



# REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

REGULATORY GUIDE 1.158  
(Task EE 006-5)

## QUALIFICATION OF SAFETY-RELATED LEAD STORAGE BATTERIES FOR NUCLEAR POWER PLANTS

### A. INTRODUCTION

The Commission's regulations in 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," require that structures, systems, and components important to safety in a nuclear power plant be designed to accommodate the effects of environmental conditions and that design control measures such as testing be used to check the adequacy of design. These general requirements are contained in General Design Criteria 1, 2, 4, and 23 of Appendix A, "General Design Criteria for Nuclear Power Plants," to Part 50; and in Criterion III, "Design Control," and Criterion XVII, "Quality Assurance Records," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Part 50.

This regulatory guide describes a method acceptable to the NRC staff for complying with Commission regulations with regard to qualification of safety-related lead storage batteries for nuclear power plants.

The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

Any information collection activities mentioned in this regulatory guide are contained as requirements in 10 CFR Part 50, which provides the regulatory basis for this guide. The information collection requirements in 10 CFR Part 50 have been cleared under OMB Clearance No. 3150-0011.

### B. DISCUSSION

The Station Design Subcommittee, a subcommittee of the Energy Development and Power Generation Committee of the Institute of Electrical and Electronics Engineers (IEEE), has prepared IEEE Std 535-1986, "IEEE Standard for Qualification of Class 1E Lead Storage Batteries for Nuclear Power Generating Stations."\* The IEEE Standards Board approved the standard on September 19, 1985. This standard describes qualification methods for Class 1E lead storage batteries and racks to be used in nuclear power plants outside of primary containment.

The safety-related batteries undergo a program of qualification as part of an overall quality assurance program that also includes requirements for design, production, quality control, installation, maintenance, and periodic testing. This regulatory guide addresses only the qualification portion of the overall quality assurance program.

Batteries qualified by test should be preconditioned by natural or artificial (accelerated) aging to their end-of-installed-life condition, and consideration must be given to all significant types of degradation that can have an effect on the functional capability of the batteries. There are uncertainties regarding the processes and environmental factors that could result in such degradation. Because of these

\*Copies may be obtained from the Institute of Electrical and Electronics Engineers, IEEE Service Center, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855.

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This guide was issued after consideration of comments received from the public. Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, to accommodate comments and to reflect new information or experience.

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uncertainties, state-of-the-art preconditioning techniques as outlined in IEEE Std 535-1986 are not capable of simulating all significant types of degradation. As the state of the art advances and uncertainties are resolved, artificial preconditioning techniques may become more effective. Until such time, the NRC staff prefers natural pre-aging of safety-related batteries to the extent practicable.

IEEE Std 535-1986 references other standards that contain valuable information. Those referenced standards not endorsed by a regulatory guide or incorporated into the regulations, if used, are to be used in a manner consistent with current regulations.

### C. REGULATORY POSITION

Conformance with the requirements of IEEE Std 535-1986, "IEEE Standard for Qualification of Class 1E Lead Storage Batteries for Nuclear Power Generating Stations," provides an acceptable method for satisfying the Commission's regulations with respect to qualification of safety-related lead storage batteries for nuclear power plants, subject to the following:

Replacement batteries installed subsequent to February 28, 1989, should be qualified in accordance with the provisions of IEEE Std 535-1986 unless there are sound reasons to the contrary. The NRC staff considers the following to be sound reasons for the use of previously qualified batteries in lieu of upgrading:

- (a) A purchase order for the identical batteries to be used for replacement was issued prior to February 28, 1989.
- (b) Replacement batteries qualified in accordance with the provisions of IEEE Std 535-1986 are not available to meet installation and operation schedules. However, in such cases, the previously qualified batteries may be used no longer than the design life of the batteries after the upgraded batteries become available from the manufacturer.

### D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff's plans for using this regulatory guide.

Except in those cases in which the applicant or licensee proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the methods described herein will be used in the evaluation of the qualification of safety-related lead storage batteries for the following nuclear power plants:

1. Plants for which the construction permit is issued after February 28, 1989.
2. Plants for which the operating license application is docketed after August 28, 1989.
3. All operating nuclear power plants that replace batteries.

## VALUE/IMPACT STATEMENT

### BACKGROUND

Large lead storage batteries are used in nuclear power plants as a source of emergency power for vital instrumentation and control systems such as electrical distribution breaker controls for engineered safety features, inverters for the reactor protection instrument channels, and certain other safety-related equipment. Since safety-related lead storage batteries must meet user specifications throughout the batteries' installed life, the batteries undergo a program of qualification as part of an overall quality assurance program that also includes requirements for design, production, quality control, installation, maintenance, and periodic testing. This guide provides regulatory guidance for the qualification of safety-related lead storage batteries used in nuclear power plants.

### VALUE

There is no published NRC document that describes methods acceptable to the NRC staff for qualifying safety-related lead storage batteries. As a consequence, license reviews of safety-related lead storage batteries are being done on a case-by-case basis.

IEEE Std 535-1979, "IEEE Standard for Qualification of Class 1E Lead Storage Batteries for Nuclear Power Generating Stations," was published in September 1979. This standard needed several improvements. Since then the staff has worked with IEEE in

developing IEEE Std 535-1986, which is satisfactory and delineates an acceptable methodology for meeting the Commission's regulations for qualification of safety-related lead storage batteries. Issuing a regulatory guide is consistent with the NRC policy of evaluating the latest versions of national standards in terms of their suitability for endorsement by regulatory guides.

This guide endorses IEEE Std 535-1986 without any exceptions, and conformance with the requirements of IEEE Std 535-1986 constitutes an acceptable method of complying with the Commission's regulations. The Regulatory Position provides regulatory guidance for replacement batteries. This guide should enhance the licensing process.

### IMPACT

This regulatory guide is consistent with current NRC practice. It applies to future nuclear power plants and to operating nuclear power plants for replacement batteries. All U.S. battery manufacturers have already qualified their batteries to the provisions of IEEE Std 535-1979 or 1986. Also, the staff has concluded that there is no significant difference between the 1979 and 1986 versions of IEEE Std 535 with respect to the pre-aging part of the qualification testing. Thus, this regulatory guide does not impose any new requirements or costs on current licensees or applicants.

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