuity of the systems and the condition of their components.

- GDC 19, “Control room” requires that a control room shall be provided, from which actions can be taken to operate the nuclear power unit safely under normal conditions, and maintained in a safe condition under accident conditions, including loss-of-coolant accidents.

- GDC 33, “Reactor coolant makeup”; GDC 34, “Residual heat removal”; GDC 35, “Emergency core cooling”; GDC 38, “Containment heat removal”; GDC 41, “Containment atmosphere cleanup”; and GDC 44, “Cooling water,” apply to the operation of the onsite electric power system, in accordance with GDC 17, to ensure the safety functions of the systems described in these criteria are accomplished.

- As stated in the introduction to Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” to 10 CFR Part 50, nuclear power plants include SSCs that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. Appendix B to 10 CFR Part 50 establishes quality assurance requirements for the design, manufacture, construction, and operation of those SSCs:

  - Criterion III, “Design Control,” requires, in part, design control measures for verifying the adequacy of the design.

  - Criterion XI, “Test Control,” requires, in part, a test program to provide assurance that all testing required to demonstrate that SSCs will perform satisfactorily in service is performed in accordance with written procedures that incorporate the requirements and acceptance limits in applicable design documents.

  - Criterion XVII, “Quality Assurance Records,” requires, in part, the maintenance of sufficient records as evidence of activities affecting quality.

- 10 CFR Part 52 governs the issuance of early site permits, standard design certifications, combined licenses, standard design approvals, and manufacturing licenses for nuclear power facilities. It specifies, among other things, that contents of certain applications must satisfy the requirements of 10 CFR 50.36, “Technical specifications”; 10 CFR 50.55a; and 10 CFR Part 50, Appendices A and B.

- o 10 CFR 52.97(b) requires that combined licenses must contain inspections, tests, analyses, and acceptance criteria that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in accordance with the license; the Atomic Energy Act of 1954, as amended (Ref. 9); and NRC rules and regulations.

- o 10 CFR 52.99(c)(1) requires that each combined license holder notify the NRC that the prescribed inspections, tests, and analyses have been performed and that the prescribed acceptance criteria are met for each inspection, test, analysis, and acceptance criterion included in their combined license.

Related Guidance

- Branch Technical Position 8-8, “Onsite (Emergency Diesel Generators) and Offsite Power Sources Allowed Outage Time Extensions,” issued February 2012 (Ref. 10), provides guidance on allowed outage time extension requests for onsite or offsite power sources to permit online maintenance.

- “Emergency Diesel Generator Technical Specifications Surveillance Requirements Regarding Endurance and Margin Testing: Summary Report,” dated December 10, 2009 (Ref. 11), provides guidance on the adequacy of nuclear power plant EDG endurance and margin testing.

- NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition” (Ref. 12), provides guidance to the NRC staff on performing safety reviews for light-water reactor technology under 10 CFR Part 50 and 10 CFR Part 2. This guidance generally provides insights to non-light water reactors. Specifically, SRP Chapter 8, “Electric Power” contains review guidance related to the onsite ac power system that includes those standby power sources, distribution systems, and auxiliary supporting systems provided to supply power to safety-related equipment or equipment important to safety for all normal operating and accident conditions.

- RG 1.6, “Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems” (Ref. 13), discusses independence between redundant standby (onsite) power sources and between their distribution systems.

- RG 1.28, “Quality Assurance Program Criteria (Design and Construction)” (Ref. 14), provides guidance on establishing and implementing a quality assurance program for the design and construction of nuclear power plants and fuel reprocessing plants.

- RG 1.32, “Criteria for Power Systems for Nuclear Power Plants” (Ref. 15), describes a method acceptable to the NRC staff for complying with the agency’s regulations for the design, operation, and testing of electric power systems in nuclear power plants. Specifically, it provides guidance for meeting the GDC for the safety-related portions of systems and equipment in the AC power systems.

- RG 1.75, “Criteria for Independence of Electrical Safety Systems” (Ref. 16), provides guidance on physical independence requirements of the circuits and electrical equipment that comprise or are associated with safety systems.

- RG 1.81, “Shared Emergency and Shutdown Electric Systems for Multi-Unit Nuclear Power Plants” (Ref. 17), provides guidance on the sharing of onsite emergency and shutdown electric systems for multi-unit nuclear power plants.

- RG 1.89, “Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants” (Ref. 18), provides guidance for meeting the regulations for environmental qualification of electric equipment important to safety for service in nuclear power plants to ensure that the equipment can perform its safety function during and after a design basis accident.

- RG 1.100, “Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants” (Ref. 19), discusses the seismic qualification of electrical equipment and other qualification provisions.

- RG 1.118, “Periodic Testing of Electric Power and Protection Systems” (Ref. 20), discusses periodic testing of the performance of the electric power and protection components of the system.

- RG 1.129, “Maintenance, Testing, and Replacement of Vented Lead-Acid Storage Batteries for Production and Utilization Facilities,” (Ref. 21), provides guidance on maintenance, testing, and replacement criteria for vented lead-acid batteries.

- RG 1.137, “Fuel Oil Systems for Emergency Power Supplies” (Ref. 22), provides the quality control requirements for diesel fuel oil because it is a safety-related component. The RG establishes acceptable methods of verifying the quality of the fuel oil and fuel-oil systems used in safety-related applications at nuclear power plants.

- RG 1.152, “Criteria for Programmable Digital Devices in Safety-Related Systems of Nuclear Power Plants” (Ref. 23), discusses criteria for high functional reliability, design quality, and a secure development and operational environment for the use of programmable digital devices.

- RG 1.155, “Station Blackout” (Ref. 24), provides guidance for meeting the regulations that require nuclear power plants to be capable of coping with a station blackout for a specified duration.

- RG 1.160, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants” (Ref. 25), describes methods that are acceptable for demonstrating compliance with the provisions of 10 CFR 50.65, “Requirements for monitoring the effectiveness of maintenance at nuclear power plants.”

- RG 1.164, “Dedication of Commercial-Grade Items for Use in Nuclear Power Plants” (Ref. 26), provides guidance on the dedication of commercial-grade items and services used in nuclear power plants.

- RG 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis” (Ref. 27), provides guidance on developing risk-informed applications for a licensing basis change that considers engineering issues and applies risk insights.

- RG 1.189, “Fire Protection for Nuclear Power Plants” (Ref. 28), provides a comprehensive fire protection guidance document and identifies the scope and depth of fire protection that the staff considers acceptable for nuclear power plants.

- RG 1.212, "Sizing of Large Lead-Acid Storage Batteries" (Ref. 29), provides guidance on the sizing of lead-acid batteries.

- RG 1.248, "Guide for Assessing, Monitoring, and Mitigating Aging Effects on Electrical Equipment Used in Production and Utilization Facilities" (Ref. 30), provides guidance on managing, monitoring, and mitigating aging effects on electrical equipment.

Purpose of Regulatory Guides

The NRC issues RGs to describe methods that are acceptable to the staff for implementing specific parts of the agency's regulations, to explain techniques that the staff uses in evaluating specific issues or postulated events, and to describe information that the staff needs in its review of applications for permits and licenses. Regulatory guides are not NRC regulations and compliance with them is not required. Methods and solutions that differ from those set forth in RGs are acceptable if the applicant provides sufficient basis and information for the NRC staff to verify that the alternative methods comply with the applicable NRC regulations.

Paperwork Reduction Act

This RG provides voluntary guidance for implementing the mandatory information collections in 10 CFR Parts 50 and 52 that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collections were approved by the Office of Management and Budget (OMB) under control numbers 3150-0011 and 3150-0151, respectively.

Send comments regarding this information collection to the Freedom of Information Act (FOIA), Library, and Information Collections Branch, Office of the Chief Information Officer, Mail Stop: T6-A10M, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001 or by email to Infocollects.Resource@nrc.gov, and to the OMB reviewer at: OMB Office of Information and Regulatory Affairs (3150-0011 and 3150-0151), Attn: Desk Officer for the Nuclear Regulatory Commission, 725 17th Street, NW, Washington, DC 20503.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

B. DISCUSSION

Reason for Revision

IEC and IEEE have released new standards regarding emergency AC standby power supplies, IEC/IEEE 63332-387:2024 and IEEE Std 2420-2019, that supersede the existing standards endorsed in RG 1.9, Revision 4. This revision of this guide (Revision 5) is updated to endorse and provide guidance on these new standards. Revision 5 applies to production and utilization facilities licensed under 10 CFR Part 50 and 10 CFR Part 52 that utilize onsite emergency AC power. Revision 5 is the result of lessons learned from license amendment review activities and inspections, industry operating experience, design certification reviews, combined license application reviews, and NRC staff analysis. Furthermore, Revision 5 includes specific guidance on CTGs and onsite emergency AC power sources other than EDGs and CTGs. Subject to the conditions in section C, Revision 5 endorses IEC/IEEE Std 63332-387:2024 and IEEE Std 2420-2019. These standards delineate (1) principal design criteria and (2) qualification and testing guidelines to help ensure that onsite emergency AC power sources, including EDGs and CTGs, meet performance requirements.

Background

Onsite emergency AC power sources, including EDGs and CTGs, are used to supply power to safety-related equipment, or equipment important to safety, for all operational events and during accident conditions (e.g., design basis events, anticipated operational occurrences, loss of offsite power (LOOP) and LOOP coincident with accident conditions). Onsite emergency AC power sources should be properly qualified, have sufficient capacity and capability, and have the necessary reliability and availability to operate as required under all design conditions. An onsite emergency AC power source (i.e., a Class 1E onsite AC power source) selected for use in an electric power system should be able to

1) Start and accelerate a number of large motor loads in rapid succession, while maintaining voltage and frequency within acceptable limits,
2) Provide power promptly to engineered safety features all operational events and during accident conditions, and
3) Supply power continuously to the equipment needed to maintain the plant in a safe condition.

Knowledge of the characteristics of each load is essential to establish the bases for selecting an onsite emergency power source capable of accepting large loads in rapid succession. For example, in large light-water nuclear power plants, the majority of the emergency loads are large induction motors. At full voltage, this type of motor draws a starting current of five to eight times its rated full-load current. The sudden, large increase in current drawn from the onsite emergency AC power source because of the startup of induction motors can result in substantial voltage reduction. This lower voltage could prevent a motor from starting (i.e., accelerating its load to rated speed in the required time) or cause a running motor to coast down or stall. Other voltage-sensitive loads may be disconnected because of low voltage, or if their associated contactors drop out. Recovery from the transient caused by starting large motors, or from the loss of a large load, could cause overspeed of the emergency generator prime mover that, if excessive, could result in a trip (i.e., loss of the safety-related power source). These consequences can also result from the cumulative effect of a sequence of more moderate transients if the system is not permitted to recover sufficiently between successive steps in a loading sequence.

The uncertainties inherent in safety-load estimates at an early stage of design, or before the combined license stage, are sometimes so large that it is prudent to provide a reasonable margin in selecting the load capabilities of the onsite emergency AC power source. Particularly for EDGs and

CTGs, as discussed in IEEE Std 2420-2019, Annex A, and IEC/IEEE Std 63332-387:2024, Annex A, this margin can be achieved by estimating the loads conservatively and selecting EDGs and CTGs with continuous ratings that exceed the sum of the loads needed at any one time. A more accurate estimate of safety loads is possible during the operating license or combined license stages of review, because detailed designs should have been completed and component test and preoperational test data are usually available. However, the design-basis-event loads during the operating license or combined license stages should be within the continuous (or nominal) rating of the selected onsite emergency AC power source with margin.

Class 1E, seismic Category I, and environmentally qualified equipment, instrumentation, and components are credited for mitigating the consequences of all accidents, events, and abnormal operating conditions postulated at nuclear power plants, as discussed in RG 1.89 and RG 1.100.

The design of the onsite emergency AC power source should also incorporate high operational reliability, which should be maintained throughout the life of the onsite emergency AC power source, by initiating a program to monitor, improve, and maintain reliability. Increased operational reliability can be achieved through appropriate testing and maintenance, as described in RG 1.160, and through the appropriate level of causal analysis of all failures of the onsite emergency AC power source.

The reliability of onsite emergency AC power sources is important in the risk evaluation of core damage from a station blackout event. Thus, both attaining and maintaining the high reliability of onsite emergency AC power sources at nuclear power plants contributes greatly to reducing the probability of station blackout. RG 1.155 discusses the reliability of the onsite emergency AC power source as one of the factors in determining the length of time a plant should be able to cope with a station blackout. If all other factors (e.g., redundancy of onsite emergency AC power source, frequency of LOOP, probable time needed to restore offsite power) remain constant, higher reliability of the onsite emergency AC power source could result in a lower probability of a station blackout, with a corresponding decrease in coping duration for certain plants.

The onsite electrical power system should have the capability to

1) Operate and supply power to safety systems that mitigate the effects of accidents and events delineated in the safety analysis and

2) Power the equipment necessary for long-term cooling.

The emergency AC power system is established on systems important to safety or as required by the individual current licensing basis, for all operational events and during accident conditions and for time to restore offsite power from a LOOP due to external events.

General industry practice is to specify a voltage reduction of 10 to 15 percent when starting large motors from large-capacity power systems and a maximum voltage reduction of 25 to 30 percent when starting these motors from limited-capacity power sources, such as EDGs or CTGs. Evaluation of voltage reduction during load sequencing should consider the plant-specific equipment to prevent load interruption. Large induction motors can achieve rated speed in less than 5 seconds when powered from adequately sized EDGs or CTGs that can restore the bus voltage to 90 percent of nominal in about 1 to 2 seconds.

Motor-starting transients also affect the frequency of the emergency AC power source. This is primarily a concern with EDGs. Frequency perturbations could affect the operation of critical equipment, such as motor-operated valves and bypass power supplies associated with uninterruptible power systems. Plant safety analyses evaluate fluid flow rates in the emergency core cooling system and make assumptions about the steady-state speed of rotating equipment. The EDG's ability to maintain steady-state voltage and frequency within an acceptable band can affect the performance capabilities of the emergency core cooling system motor loads (e.g., pumps, motor-operated valves, and fans) and bypass power supplies associated with uninterruptible power systems. Hence, voltage and frequency perturbations during load sequencing, coupled with an allowable operating band for EDGs during steady-state conditions, should be evaluated for their impact on critical parameters, such as flow rates and stroke times, assumed in plant safety analyses.

The transient operation period includes starting of the EDG or CTG and adding or subtracting loads. The steady-state operation period occurs after the EDG or CTG starts and no further loads are added or removed, including the recovery period after loading changes.

The immediate operation of an overspeed trip device (usually set at 115 percent of nominal speed for EDGs or CTGs) protects an EDG or CTG from excessive overspeed, which can result from an improperly adjusted control system or governor failure. Similarly, to prevent substantial damage to the generator, the generator differential current trip must operate immediately upon occurrence of an internal fault. Other protective trips can also safeguard the EDGs or CTGs from possible damage. Conversely, spurious operation of a trip circuit lowers EDG or CTG availability and reliability. It is important to ensure that these other protective trips do not prevent EDGs or CTGs from performing their safety function during the accident mode of operation.

Consideration of International Standards

The International Atomic Energy Agency (IAEA) works with member states and other partners to promote the safe, secure, and peaceful use of nuclear technologies. The IAEA develops Safety Requirements and Safety Guides for protecting people and the environment from harmful effects of ionizing radiation. This system of safety fundamentals, safety requirements, safety guides, and other relevant reports reflects an international perspective on what constitutes a high level of safety. To inform its development of this RG, the NRC considered IAEA Safety Requirements and Safety Guides pursuant to the Commission's International Policy Statement (Ref. 31) and Management Directive and Handbook 6.6, "Regulatory Guides" (Ref. 32).

The following international documents were considered in the update of the Regulatory Guide:

- International Organization for Standardization (ISO)-21789, "Gas Turbine Applications—Safety," issued July 2022 (Ref. 33)

- IAEA Specific Safety Guide No. SSG-34, "Design of Electrical Power Systems for Nuclear Power Plants," issued March 2016 (Ref. 34)

Documents Discussed in Staff Regulatory Guidance

This RG endorses, in part, the use of one or more codes or standards developed by external organizations, and other third-party guidance documents. These codes, standards and third-party guidance documents may contain references to other codes, standards or third-party guidance documents ("secondary references"). If a secondary reference has itself been incorporated by reference into NRC regulations as a requirement, then licensees and applicants must comply with that standard as set forth in the regulation. If the secondary reference has been endorsed in an RG as an acceptable approach for meeting an NRC requirement, then the standard constitutes a method acceptable to the NRC staff for meeting that regulatory requirement as described in the specific RG. If the secondary reference has neither been incorporated by reference into NRC regulations nor endorsed in an RG, then the secondary reference is neither a legally-binding requirement nor a “generic” NRC approved acceptable approach for meeting an NRC requirement. However, licensees and applicants may consider and use the information in the secondary reference, if appropriately justified, consistent with current regulatory practice, and consistent with applicable NRC requirements.

C. STAFF REGULATORY GUIDANCE

1 Emergency Diesel Generators

When implemented with supplements and clarifications, the NRC finds IEC/IEEE 63332-387:2024 provides acceptable design and testing considerations for EDGs in order to comply with the agency's regulatory requirements, as cited in section A of this RG. The NRC staff endorses IEC/IEEE 63332-387:2024, subject to the regulatory positions listed below.

1.1 This RG does not endorse Section 2, "Normative References," of IEC/IEEE 63332-387:2024.

1.2 Supplement IEC/IEEE 63332-387:2024, Section 5.1.2.2, "Design Conditions," with the following:

Margins should be applied in addition to any conservatism used during the derivation of local environmental conditions of the equipment, unless these conservatisms can be quantified and shown to contain appropriate margins. The margins should account for variations in commercial production of the equipment and inaccuracies in the test equipment.

1.3 Supplement IEC/IEEE 63332-387:2024, Section 5.2.2, "Operation," item b with the following:

Cumulative operating time above the nominal rating of the EDG should be monitored for manufacturer and/or industry consensus group recommendations for accelerated maintenance requirements as appropriate.

1.4 Supplement IEC/IEEE Std 63332-387:2024, Section 5.5.1.8, "Fuel Oil Storage and Supply Systems," with the following:

The fuel stability should be considered for fuel storage. This is especially of concern when ultra-low sulfur diesel fuel or biodiesel blends are used. RG 1.137 provides additional information.

1.5 Supplement IEC/IEEE Std 63332-387:2024, Section 5.5.4, "Protection," with the following:

Justification should be documented for protective trips that are bypassed during emergency mode of operation (e.g., LOOP, accident, and accident/LOOP).

1.6 Supplement IEC/IEEE Std 63332-387:2024, Section 7.2.1, "General" with the following:

Initial type tests of the EDGs should be supplemented to demonstrate successful operation, including the parameters of operation (e.g., manual start, automatic start, load sequencing, load shedding, and operation time), normal standby conditions, and environments (e.g., temperature and humidity) that would be expected if an actual demand were placed on the system. If prelubrication or prewarming systems (or both) designed to maintain lube oil and jacket water within a temperature range are normally in operation, this range would constitute normal standby temperature for the given plant.

1.7 Supplement IEC/IEEE Std 63332-387:2024, Section 8.2.2.7, "Subsystem Test," with the following:

EDG site testing (IEC/IEEE Std 63332-387:2024, Table 4) should include verification of all subsystems, such as fuel oil, lube oil, cooling and starting air tanks, and piping systems credited for operation of the DG. If redundant trains of systems (e.g., starting air, fuel oil transfer) are used for each DG, then test each system separately.

1.8 While the following annexes are attached to IEC/IEEE 63332-387 as ‘informative’; however, the NRC staff’s endorsement of IEC/IEEE Std 63332-387:2024 does not include endorsement of the following annexes:

a. Annex A, “Method for establishing steady-state load profile for diesel-generator units”
b. Annex B, “Example of ageing and aged equipment testing”
c. Annex C, “Diesel-generator unit reliability program elements”
d. Annex D, “Influence of voltage regulating equipment on DG unit surveillance testing”
e. Annex E, “Example of starting times”
f. Annex F, “Power quality considerations for diesel generator units and impact on loads”

2 Combustion Turbine Generators

When implemented with supplements and clarifications, the NRC finds IEEE Std 2420-2019 provides acceptable design and testing considerations for CTGs in order to comply with the agency’s regulatory requirements, as cited in section A of this RG. The NRC staff endorses IEEE Std 2420-2019, subject to the regulatory positions listed below.

2.1 This RG does not endorse Section 2, “Normative References,” of IEEE Std 2420-2019.

2.2 Supplement IEEE Std 2420-2019, Section 3, “Definitions,” with the following definitions:

a. Load-run demands: Load-run following a successful start and involving defined acceptance criteria. This may include the following:

(1) A load-run of any duration that results from a real (i.e., not a test) automatic or manual signal

(2) A load-run test to satisfy the plant’s load and duration test specifications

(3) Other operations (e.g., special tests) in which the CTG unit is planned to run for at least 1 hour with at least 50 percent of design load

b. Load-run demand failures: Load-run when the CTG unit starts but does not pick up the load and run successfully following a valid load-run demand, with consideration to the exceptions provided below.

For monthly surveillance tests, the CTG unit can be loaded at the rate recommended by the manufacturer, or it can be slow-started and reach rated speed on a prescribed schedule to reduce stress and wear on the CTG unit. Any condition identified during maintenance inspections (with the CTG unit in standby mode) that would have resulted in a load-run failure if a demand had occurred should count as a valid load-run demand failure.

Unsuccessful attempts to load-run should not count as valid demands or failure when they can be attributed to any of the following:

(1) Any operation of a trip that would be bypassed in the emergency operating mode (e.g., high cooling-water temperature trip)

(2) Malfunction of equipment that is not required to operate during the emergency operating mode (e.g., synchronizing circuitry)

(3) Intentional termination of the test because of alarmed or observed abnormal conditions (e.g., small water or oil leaks) that would not have ultimately resulted in significant damage to or failure of the CTG unit

(4) Component malfunctions or operating errors that did not prevent the CTG unit from being restarted and brought to load within 5 minutes (i.e., without corrective maintenance or significant problem diagnosis)

(5) A failure to start because a portion of the starting system was disabled for test purposes, if followed by a successful start with the starting system in its normal alignment

(6) Exploratory tests during corrective or preventive maintenance, which should not count as demands or failures

c. Start demands: All valid and inadvertent starts, including all starts that are followed by load runs, whether by automatic or manual initiation, and situations where the CTG unit is started but no attempt is made to load the CTG unit.

The following conditions may apply to start demand failures:

(1) Any failure within the CTG unit system that prevents the generator from achieving a specified frequency (or speed) and voltage within specified time allowance is classified as a valid start failure. For monthly surveillance tests, the CTG unit can be brought to rated speed and voltage in the time recommended by the manufacturer to reduce stress and wear.

(2) Any condition identified during maintenance inspections (with the CTG unit in standby mode) that would have resulted in a start failure if a demand had occurred should count as a valid start demand and failure.

Unsuccessful attempts to start should not count as valid demands or failure when they can be attributed to any of the following:

(1) Any operation of a trip that would be bypassed in the emergency operating mode (e.g., high cooling-water temperature trip)

(2) Malfunction of equipment that is not required to operate during the emergency operating mode (e.g., synchronizing circuitry)

(3) Intentional termination of the test because of alarmed or observed abnormal conditions (e.g., small water or oil leaks) that would not have ultimately resulted in significant damage to or failure of the CTG unit

(4) Component malfunctions or operating errors that did not prevent the CTG unit from being restarted and brought to load within 5 minutes (i.e., without corrective maintenance or significant problem diagnosis)

(5) A failure to start because a portion of the starting system was disabled for test purposes, if followed by a successful start with the starting system in its normal alignment

(6) Exploratory tests during corrective or preventive maintenance, which should not count as demands or failures

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2.3 Supplement IEEE Std 2420-2019, Section 4.1.2a, "Design Conditions," with the following:

Margins should be applied in addition to any conservatism used during the derivation of local environmental conditions of the equipment unless these conservatisms can be quantified and shown to contain appropriate margins. The margins should account for variations in commercial production of the equipment and any inaccuracies in the test equipment.

14. Maximum wind speed(s) and direction(s), if radiator cooling is used

15. External events, such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches

16. Site-specific weather conditions (cold or hot), such as ice clogging

2.4 Supplement IEEE Std 2420-2019, Section 4.4, Table 1, "Design and application considerations," with the following (supplement in italics):

- Item 21: Design load*, including effects of frequency and voltage variation*
- Item 42: Tornado depressurization*'s air intake impact*

2.5 Supplement IEEE Std 2420-2019, Section 4.5.4, "Protection," with the following:

Justification should be documented for protective trips that are bypassed during an emergency mode of operation (e.g., LOOP, accident, and accident/LOOP).

2.6 Supplement IEEE Std 2420-2019, Section 7.2.1.6, "Subsystem Test," with the following:

The CTG site testing (IEEE Std 2420-2019, Table 3) should include verification of all subsystems (e.g., fuel oil, lube oil, cooling, starting, and piping systems) credited for operation of the CTG. If redundant trains of systems (e.g., fuel oil transfer) are used for each CTG, then each system should be tested separately.

2.7 Supplement IEEE Std 2420-2019, Section 7.5.4b, "Loss of offsite power (LOOP) test," with the following:

If the required safety loads are not available, then the applicable circuit for breaker open/close signal should be verified, and one or more equivalent load(s) may be used to make up the load for CTG testing.

2.8 Supplement IEEE Std 2420-2019, Section 7.6, "Records," with the following:

Records should include, at a minimum, the following features:

a. All start demands and all load-run demands, including those from bona fide signals, maintenance, repair, and out-of-service time histories, as well as cumulative maintenance and operating data, together with results of operation of the CTG unit when required by actual demand

b. Critical failure mechanisms observed during failures to start, load-run failures, human errors, and common-cause failures, including cause and corrective action

c. Test parameter data indicated in table 4 that could apply to reliability and data trending

2.9 CTG systems may include evaporative inlet air coolers and water injection. These subsystems may add to the maximum load that the systems can support; however, they also add complexity to the system and may require special maintenance to ensure continued operation. If these subsystems are provided and design-load calculations consider any additional power available due to their operation, then the performance and long-term reliability of the subsystems should be adequately demonstrated.

2.10 The high rotational speeds of CTGs may result in the creation of missiles upon failure of the rotational parts. Thus, all nearby safety-related equipment, including other nearby CTG systems, should be protected from potential missiles generated from the CTG rotor. However, protecting subsystems associated with the same CTG unit that incurs the failure is not necessary, since failure of the rotor will make further use of these subsystems irrelevant (as long as the subsystems are not shared).

2.11 Given the potential for explosion of residual fuel or fuel vapor remaining in the CTG, the exhaust system should be purged before startup or during shutdown. The turbine's starting and shutdown sequence systems should include an automatic gas purge process to prevent damage to the turbine and downstream components by explosion on startup. The purge volume should be at least three volume changes of the gas turbine and downstream exhaust system equipment.

2.12 Pressure loss associated with air intakes may be significant. For this reason, the CTG design should consider the local environment and the possibility of moisture condensation from ambient humidity. The design should also consider humid air and condensed moisture generated by wet cooling towers or other onsite equipment. During cold periods, ice may form on the inlet structures and impede the air flow. When there is a potential for low ambient temperatures, the design should address the potential for ice accumulation on air inlet structures and include appropriate mitigating measures.

2.13 Inlet air filter design should consider preventing excessive increases in pressure loss due to particle deposition on the inlet air filter. When increased pressure loss is not acceptable for CTG performance, the inlet air filter should be removed, replaced, or cleaned without power reduction of the CTG.

2.14 Regarding provisions for operator/attendant actions, each CTG should have the capability to start and stop from the main control room. Synchronization capability should be available in the main control room and on the local panel in the CTG room. The main control room should have adequate information for operators to monitor generator voltage, frequency, output power, and critical parameters such as bearing temperature, exhaust temperature, and any other parameters recommended by manufacturer. If the plant design requires a remote-control panel (external to the main control room), then adequate control and indication should be provided in the remote-control panel to start, stop, and monitor key power output parameters. The unit should be equipped with provisions for the following:

a. Expected maintenance actions while carrying the design load, including replenishment of fluids and duplex filter changes

b. Manual/automated synchronization (if the safety case requires manual synchronization) with the offsite power source (or another running source) for conducting surveillance and recovery from a LOOP/station blackout condition

c. Override emergency mode of operation, with interlocks to prevent human errors or spurious switchover

2.15 The generator output circuit breaker's successful operation is critical for the CTG unit's power delivery to the plant loads. The design should include the following features, which should operate automatically and safely when required by plant conditions:

a. Energizing the safety class buses to support CTG unit loading tests

b. Energizing the isolated bus for LOOP, accident actuation signal concurrent with LOOP, and routine testing

c. Restoring the loads back to preferred power supply system without deenergizing or tripping loads

d. Precluding out-of-phase closure that could result in unacceptable engine vibrations, preferably by synchronizing check relay with automatic breaker closure

2.16 The following items indicate the need for an overhaul and should be monitored, when appropriate, for a CTG based on the manufacturer's recommendations:

a. Decreasing runout time after shutdown

b. Deposits or deterioration of turbine blades or vanes (as inferred from ideal model results)

2.17 Design provisions should include the capability to test each CTG independently. Test equipment should not cause a loss of independence between redundant CTGs or between CTG groups. Consider testability when selecting and locating instrumentation sensors and critical components (e.g., governor, starting system components). Instrumentation sensors should be readily accessible and designed to allow in-place verification of their inspection and calibration.

2.18 Fuel stability should be considered for fuel storage. This is especially of concern when ultra-low-sulfur diesel fuel or biodiesel blends are used. RG 1.137 provides additional information.

2.19 CTG maintenance activities performed during qualification should be documented in the qualification test report and added to the technical specification surveillance requirements to specify maintenance activity frequency. For example, fuel-nozzle cleaning maintenance performed before conducting the start and load acceptance tests should be documented in the qualification report to demonstrate successful qualification. In this example, a technical specification surveillance requirement would be added added to document and address the testing frequency of once per 50 starts required for the fuel-nozzle cleaning maintenance activity.

2.20 The CTG starting system should be designed to provide multiple starts/attempts, in accordance with the following minimum requirements:

a. CTG unit restarts after failing to start in response to a LOOP or an accident signal.

b. CTG unit restart attempts are not necessarily required to meet the safety analysis start-time requirement.

c. Provide for start and operation of the CTG unit in response to a LOOP or an accident signal during or immediately following periodic testing of the CTG unit.

2.21 While the following annexes are attached to IEEE Std. 2420-2019 as 'informative'; however, the NRC staff's endorsement of IEEE Std 2420-2019 does not include endorsement of the following annexes:

a. Annex A, "Method for establishing a load profile for a combustion turbine-generator unit"

b. Annex B, "Example of aging and aged equipment testing"

c. Annex C, "Recommended combustion turbine-generator unit monitoring and trending"

d. Annex D, "Combustion turbine-generator unit reliability program elements"

e. Annex E, "Bibliography"

3 Design and Testing Considerations for Onsite Emergency Alternating Current Power Sources Other than EDGs and CTGs

. This section provides acceptable design and testing considerations for onsite emergency AC power sources other than EDGs and CTGs, in order to comply with the agency's regulatory requirements, as cited in section A of this RG. The GDC in 10 CFR Part 50, Appendix A establish the minimum requirements for the principal design criteria for water-cooled nuclear power plants similar in design and location for which construction permits have been issued by the commission, and are also considered to be generally applicable to other types of nuclear power units and are intended to provide guidance in establishing the principal design criteria for such other units.

3.1 Principal Design Criteria: Safety classification, per GDC 17.

a. For the onsite emergency AC power system, describe or list components and assemblies necessary to enable the onsite emergency power source to meet its capabilities in accordance with the regulations (i.e., the safety-related function). These components and assemblies should consider aging as a potential cause of common-mode failures.

b. In addition, describe or list components and assemblies necessary to enable the onsite emergency power system to perform a non-safety-related function. For each non-safety-related component or assembly, it should be verified (via test or analysis) that the component or assembly will not degrade the safety-related function.

3.2 Principal Design Criteria: Safety function, per GDC 17, GDCs 33, 34, 35, 38, 41, and 44,.

a. Specify the safety function and address startup, normal operation, safe-shutdown, accident, and post-accident operation.

3.3 Principal Design Criteria: Capacity, including but not limited to sizing, per GDC 17 .

a. Specify the rating or nameplate capacity, typically expressed in kilovolt-amperes (kVA) and kilowatts (kW). The rating is defined as the electric power capability, that the unit can maintain in a specified environment and is stamped on its name plate and/or described in its specification. If applicable, specify the continuous rating, defined as the electric power output capability that the unit can maintain in the service environment for 8760 hours of operation per year with only scheduled outages for maintenance.

b. Specify the load profile, including description of loading sequence with time durations of application of individual loads, if applicable. Using the load profile, demonstrate that the onsite emergency power source is able to provide power to loads important to safety with margin.

c. Specify the equipment design life. Design life is a life expectancy or specified time period during which performance, in accordance with its design, can be expected and based on its specific design; conditions, uses, performance characteristics and other physical properties of the application.

3.4 Principal Design Criteria: Capability, including but not limited to controls and protection, per GDC 2, GDC 17, GDC 19, 10 CFR 50.55a(h).

a. Demonstrate the capability to start and load under all design ambient conditions in combination with the full range of starting temperatures. In particular, light-load and no-load operation and dynamic load performance criteria for voltage and frequency under step load application or removal should be demonstrated, if applicable. In addition, discuss protection against electric fault conditions and electric transients.

b. Discuss operability and functional performance, including allowable voltage and frequency variations.

c. Address failure modes and effects, including avoidance of common-cause/common-mode failures.

d. Discuss any interfaces and impacts to the onsite emergency AC power system.

e. Address automatic and manual control systems for the onsite emergency AC power system, and discuss emergency controls and trips, as necessary.

f. Discuss control modes, control power and starting capabilities.

g. Address fuel type, fuel quality, fuel storage and supply requirements, if applicable.

h. Discuss instrumentation of the variables necessary for successful operation and to generate the abnormal, pre-trip, and trip signals required for alarm.

i. Address electromagnetic and radiofrequency interference, grounding, and lightning protection provisions.

j. Discuss any auxiliary systems, including but not limited to lubrication, ventilation, cooling, hydraulic, or pneumatic systems.

k. If the onsite emergency AC power source has moving parts with high inertia, address the creation of internally generated missiles.

3.5 Principal Design Criteria: Physical and electrical independence, per GDC 17.

a. Demonstrate single failure criterion as applied to the onsite emergency AC power supply.

b. Additional information on the physical independence requirements of the circuits and electric equipment that comprise or are associated with safety systems appears in RG 1.75.

c. RG 1.6 discusses independence between redundant onsite AC power sources and their distribution systems. Discuss how independence will be demonstrated and, if shown by test, describe the test and specify the frequency of performing the test.

3.6 Principal Design Criteria: Redundancy, per GDC 5,GDC 17.

a. Redundancy of safety-related components is necessary and should be such that a system safety function can be accomplished assuming a single failure.

b. RG 1.81 addresses sharing of components, as required by GDC 5.

c. Show that the onsite emergency electric power systems are designed to minimize undesirable interaction effects.

3.7 Principal Design Criteria: Availability including, but not limited to, automatic and manual capabilities, per GDC 17.

a. Discuss testing to demonstrate the continued capability.

3.8 Principal Design Criteria: Reliability, per GDC 17 and 10 CFR 50.49.

a. At minimum, demonstrate 95-percent reliability with 95-percent confidence (i.e., the minimum acceptable level for new designs to demonstrate reliable operation) of the onsite emergency power system. The NRC staff reviewed IEEE Std 352-2016, "IEEE Guide for General Principles of Reliability Analysis of Nuclear Power Generating Station Systems and Other Nuclear Facilities" (Ref. 35), and IEEE Std 577-2012, "IEEE Standard Requirements for Reliability Analysis in the Design and Operation of Safety Systems for Nuclear Power Generating Stations" (Ref. 36), and found that they contain additional technical information and criteria useful for quantitative and qualitative reliability analyses. In addition, the NRC staff reviewed IEEE Std 500-1984, "IEEE Guide to the Collection and Presentation of Electrical, Electronic, Sensing Component, and Mechanical Equipment Reliability Data for Nuclear-Power Generating Stations" (Ref. 37), and found that this standard contains a method for collecting and presenting reliability data for use in reliability calculations. This revision of RG 1.9 does not endorse IEEE Std 352-2016, 577-2012, or 500-1984.

b. When addressing the reliability of the onsite emergency AC power system, include the reliability of any support systems.

c. Fail-to-start or fail-to-run data should be provided, and in conjunction should include operational data. The following definitions pertain to reliability for fail-to-start or fail-to-run data. Each valid failure that results in declaration of the onsite emergency AC power source being inoperable should count as one demand and one failure. Exploratory tests during corrective or preventive maintenance should not count as demands or failures. However, the successful test performed to declare the onsite emergency AC power source operable following maintenance should count as a demand.

(1) Load-run demands: Load-run following a successful start and involving defined acceptance criteria. This may include the following: (

A. a load-run of any duration that results from a real (i.e., not a test) automatic or manual signal,

B. a load-run test to satisfy the plant's load and duration test specifications, and

C. other operations (e.g., special tests) in which the onsite emergency AC power source is planned to run loaded for at least 1 hour with at least 50-percent continuous rating.

(2) Load-run demand failure: A load-run failure should be counted when the onsite emergency AC power source starts but does not pick up the load and run successfully. Any failure during a valid load-run demand should count (subject to 3.8(c)(5)). Any condition identified during maintenance inspections that would have resulted in a load-run failure if a demand had occurred should count as a valid load-run demand and failure.

(3) Start demands: All valid and inadvertent start demands, including all start-only demands and all start demands that are followed by load/run demands, whether by automatic or manual initiation, are start demands. In a start-only demand, the

onsite emergency AC power source is started, but no attempt is made to load the onsite emergency AC power source (subject to 3.8(c)(5)).

(4) Unsuccessful attempts to start or load/run should not count as valid demands or failures when they can be attributed to any of the following:

A. Any operation of a trip that would be bypassed in emergency operating mode (e.g., high cooling-water temperature trip),

B. Malfunction of equipment not required to operate during emergency operating mode (e.g., synchronizing circuitry),

C. Intentional termination of the test because of alarmed or observed abnormal conditions (e.g., small water or oil leaks) that would not have ultimately resulted in significant damage or failure of the onsite emergency AC power system,

D. Component malfunctions or operating errors that did not prevent the onsite emergency AC power source from being restarted and brought to load within 5 minutes (i.e., without corrective maintenance or significant problem diagnosis), or

E. A failure to start because a portion of the starting system was disabled for test purposes, if followed by a successful start with the starting system in its normal alignment.

F. Exploratory tests during corrective or preventative maintenance shall not could as demands or failures.

3.9 Principal Design Criteria: Quality assurance program, per 10 CFR Part 50, Appendix B

a. Discuss the quality assurance program elements with sufficient detail to demonstrate compliance with 10 CFR Part 50, Appendix B, in accordance with the guidance in RG 1.28. RG 1.28 provides one method for meeting the requirements of 10 CFR Part 50, Appendix B, during the design and construction of SSCs that perform safety functions.

3.10 Principal Design Criteria: Station blackout, per 10 CFR 50.63

a. Address the redundancy and reliability of the onsite emergency AC power sources as part of the specified station blackout duration.

b. If there is an alternate AC source, describe the diversity from the onsite emergency AC power sources. RG 1.155 provides additional information on station blackout.

3.11 Principal Design Criteria: Fire protection, including but not limited to fire prevention, detection, and suppression, per GDC 3,10 CFR 50.48.

a. Address methods to minimize both the probability of occurrence and the consequences of fire and explosion originating from the emergency AC power sources. RG 1.189 provides additional information on fire protection.

3.12 Testability, per GDC 17 and 18.

a. Specify preventive maintenance, inspection, testing, and monitoring programs, including fixed-time or operating time intervals.

b. Specify the tests performed as part of factory testing, site testing, preoperational testing, and periodic testing, as well as the frequency of the tests (e.g., monthly, semiannually, at refueling). RG 1.118 provides additional information on periodic testing.

c. Address surveillance requirements and annunciation systems.

d. Confirm that the onsite emergency power system has remote indication in the control room to display status of the system and local alarms.

e. Discuss the means of communication between the onsite emergency AC power system testing locations and the main control room to confirm that the operators know the status under test.

f. Discuss testing to demonstrate starting and operating under LOOP conditions, safety injection actuation signal, and combined safety injection actuation signal and LOOP.

3.13 Qualification, per GDC 2, GDC 4, 10 CFR 50.49.

a. Specify the environmental conditions, including temperature, pressure, humidity, radiation, chemicals, and submergence at the location where the equipment must perform.

b. Specify the qualified life and maintain the qualification test report that demonstrates environmental qualification of the onsite emergency power system.

c. RG 1.89 and RG 1.100 provide NRC staff guidance on qualification methodology and seismic qualification. RG 1.164 contains additional information for the commercial-grade dedication process.

3.14 Post-Construction Acceptance Process per 10 CFR 52.79(b), 10 CFR 52.99(c)(1),).

a Identify Inspections, Tests, Analyses, and Acceptance Criteria or equivalent verification criteria to provide reasonable assurance that the facility has been constructed and will be operated in accordance with the license.

D. IMPLEMENTATION

Licensees generally are not required to comply with the guidance in this regulatory guide. If the NRC proposes to use this regulatory guide in an action that would constitute backfitting, as that term is defined in 10 CFR 50.109, “Backfitting,” as applicable, and as described in NRC Management Directive 8.4, “Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests” (Ref. 38); affect the issue finality of an approval issued under 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants” or constitute forward fitting, as that term is defined in Management Directive 8.4, then the NRC staff will apply the applicable policy in Management Directive 8.4 to justify the action. If a licensee believes that the NRC is using this regulatory guide in a manner inconsistent with the discussion in this Implementation section, then the licensee may inform the NRC staff in accordance with Management Directive 8.4.

REFERENCES[1]

These references indicate the versions of the documents available at the time of issuance of this RG. Licensees or applicants using this RG should check all referenced documents to verify that no change has occurred since the issuance of the RG.

1 International Electrotechnical Commission (IEC)/Institute of Electrical and Electronics Engineers (IEEE) Standard (Std) 63332-387:2024, "Nuclear facilities - Electrical power systems - Diesel generator units applied as standby sources," Edition 1, 2024.

2 IEEE Std 2420-2019, "IEEE Standard Criteria for Combustion Turbine-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations," 2019, New York, NY.

3 *U.S. Code of Federal Regulations* (CFR), "Domestic Licensing of Production and Utilization Facilities," Part 50, Chapter I, Title 10, "Energy."

4 CFR, "Licenses, Certifications, and Approvals for Nuclear Power Plants," Part 52, Chapter I, Title 10, "Energy."

5 NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," National Fire Protection Association, Quincy, MA

6 IEEE Std 279-1968, "Proposed IEEE Criteria for Nuclear Power Plant Protection Systems," 1968, New York, NY.

7 IEEE Std 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations," 1971, New York, NY.

8 IEEE Std 603-1991, "Standard Criteria for Safety Systems for Nuclear Power Generating Stations," 1991, and IEEE Std 603-1991, Standard Criteria for Safety Systems for Nuclear Power Generating Stations, Correction Sheet," 1995.

9 Atomic Energy Act of 1954, as amended, Section 42, United States Code (U.S.C.) 2011, et seq.

1 Publicly available NRC published documents are available electronically through the NRC Library on the NRC's public website at http://www.nrc.gov/reading-rm/doc-collections/ and through the NRC's Agencywide Documents Access and Management System (ADAMS) at http://www.nrc.gov/reading-rm/adams.html. For problems with ADAMS, contact the Public Document Room staff at 301-415-4737 or (800) 397-4209, or email pdr.resource@nrc.gov. The NRC Public Document Room (PDR), where you may also examine and order copies of publicly available documents, is open by appointment. To make an appointment to visit the PDR, please send an email to pdr.resource@nrc.gov or call 1-800-397-4209 or 301-415-4737 between 8 a.m. and 4 p.m. eastern time (ET), Monday through Friday, except Federal holidays.

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Copies of International Atomic Energy Agency (IAEA) documents may be obtained through their website: www.IAEA.Org/ or by writing the International Atomic Energy Agency, P.O. Box 100 Wagramer Strasse 5, A-1400 Vienna, Austria.

Copies of International Organization for Standardization (ISO) documents may be obtained through its website: www.iso.org or by writing the ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland. ISO can also be reached by calling +41 22 749 01 11.

Copies of the non-NRC documents included in these references may be obtained directly from the publishing organization.

10 U.S. Nuclear Regulatory Commission (NRC), Branch Technical Position 8-8, Revision 0, “Onsite (Emergency Diesel Generators) and Offsite Power Sources Allowed Outage Time Extensions,” February 2012 (ML113640138), Washington, DC.

11 NRC, “Emergency Diesel Generator Technical Specifications Surveillance Requirements Regarding Endurance and Margin Testing: Summary Report,” December 10, 2009 (ML093370252), Washington, DC.

12 NRC, NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition,” Washington, DC.

13 NRC, Regulatory Guide (RG) 1.6, “Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems,” Washington, DC.

14 NRC, RG 1.28, “Quality Assurance Program Criteria (Design and Construction),” Washington, DC.

15 NRC, RG 1.32, “Criteria for Power Systems for Nuclear Power Plants,” Washington, DC.

16 NRC, RG 1.75, “Criteria for Independence of Electrical Safety Systems,” Washington, DC.

17 NRC, RG 1.81, “Shared Emergency and Shutdown Electric Systems for Multi-Unit Nuclear Power Plants,” Washington, DC.

18 NRC, RG 1.89, “Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants,” Washington, DC.

19 NRC, RG 1.100, “Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants,” Washington, DC.

20 NRC, RG 1.118, “Periodic Testing of Electric Power and Protection Systems,” Washington, DC.

21 NRC, RG 1.129, “Maintenance, Testing, and Replacement of Vented Lead-Acid Storage Batteries for Production and Utilization Facilities,” Washington, DC.

22 NRC, RG 1.137, “Fuel Oil Systems for Emergency Power Supplies,” Washington, DC.

23 NRC, RG 1.152, “Criteria for Programmable Digital Devices in Safety-Related Systems of Nuclear Power Plants,” Washington, DC.

24 NRC, RG 1.155, “Station Blackout,” Washington, DC.

25 NRC, RG 1.160, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” Washington, DC.

26 NRC, RG 1.164, “Dedication of Commercial-Grade Items for Use in Nuclear Power Plants” Washington, DC.

27 NRC, RG 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,” Washington, DC.

28 NRC, RG 1.189, “Fire Protection for Nuclear Power Plants” Washington, DC.

29 NRC, RG 1.212, “Sizing of Large Lead-Acid Storage Batteries,” Washington, DC.

30 NRC, RG 1.248, “Guide for Assessing, Monitoring, and Mitigating Aging Effects on Electrical Equipment Used in Production and Utilization Facilities,” Washington, DC.

31 NRC, "Nuclear Regulatory Commission International Policy Statement," *Federal Register*, Vol. 79, No. 132, pp. 39415–39418 (79 FR 39415), July 10, 2014, Washington, DC.

32 NRC, Management Directive and Handbook 6.6, "Regulatory Guides," Washington, DC.

33 International Organization for Standardization (ISO)– 21789, "Gas Turbine Applications—Safety," Edition 2, July 2022.

34 International Atomic Energy Agency (IAEA), Specific Safety Guide No. SSG-34, "Design of Electrical Power Systems for Nuclear Power Plants," March 2016.

35 IEEE Std 352-2016, "IEEE Guide for General Principles of Reliability Analysis of Nuclear Power Generating Station Systems and Other Nuclear Facilities," 2016, New York, NY.

36 IEEE Std 577-2012, "IEEE Standard Requirements for Reliability Analysis in the Design and Operation of Safety Systems for Nuclear Power Generating Stations," 2012, New York, NY.

37 IEEE Std 500-1984, "IEEE Guide to the Collection and Presentation of Electrical, Electronic, Sensing Component, and Mechanical Equipment Reliability Data for Nuclear Power Generating Stations," 1984, New York, NY.

38 NRC, Management Directive 8.4, "Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests."