U.S. NUCLEAR REGULATORY COMMISSION

REGULATORY GUIDE 1.210, REVISION 1

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QUALIFICATION OF CLASS 1E BATTERY CHARGERS, INVERTERS, AND UNINTERRUPTIBLE POWER SUPPLY SYSTEMS FOR PRODUCTION AND UTILIZATION FACILITIES

A. INTRODUCTION

Purpose

This regulatory guide (RG) describes an approach that is acceptable to the staff of the U.S. Nuclear Regulatory Commission (NRC) to meet regulatory requirements for the qualification of safety-related or Class 1E battery chargers, inverters, and uninterruptible power supply systems for production and utilization facilities. It endorses, with clarifications, Institute of Electrical and Electronics Engineers (IEEE) Standard (Std.) 650-2017, "IEEE Standard for Qualification of Class 1E Static Battery Chargers, Inverters, and Uninterruptible Power Supply Systems for Nuclear Power Generating Stations" (Ref. 1).

Applicability

This RG applies to reactor licensees subject to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, "Domestic Licensing of Production and Utilization Facilities" (Ref. 2), or 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants" (Ref. 3). Under 10 CFR Part 50, this RG applies to licensees or applicants for nuclear power plants and utilization facilities. Under 10 CFR Part 52, this RG applies to applicants and holders of combined licenses, standard design certifications, standard design approvals, and manufacturing licenses.

Applicable Regulations

- The regulations in 10 CFR Part 50 cover both power production and utilization facilities and non-power production and utilization facilities (NPUF).
    - 10 CFR 50.34(a)(1)(i) and 50.34(a)(1)(ii) require applications for NPUFs and power reactors, respectively, to include, among other things, the information in 10 CFR 50.34(a)(3) and 50.34(a)(7).

Written suggestions regarding this guide may be submitted through the NRC's public Web site in the NRC Library at https://www.nrc.gov/reading-rm/doc-collections/reg-guides/index.html., under Document Collections, in Regulatory Guides, at https://www.nrc.gov/reading-rm/doc-collections/reg-guides/contactus.html, and will be considered in future updates and enhancements to the "Regulatory Guide" series. During the development process of new guides suggestions should be submitted within the comment period for immediate consideration. Suggestions received outside of the comment period will be considered if practical to do so or may be considered for future updates.

Electronic copies of this RG, previous versions of RGs, and other recently issued guides are also available through the NRC's public web site in the NRC Library at https://www.nrc.gov/reading-rm/doc-collections/reg-guides/index.html/under Document Collections, in Regulatory Guides. This RG is also available through the NRC's Agencywide Documents Access and Management System (ADAMS) at http://www.nrc.gov/reading-rm/adams.html, under ADAMS Accession Number (No.) ML23202A242. The regulatory analysis may be found in ADAMS under Accession No. ML22160A589. The associated draft guide DG-1412 may be found in ADAMS under Accession No. ML22160A570, and the staff responses to the public comments on DG-1412 may be found under ADAMS Accession No. ML23202A244

- 10 CFR 50.34(a)(3) requires the preliminary safety analysis report (PSAR) of a facility to include, among other things, (i) the principal design criteria (PDC) for the facility and (ii) the design bases and the relation of the design bases to the PDC for the preliminary design of the facility.

- 10 CFR 50.34(a)(7) requires the PSAR to include a description of the quality assurance program to be applied to the design and construction of the SSCs of the facility.

- 10 CFR 50.49(b)(1) defines "safety-related electric equipment" for the purposes of that rule, and 10 CFR 50.2 defines "safety-related structures, systems, and components" as used in 10 CFR Part 50. 10 CFR 50.49(c)(3) defines a mild environment for the purposes of section 50.49.

- 10 CFR 50.55a(h)(3) requires safety systems to meet the requirements for safety systems in IEEE Std. 603-1991, "Criteria for Safety Systems for Nuclear Power Generating Stations" (Ref. 4) and the correction sheet dated January 30, 1995, if applications for construction permits and operating licenses under 10 CFR Part 50, and for design approvals, design certifications, and combined licenses under 10 CFR Part 52, were filed on or after May 13, 1999. The system criteria identified in this standard, include the qualification for the safety system equipment to demonstrate that the equipment can perform its safety functions as specified in the design basis.

- 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants" establish the minimum requirements for PDC[1] for water-cooled nuclear power plants, including:

  - General Design Criterion (GDC) 1, "Quality standards and records," requires that SSCs important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

  - 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 4, "Environmental and dynamic effects design bases," requires that SSCs important to safety be "designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents."

- 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," Criterion III, "Design Control," Criterion XI, "Test Control," and Criterion XVII, "Quality Assurance Records," require design control measures to verify the adequacy of the design, a test program to assure that all testing required to demonstrate that SSCs will perform satisfactorily in service is performed in accordance with written procedures, and the maintenance of sufficient records as evidence of quality assurance activities, respectively. Criterion III specifically requires that a test program used to verify the adequacy of a specific design feature shall include suitable qualification testing of a prototype unit under the most adverse design conditions.

1 Application-specific PDC for NPUFs include PDC similar to GDC 1, 2, and 4 to the extent necessary for the NRC to find that operation of the proposed facility will provide adequate protection of the public health and safety.

- 10 CFR Part 50, Appendix S, "Earthquake Engineering Criteria for Nuclear Power Plants," requires that SSCs important to safety be designed to "withstand the effects of natural phenomena, such as earthquakes, without loss of capability to perform their safety functions."

- 10 CFR Part 52 governs the issuance of early site permits, standard design certifications, combined licenses, standard design approvals, and manufacturing licenses. Part 52 specifies, among other things, that contents of some applications must satisfy the requirements of 10 CFR Part 50, Appendix A, Appendix B, Appendix S, and 50.55a.

  - 10 CFR 52.97(b) requires combined licenses to contain inspections, tests, and analyses (ITAAC) 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; and NRC rules and regulations.

  - 10 CFR 52.99(c)(1) requires each combined license holder to notify the NRC that the prescribed ITAAC have been performed and that the prescribed acceptance criteria are met for each ITAAC included in their combined license.

Related Guidance

- 10 CFR Part 50, Appendix A, states that the GDC are intended to provide guidance in establishing the PDC for types of nuclear power units other than those that are water cooled.

- NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (Ref. 5), provides guidance to the NRC staff in performing safety reviews under 10 CFR Part 50 and 10 CFR Part 52. Specifically, Section 8.3.1, "A-C Power Systems (Onsite)," Section 8.3.2, "D-C Power Systems (Onsite)," and Section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment," contain review guidance related to the environmental qualification of safety-related electrical equipment. Section 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment," contains review guidance for the seismic qualification of electrical equipment in the event of a seismic occurrence.

- RG 1.75, "Physical Independence of Electric Systems," (Ref. 6) provides guidance concerning physical independence of the circuits and electrical equipment that comprise or are associated with safety systems (Ref. 7).

- RG 1.89, "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants," (Ref. 8) describes an approach to meet regulatory requirements for environmental qualification of certain electric equipment important to safety for nuclear power plants.

- RG 1.100, "Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants" (Ref. 9), discusses, in part, the seismic qualification of electrical equipment.

- RG 1.152, "Criteria for Use of Computers in Safety Systems of Nuclear Power Plants" (Ref. 10), gives guidance for addressing the design and qualification of digital systems, including computer hardware, software, firmware, and interfaces in safety systems.

- RG 1.156, "Qualification of Connection Assemblies for Nuclear Power Plants" (Ref. 11), describes a method that the NRC staff considers acceptable for complying with the Commission's regulations on the environmental qualification of connection assemblies and environmental seals in combination with cables or wires as assemblies for service. The environmental qualification helps ensure that connection assemblies can perform their safety functions during and after a design basis event.

- RG 1.158, "Qualification of Safety-Related Vented Lead-Acid Storage Batteries for Nuclear Power Plants" (Ref. 12), describes methods and procedures the NRC staff considers acceptable for use in complying with NRC regulations on the qualification method of safety-related lead-acid storage batteries.

- RG 1.164, "Dedication of Commercial-Grade Items for Use in Nuclear Power Plants" (Ref. 13), gives guidance on the dedication of commercial-grade items and services.

- RG 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems" (Ref. 14), describes design, installation, and testing practices acceptable to the NRC staff for addressing the effects of electromagnetic interference/radio frequency interference and power surges on safety-related instrumentation and control systems.

- RG 1.209, "Guidelines for Environmental Qualification of Safety-Related Computer-Based Instrumentation and Control Systems in Nuclear Power Plants" (Ref. 15), describes an acceptable method for demonstrating environmental qualification for digital instrumentation and control systems and addresses service conditions that include electromagnetic and power surge environments.

- RG 1.211, "Qualification of Safety-Related Cables and Field Splices for Nuclear Power Plants" (Ref. 16), describes a method that the NRC staff considers acceptable for complying with the Commission's regulations for the qualification of safety-related cables and field splices.

- RG 1.215, "Guidance for ITAAC Closure Under 10 CFR Part 52," (Ref. 17) describes a method for documenting the completion of inspections, tests, analyses, and acceptance criteria.

- RG 1.232, "Guidance for Developing Principal Design Criteria for Non-Light-Water Reactors," (Ref. 18) provides guidance in establishing PDC for non-light-water reactors. Footnotes 1 and 4 in RG 1.232, Revision 0, states: "While the design criteria described in this RG were developed for nuclear power reactor applicants developing non-LWR [non-light water reactor] designs, the design criteria described in this RG may be applied, as appropriate, to non-light-water non-power reactors."

- RG 1.250, "Dedication of Commercial-Grade Digital I&C Items for Use in Nuclear Power Plants," (Ref. 19) provides guidance on using an IEC safety integrity level to support the dedication of commercial-grade digital instrumentation and control (I&C) items for use in nuclear power plant safety applications.

- RG 2.5, "Quality Assurance Program Requirements for Research and Test Reactors" (Ref. 20) endorses American National Standards Institute (ANSI) and the American Nuclear Society (ANS) document ANSI/ANS-15.8-1995, "Quality Assurance Program Requirements," (Ref. 21) as an acceptable method for complying with the program requirements of 10 CFR 50.34.

- NUREG-1537, Parts 1 and 2, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors," (Ref. 22), contains format and content guidance for non-power reactor applicants and licensees, as well as a standard review plan and acceptance criteria for NRC staff. NUREG-1537 recommends that the PDC for the non-power reactors be based on applicable standards, guides, codes, and criteria.

- "Final Interim Staff Guidance Augmenting NUREG-1537, Parts 1 and 2 "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors," for Licensing Radioisotope Production Facilities and Aqueous Homogeneous Reactors," (Ref. 23), gives format and content guidance for non-power aqueous homogeneous reactor and radioisotope production facility applicants and licensees, as well as a standard review plan and acceptance criteria for NRC staff.

- "Endorsement of Appendix A to Oak Ridge National Laboratory Report, 'Proposed Guidance For Preparing and Reviewing A Molten Salt Non-Power Reactor Application,' as Guidance for Preparing Applications for the Licensing of Non-Power Liquid Fueled Molten Salt Reactors,", (Ref. 24) endorses with clarifications, Appendix A, "Part 1, Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power MSRs: Format and Content," of the report titled, "Proposed Guidance for Preparing and Reviewing a Molten Salt Non-Power Reactor Application" (ORNL/TM-2020/1478) to support the review of non-power molten salt reactors (Ref. 25).

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 supported by a basis for the issuance or continuance of a permit or license by the Commission.

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 FOIA, Library, and Information Collections Branch (T6-A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the OMB reviewer at: OMB Office of Information and Regulatory Affairs,NEOB-10202 (3150-0011 and 3150-0151), Attn: Desk Officer for the Nuclear Regulatory Commission, 725 17th Street, NW, Washington, DC, 20503; e-mail: oira_submissions@omb.eop.gov.

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

This revision (Revision 1) of RG 1.210 revises the title of the RG to clarify that other nuclear facilities are also within the scope of this RG and updates the RG to endorse, with clarifications, the 2017 version of IEEE Std. 650, which addresses new issues identified since the RG's original issuance. These new issues include qualification of uninterruptible power supply (UPS) systems and programmable digital devices included in direct current (dc) power sources and qualification of the equipment to withstand electrical transients during operation. Notably, the revised standard also clarifies mechanical cycling steps for connectors and functional monitoring recommended during environmental stress test and acceptable methods for seismic testing that were discussed in the regulatory positions of Revision 0 of the RG. The information in this revised guide is specific to the qualification of safety-related equipment important to safety located in mild environments at production and utilization facilities licensed under 10 CFR Part 50 or 10 CFR Part 52.

Background

RG 1.210, "Qualification of Safety-Related Battery Chargers and Inverters for Nuclear Power Plants," Revision 0, issued June 2008 (Ref. 26), endorsed IEEE Std. 650-2006, "IEEE Standard for Qualification of Class 1E Static Battery Chargers and Inverters for Nuclear Power Generating Stations," (Ref. 27) which provided methods for qualifying battery chargers and inverters in accordance with IEEE Std. 323-2003, "IEEE Standard for Qualifying Class 1E Electrical Equipment for Nuclear Power Generating Stations" (Ref. 28). In 2016, the IEEE issued Std. 323 jointly with the IEC as IEC/IEEE Std. 60780-323-2016. The joint standard describes principles, methods, and procedures for qualifying, maintaining, and extending qualification, as well as updating qualification, of Class 1E equipment and interfaces, including components or equipment of any interface whose failure could adversely affect any Class 1E equipment.

IEEE Std. 650-2017 provided updates to the 2006 version including the qualification of safety-related UPS systems. UPS systems are designed to provide a continuous, highly reliable source of alternating current (ac) supply automatically, without delay or transients, during any period when the normal power supply is incapable of performing acceptably. UPS systems may include inverters, battery chargers, rectifiers (ac-dc converters), static transfer switches, maintenance bypass switches, and line regulating transformers. Power supplies for low voltage critical loads such as reactor protection systems may include a standalone UPS, or a UPS formed by an inverter connected to a dc source working in conjunction with an alternate ac source and a fast-acting automatic transfer switch. Components used in inverters are included in UPS systems.

IEEE Std. 650-2017 also clarified the use of the standard for qualification of safety-related battery chargers, inverters, and UPS systems located in a mild environment. The definition of "mild environment," as provided in 10 CFR 50.49(c)(3), is "an environment that would at no time be significantly more severe than the environment that would occur during normal plant operation, including anticipated operational occurrences," which include loss of all offsite power.[2] Specifically, 10 CFR Part 50 Appendix A, GDC 2, and Appendix S require that safety-related equipment including equipment in a mild environment be capable of withstanding the effects of natural phenomena such as earthquakes (seismic events). Additionally, in accordance with 10 CFR 50.55a(h)(3) and 10 CFR Part 50 Appendix A,

2 The reference to 10 CFR 50.49(c)(3) is being provided for definitional purposes. The environmental qualification of electrical equipment important to safety located in a mild environment is not within the scope of 10 CFR 50.49.

GDC 4, safety-related equipment including equipment in a mild environment, is required to be qualified to perform its functions when subjected to environmental and natural phenomena associated with normal and abnormal conditions. Based on the above-mentioned requirements, safety-related battery chargers, inverters, and UPS systems in production and utilization facilities must be qualified to perform their functions in normal and abnormal environmental conditions, and design basis seismic events, as these are typically located in a mild environment.

IEEE Std. 650-2017 updated the qualification for the safety-related battery chargers, inverters, and UPS systems in accordance with the joint standard IEC/IEEE Std. 60780-323. Equipment qualification, as defined in IEEE Std. 650-2017, is the "generation and maintenance of evidence to ensure that equipment will operate on demand to meet system performance requirements during normal and abnormal service conditions and postulated design basis events." IEEE Std. 650-2017 described an equipment qualification process that involves a combination of analysis and type testing methods and recommended that the analysis methods include a justification of the methods, theories, and assumptions used.

IEEE Std. 650-2017 further incorporated a software analysis and a transient test into the qualification methods. Safety-related static battery chargers, inverters, and UPS systems may contain programmable digital devices. Section 5.1.2.1, "Software Analysis," of IEEE Std. 650-2017 provides guidance for the qualification of these programmable digital devices to demonstrate that they can perform their safety functions. In addition, safety-related static battery chargers, inverters, and UPS systems in production and utilization facilities are designed to remain operable during anticipated transient events, such as a large electrical load rejection, a main turbine generator trip, a loss of offsite power with subsequent emergency diesel generator start and load, and a loss of ac power to UPS systems. Also, operating experience has indicated that asymmetric electrical transients are also possible. IEEE Std. 650-2017, Section 5.1.3.5, "Transient Test," provides transient testing that will ensure the equipment is capable of functioning during transient events, if required.

IEEE Std. 650-2017 incorporated regulatory positions in RG 1.210, Revision 0, regarding the criterion for ignoring mechanical cycling of connectors as an aging factor during the acceleration aging process and the functional performance monitoring during the environmental stress test, in Section 5.2.2.4, "Wire, cable, terminal blocks, and connections," and Section 5.3.1.7, "Environmental Stress Test," respectively. Furthermore, the regulatory position in RG 1.210, Revision 0, related to the qualification methods for seismic testing was clarified in Section 5.3.1.8, "Seismic Test," of IEEE Std. 650-2017

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. 29) and Management Directive and Handbook 6.6, "Regulatory Guides" (Ref. 30). There are IAEA Safety Guides that address the qualification of electrical equipment. These include IAEA Safety Standards Series No. SSG-69, "Equipment Qualification for Nuclear Installations," issued in December 2021 (Ref. 31) and IAEA Safety Standards Series No. SSG-67, "Seismic Design for Nuclear Installations," issued in November 2021 (Ref. 32).

Furthermore, this RG is endorsing IEEE Std. 650-2017, which provides qualification methods based on the joint IEC/IEEE Std. 60780-323, Edition 1.0, 2016-02. This joint standard was created based on a collaborative international effort to harmonize standard qualification practices developed from IEC 60780:1998, "Nuclear Power Plants—Electrical Equipment of the Safety System—Qualification" (Ref. 33), and IEEE Std. 323-2003.

Documents Discussed in Staff Regulatory Guidance

This RG endorses 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").[3] 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 a 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 a 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.

3 IEEE Std. 650-2017 denotes some of these secondary references as "normative references."

C. STAFF REGULATORY GUIDANCE

The NRC staff considers conformance with the provisions of IEEE Std. 650-2017 to be a method that is acceptable for use in satisfying the regulations with respect to the qualification of safety-related or Class 1E battery chargers, inverters, and UPS systems, with the following clarifications:

1. This RG does not endorse Section 2, "Normative References," of IEEE Std. 650-2017. The following RGs contain additional information with respect to the qualification of safety-related or Class 1E batter chargers, inverters, and UPS systems:

   RG 1.89, "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants," which endorses IEC/IEEE Std. 60780-323 with clarifications.

   RG 1.100, "Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants," which endorses IEEE Std. 344, with clarifications.

   RG 1.211, "Qualification of Safety-Related Cables and Field Splices for Nuclear Power Plants," which endorses IEEE Std. 383, with clarifications.

   RG 1.75, "Physical Independence of Electric Systems," which endorses IEEE Std. 384, with clarifications.

   RG 1.152, "Criteria for Use of Computers in Safety Systems of Nuclear Power Plants," which endorses IEEE Std. 7-4.3.2, with clarifications.

   RG 1.156, "Qualification of Connection Assemblies for Nuclear Power Plants" which endorses IEEE Std. 572, with clarifications.

2. Section 5.2, "Maintenance/replacement interval assignment," and Figure 1, "Flowchart for qualification of Class 1E static battery chargers, inverters, and UPS systems," of IEEE Std. 650-2017 recommend that "qualified life" be established for any component or equipment that is subject to a significant aging mechanism that cannot be addressed by surveillance and maintenance activities. The NRC staff recognizes that the term "qualified life," as defined in RG 1.89, Revision 2, is used for the qualification of equipment meeting the requirements of 10 CFR 50.49 (i.e., equipment located in harsh environments). Because the requirements of 10 CFR 50.49 are not applicable to equipment located in mild environments, the use of the term "qualified life" for battery chargers, inverters, and UPSs located in mild environment could cause confusion. Therefore, for the purposes of this RG, the staff clarifies that the term "qualified life" as used in IEEE Std. 650-2017 should be deemed equivalent to the term 'design life,' as defined in IEEE Std. 627-2019, "IEEE Standard for Qualification of Equipment Used in Nuclear Facilities," (Ref. 34) for the qualification of battery chargers, inverters, and UPSs. The staff notes that regardless of the term used, the qualification processes, including considerations of significant aging mechanisms, described in IEEE Std. 650-2017, as endorsed in this RG, should be followed to demonstrate that safety-related battery chargers, inverters, and UPSs are capable of remaining functional during and following design basis events. The staff is not endorsing IEEE 627-2019 in this RG.

3. Section 3.1, "Definitions," of IEEE Std. 650-2017 includes a note to indicate that design-extension conditions (i.e., beyond design basis events) are applicable to the qualification of equipment located in a mild environment. The staff clarifies that battery chargers, inverters, and UPSs need not be qualified for design-extension conditions (i.e., beyond design basis events).

D. IMPLEMENTATION

The NRC staff may use this regulatory guide as a reference in its regulatory processes, such as licensing, inspection, or enforcement. However, the NRC staff does not intend to use the guidance in this regulatory guide to support NRC staff actions in a manner that would constitute backfitting as that term is defined in 10 CFR 50.109, "Backfitting," and as described in NRC Management Directive 8.4, "Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests" (Ref. 35), nor does the NRC staff intend to use the guidance to affect the issue finality of an approval under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." The staff also does not intend to use the guidance to support NRC staff actions in a manner that constitutes forward fitting as that term is defined and described in Management Directive 8.4. 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 file a backfitting or forward fitting appeal with the NRC in accordance with the process in Management Directive 8.4.

REFERENCES[4]

The References section applies to versions of the documents available at the time of this RG's issuance. Licensees or applicants using this RG should check all referenced documents to ensure no change has occurred since issuance of the RG.

1. Institute of Electrical and Electronics Engineers (IEEE), IEEE Standard 650-2017, "IEEE Standard for Qualification of Class 1E Static Battery Chargers, Inverters, and Uninterruptible Power Supply Systems for Nuclear Power Generating Stations," New York, NY.[5]

2. Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, "Domestic Licensing of Production and Utilization Facilities."

3. 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

4. IEEE Standard 603-1991, "Criteria for Safety Systems for Nuclear Power Generating Stations," New York, NY.

5. U.S. Nuclear Regulatory Commission (NRC), NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment," Washington, DC.

6. NRC, Regulatory Guide (RG) 1.75. "Physical Independence of Electric Systems," Washington, DC.

7. IEEE Standard 384-1992, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits," New York, NY.

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

9. 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.

10. NRC, RG 1.152, "Criteria for Use of Computers in Safety Systems of Nuclear Power Plants," Washington, DC.

11. NRC, RG 1.156, "Qualification of Connection Assemblies for Nuclear Power Plants," Washington, DC.

4 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.

5 Copies of Institute of Electrical and Electronics Engineers (IEEE) documents may be purchased from the Institute of Electrical and Electronics Engineers Service Center, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855 or through the IEEE's public Web site at http://www.ieee.org/publications_standards/index.html.

12. NRC, RG 1.158, "Qualification of Safety-Related Vented Lead-Acid Storage Batteries for Nuclear Power Plants," Washington, DC.

13. NRC, RG 1.164, "Dedication of Commercial-Grade Items for Use in Nuclear Power Plants," Washington, DC.

14. NRC, RG 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems," Washington, DC.

15. NRC, RG 1.209, "Guidelines for Environmental Qualification of Safety-Related Computer-Based Instrumentation and Control Systems in Nuclear Power Plants," Washington, DC.

16. NRC, RG 1.211, "Qualification of Safety-Related Cables and Field Splices for Nuclear Power Plants," Washington, DC.

17. NRC, RG 1.215, "Guidance for ITAAC Closure Under 10 CFR Part 52," Washington, DC.

18. NRC, RG 1.232, "Developing Principal Design Criteria for Non-Light Water Reactors," Washington, DC.

19. NRC, RG 1.250, "Dedication of Commercial-Grade Digital I&C Items for Use in Nuclear power Plants," Washington, DC.

20. NRC, RG 2.5, "Quality Assurance Program Requirements for Research and Test Reactors," Washington, DC.

21. American National Standards Institute (ANSI)/American Nuclear Society (ANS) -15.8-1995, "Quality Assurance Program Requirements for Research Reactors," American Nuclear Society, La Grange Park, IL, reaffirmed September 2005.[6]

22. NUREG-1537, Parts 1 and 2, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors," issued February 1996. (ML12156A069 and ML12156A075, respectively)

23. NRC, "Final Interim Staff Guidance Augmenting NUREG-1537, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors," Parts 1 and 2, for Licensing Radioisotope Production Facilities and Aqueous Homogeneous Reactors," Washington, DC, October 17, 2012. (ML12156A053)

24. "Endorsement of Appendix A to Oak Ridge National Laboratory Report, 'Proposed Guidance For Preparing and Reviewing A Molten Salt Non-Power Reactor Application,' as Guidance for Preparing Applications for the Licensing of Non-Power Liquid Fueled Molten Salt Reactors," dated November 18, 2020. (ML20251A008)

25. Oak Ridge National Laboratory, "Proposed Guidance for Preparing and Reviewing a Molten Salt Non-Power Reactor Application," (ORNL/TM-2020/1478). (ML20219A771)

6 Copies of American National Standards Institute (ANSI) standards may be purchased from ANSI, 1819 L Street, NW, Washington, DC 20036, on the ANSI Web site at http://websotre.ansi.org/, via telephone (202) 293-8202, fax (202) 293 293-9287, or e-mail storemamager@ansi.org.

26. NRC, RG 1.210, "Qualification of Safety-Related Battery Chargers and Inverters for Nuclear Power Plants," Washington, DC.

27. IEEE Standard 650-2006, "IEEE Standard for Qualification of Class 1E Static Battery Chargers and Inverters for Nuclear Power Generating Stations," New York, NY.

28. IEEE Standard 323-2003, "IEEE Standard for Qualifying Class 1E Electrical Equipment for Nuclear Power Generating Stations," New York, NY.

29. NRC, "Nuclear Regulatory Commission International Policy Statement," *Federal Register*, Vol. 79, No. 132, July 10, 2014, pp. 39415–39418.

30. NRC, Management Directive (MD) 6.6, "Regulatory Guides," Washington, DC.

31. International Atomic Energy Agency (IAEA) Safety Standards Series No. SSG-69, "Equipment Qualification for Nuclear Installations," issued in December 2021.[7]

32. IAEA Safety Standards Series No. SSG-67, "Seismic Design for Nuclear Installations," issued in November 2021.

33. IEC 60780:1998, "Nuclear Power Plants—Electrical Equipment of the Safety System—Qualification," Geneva, Switzerland, October 1998.[5]

34. IEEE Standard 627-2019, "IEEE Standard for Qualification of Equipment Used in Nuclear Facilities," New York, NY.

35. NRC, MD 8.4, "Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests," Washington, DC.

7 Copies of International Atomic Energy Agency (IAEA) documents may be obtained through their Web site: www.iaea.org/ or by contacting the IAEA headquarters, P.O. Box 100 Wagramer Strasse 5, A-1400 Vienna, Austria.