U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REGULATORY RESEARCH

July 2007
Division 1

DRAFT REGULATORY GUIDE

Contact: Satish Aggarwal
(301) 415-6005

DRAFT REGULATORY GUIDE DG-1148

QUALIFICATION OF SAFETY-RELATED BATTERY CHARGERS & INVERTERS FOR NUCLEAR POWER PLANTS

A. INTRODUCTION

The regulations in Title 10, Part 50, of the *Code of Federal Regulations* (10 CFR Part 50), "Domestic Licensing of Production and Utilization Facilities," require that structures, systems, and components that are important to safety in a nuclear power plant must be designed to accommodate the effects of environmental conditions [i.e., remain functional under postulated design-basis events (DBEs)]. Toward that end, the general requirements are contained in General Design Criteria 1, 2, 4, and 23 of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50. Augmenting those general requirements, the specific requirements pertaining to qualification of certain electrical equipment important to safety are contained in 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants." In addition, Criterion III, "Design Control," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants," to 10 CFR Part 50, requires that where a test program is used to verify the adequacy of a specific design feature, it should include suitable qualification testing of a prototype unit under the most severe DBE.

This regulatory guide describes a method that the staff of the U.S. Nuclear Regulatory Commission (NRC) considers acceptable for complying with the regulations for qualification of safety-related battery chargers and inverters for nuclear power plants.

The NRC issues regulatory guides to describe to the public methods that the staff considers acceptable for use in implementing specific parts of the agency's regulations, to explain techniques that the staff uses in evaluating specific problems or postulated accidents, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations, and compliance with regulatory guides is not required.

This regulatory guide contains information collections that are covered by the requirements of 10 CFR Part 50 which the Office of Management and Budget (OMB) approved under OMB control number 3150-0011. The NRC may neither conduct nor sponsor, and a person is not required to respond

This regulatory guide is being issued in draft form to involve the public in the early stages of the development of a regulatory position in this area. It has not received final staff review or approval and does not represent an official NRC final staff position.

Public comments are being solicited on this draft guide (including any implementation schedule) and its associated regulatory analysis or value/impact statement. Comments should be accompanied by appropriate supporting data. Written comments may be submitted to the Rulemaking, Directives, and Editing Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; emailed to NRCREP@nrc.gov; submitted through the NRC's interactive rulemaking Web page at http://www.nrc.gov; faxed to (301) 415-5144; or hand-delivered to Rulemaking, Directives, and Editing Branch, Office of Administration, US NRC, 11555 Rockville Pike, Rockville, Maryland 20852. Between 7:30 a.m. and 4:15 p.m. on Federal workdays. Copies of comments received may be examined at the NRC's Public Document Room, 11555 Rockville Pike, Rockville, MD. Comments will be most helpful if received by October 2, 2007.

Electronic copies of this draft regulatory guide are available through the NRC's interactive rulemaking Web page (see above); the NRC's public Web site under Draft Regulatory Guides in the Regulatory Guides document collection of the NRC's Electronic Reading Room at http://www.nrc.gov/reading-rm/doc-collections/; and the NRC's Agencywide Documents Access and Management System (ADAMS) at http://www.nrc.gov/reading-rm/adams.html, under Accession No. ML071440292.

to, an information collection request or requirement unless the requesting document displays a currently valid OMB control number.

B. DISCUSSION

The Institute of Electrical and Electronics Engineers (IEEE) Std 650-2006, "IEEE Standard for Qualification of Class 1E Static Battery Chargers and Inverters for Nuclear Power Generating Stations,"[1] published on August 31, 2006, was developed by the Working Group on Battery Chargers and Inverters (SC 2.13). The Working Group was part of the Nuclear Power Engineering Committee of the IEEE. The IEEE Std 650-2006 was approved by the IEEE Standards Board on June 8, 2006. That standard provides general requirements, direction, and methods for qualifying safety-related static battery chargers and inverters for service in nuclear power plants. The demonstration that an installed battery charger or inverter will meet its design specification requires many steps in a program of design, fabrication, quality assurance, qualification, transportation, storage, installation, maintenance, periodic testing, and surveillance. However, the scope of IEEE Std 650-2006 is limited to qualification.

The objective to verify the adequacy of a specific design such that the battery chargers and inverters remain functional under postulated events should be accomplished using qualification methods (type testing, operating experience, analysis as a supplement to type testing and operating experience, ongoing qualification, or any combination thereof).

C. REGULATORY POSITION

Conformance with the requirements of IEEE Std 650-2006 is a method that the NRC staff considers acceptable for use in satisfying the regulations with respect to qualification of safety-related battery chargers and inverters, subject to the following conditions:

(1) Clause 5.2.2.4 of IEEE Std 650-2006 should be supplemented to specify the following criterion for ignoring cycling as an aging factor:

The mechanical cycling of connectors is expected to be less than 10 times during the qualified life or service life of the battery chargers and inverters.

(2) Due to the complexity of static battery chargers and inverters, Clauses 5.3.1.6 and 5.3.1.7 of IEEE Std 650-2006 should be supplemented to specify that testing is the preferred method of qualification for environmental stress test and seismic tests.

(3) Clause 5.3.1.6 of IEEE Std 650-2006 should be supplemented to specify that functional performance data should be continuously monitored during the qualification testing.

IEEE Std 650-2006 references several industry codes and standards. If a referenced standard has been separately incorporated into the NRC's regulations, licensees and applicants must comply with the standard as set forth in the regulations. By contrast, if the NRC staff has endorsed a referenced standard

[1] The IEEE standards are available for purchase from the IEEE Web site at http://shop.ieee.org/ieeestore/Product.aspx?product_no=SS10041.

in a regulatory guide, that standard constitutes an acceptable method of meeting a regulatory requirement as described in the regulatory guide.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff's plans for using this draft regulatory guide. No backfit is intended or approved in connection with its issuance.

The NRC has issued this draft guide to encourage public participation in its development. Except in those cases in which an applicant or licensee proposes or has previously established an acceptable alternative method for complying with specified portions of the NRC's regulations, the methods to be described in the active guide will reflect public comments and will be used in evaluating (1) submittals in connection with applications for construction permits, standard plant design certifications, operating licenses, early site permits, and combined licenses; and (2) submittals from operating reactor licensees who voluntarily propose to initiate system modifications involving safety-related battery chargers and inverters.

REGULATORY ANALYSIS

1. Background

Since its issuance in 1979, IEEE Std 650-1979, "Standard for Class 1E Battery Chargers and Inverters for Nuclear Power Generating Stations," has been used by the nuclear industry for qualification of safety-related battery chargers and inverters. This standard was revised and issued in 1990 as IEEE Std 650-1990, "Standard for Qualification of Class 1E Static Battery Chargers and Inverters for Nuclear Power Generating Stations." The NRC staff had never endorsed its use. However, over the ensuing years, the staff has been working with IEEE in revising this standard, and a revised version, IEEE Std 650-2006 was issued in August 2006 and is generally consistent with the NRC's regulatory requirements.

2. Problem

Since its issuance in 1979, nuclear power plant licensees have used IEEE Std 650-1979 and IEEE Std 650-1990 for qualification of safety-related battery chargers and inverters for nuclear power plants, subject to NRC staff review on a case-by-case basis. This is time-consuming.

3. Objective

The objective of this action is to provide clear guidance on qualification of safety-related battery chargers and inverters. Issuing a regulatory guide is consistent with the NRC policy of evaluating the latest versions of consensus safety standards in terms of their suitability for endorsement by regulatory guides. This approach would also comply with the NRC's directive to use standards developed by consensus bodies in accordance with Public Law 104-113, "National Technology and Transfer Act of 1995."

4. Technical Approach

IEEE Std 650-2006 is a much-improved consensus standard, which reflects the current state-of-technology. Moreover, the technical approach discussed in this revised standard is generally consistent with the NRC's regulatory requirements.

5. Conclusion

The NRC should issue this regulatory guide to enhance the licensing process. The staff has concluded that the proposed action will reduce unnecessary burden on both the NRC and its licensees, and will result in an improved and more uniform process for qualifying safety-related static battery chargers and inverters. Moreover, the staff sees no adverse effects associated with issuing this regulatory guide.