



# U.S. NUCLEAR REGULATORY COMMISSION

## REGULATORY GUIDE 1.129, Revision 4

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### MAINTENANCE, TESTING, AND REPLACEMENT OF VENTED LEAD-ACID STORAGE BATTERIES FOR PRODUCTION AND UTILIZATION FACILITIES

#### A. INTRODUCTION

##### Purpose

This regulatory guide (RG) describes methods and procedures that the staff of the U.S. Nuclear Regulatory Commission (NRC) considers acceptable for use in complying with the agency's regulations regarding the maintenance, testing, and replacement of vented lead-acid storage batteries in production and utilization facilities. This revision of RG 1.129 endorses (with certain clarifying regulatory positions described in Section C of this guide) Institute of Electrical and Electronics Engineers (IEEE) Standard (Std.) 450-2020, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications" (Ref. 1).

##### 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. 2), and 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants" (Ref. 3). With respect to 10 CFR Part 50, this RG applies to applicants for and holders of a license, as defined in 10 CFR 50.2. With respect to 10 CFR Part 52, this RG applies to applicants for and holders of licenses, as defined in 10 CFR 52.1, standard design certifications, and standard design approvals.

##### Applicable Regulations

The General Design Criteria (GDC) in Appendix A to 10 CFR Part 50 establish minimum requirements for the principal design criteria for water-cooled nuclear power plants similar in design and location to plants for which construction permits have been issued by the Commission. The GDC 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. The following GDC are related to vented lead-acid storage batteries:

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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://nrcweb.nrc.gov/reading-rm/doc-collections/reg-guides/>, 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.) ML22332A409. The regulatory analysis is associated with a rulemaking and may be found in ADAMS under Accession No. ML22026A443. The associated draft guide DG-1401 may be found in ADAMS under Accession No. ML22026A441. There were no comments received during the public comment period.

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- GDC 1, “Quality Standards and Records,” requires, in part, that structures, systems, and components (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 4, “Environmental and dynamic effects design bases,” requires, in part, that SSCs important to safety shall 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.
- GDC 17, “Electric Power Systems,” requires, in part, that an onsite electric power system and an offsite electric power system be provided to permit functioning of SSCs important to safety.
- 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 of important areas and features, such as wiring, insulation, connections, and switchboards, to assess the continuity of the systems and the conditions of their components.

Nuclear power plants and fuel reprocessing 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, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” to 10 CFR Part 50 establishes quality assurance requirements for the design, manufacture, construction, and operation of those SSCs. The following quality assurance criteria are related to vented lead-acid storage batteries:

- Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” to 10 CFR Part 50, Criterion XI, “Test Control,” sets forth the following requirements.
  - A test program shall be established to ensure that all testing is required to demonstrate that SSCs will perform satisfactorily in service and is identified and performed in accordance with written test procedures that incorporate the requirements and acceptance limits contained in applicable design documents.
  - The test program shall include, as appropriate, proof tests before installation, preoperational tests, and operational tests during nuclear power plant or fuel reprocessing plant operation of SSCs.
  - Test procedures shall include provisions for ensuring that all prerequisites for the given test have been met, that adequate test instrumentation is available and used, and that the test is performed under suitable environmental conditions.
  - Test results shall be documented and evaluated to ensure that test requirements have been satisfied.
- Appendix B to 10 CFR Part 50, Criterion XII, “Control of Measuring and Test Equipment,” sets forth the following requirement.
  - Measures shall be established to ensure that tools, gauges, instruments, and other measuring and testing devices used in activities affecting quality are properly

controlled, calibrated, and adjusted at specified periods to maintain accuracy within necessary limits.

10 CFR Part 52 requires that SSCs 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 the design. Part 52 specifies, among other things, that contents of some applications must satisfy the requirements of 10 CFR Part 50, Appendix A and Appendix B.

### **Related Guidance**

- NUREG/CR-7148, “Confirmatory Battery Testing: The Use of Float Current Monitoring to Determine Battery State-of-Charge,” issued November 2012 (Ref. 4), provides information on confirmatory battery testing; specifically, the use of float current monitoring to determine battery state-of-charge.
- The Model Application for Plant-Specific Adoption of Technical Specification Task Force (TSTF) Traveler TSTF-500, Revision 2, “DC Electrical Rewrite—Update to TSTF-360,” issued September 2009 (Ref. 5), provides model technical specifications to verify the capability of batteries used in nuclear power plants.
- NUREG-1537, Parts 1 and 2, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors,” issued February 1996 (Ref. 6), 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.
- “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,” issued October 2012 (Ref. 7), contains 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 the 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,” dated November 18, 2020, (Ref. 8) which endorses with clarifications, “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. 9).
- RG 1.128, “Installation Design and Installation of Vented Lead-Acid Storage Batteries for Nuclear Power Plants,” (Ref. 10).
- RG 1.212, “Sizing of Large Lead-Acid Storage Batteries,” (Ref. 11).
- RG 1.232, “Guidance for Developing Principal Design Criteria for Non-Light Water Reactors,” (Ref. 12) provides guidance for developing principal design criteria for non-light water reactors.

## **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 provide guidance to applicants. RGs 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 Part 50 and 10 CFR Part 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](mailto:Infocollects.Resource@nrc.gov), and to the OMB Reviewer at 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; e-mail: [oir\\_submission@omb.eop.gov](mailto:oir_submission@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**

The NRC issued RG 1.129, Revision 3, in September 2013, to endorse (with certain clarifying regulatory positions) IEEE Std. 450-2010 (Ref. 13). Since then, IEEE has revised the standard as IEEE Std. 450-2020 to provide clarifying guidance on maintenance, testing, and corrective actions. The revised IEEE standard also provides guidance for the condition monitoring of stationary batteries. The staff determined that the revised IEEE standard, subject to the conditions below, supports applications for new licenses, design certifications, standard design approvals, and license amendments.

### **Background**

This RG provides guidance to manage vented lead-acid battery degradation such that a battery in service would retain its readiness for supporting design-basis events. It endorses, with certain clarifying regulatory positions, IEEE Std. 450-2020. The IEEE Power Engineering Society Energy Storage and Stationary Battery Committee developed this standard, and the IEEE Standards Association Standards Board approved it on December 3, 2020. IEEE Std. 450-2020 provides the recommended maintenance, test schedules, and testing procedures intended to optimize the life and performance of permanently installed vented lead-acid storage batteries used for standby power applications. It also provides guidance to determine when batteries should be replaced. IEEE Std. 450-2020 applies to full-float stationary applications in which a battery charger normally maintains the battery fully charged and supplies the direct current (DC) loads. However, specific applications, such as emergency lighting units, semiportable equipment, and alternate energy applications, may have other appropriate practices that are beyond the scope of the recommended practice. This standard does not include any other components of the DC system, and it does not require inspection and testing of the DC system even though the battery is part of that system.

IEEE Std. 450-2020 is an updated consensus standard that adds new recommendations, as well as informative annexes, which reflect the current state of technology for vented lead-acid batteries. In addition, RG 1.128 relates to installation of vented lead-acid storage batteries, and RG 1.212 relates to sizing of large lead-acid storage batteries.

### **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. 14) and Management Directive and Handbook 6.6, "Regulatory Guides" (Ref. 15).

The staff also considered IAEA Specific Safety Guide (SSG) No. SSG-34, "Design of Electrical Power Systems for Nuclear Power Plants," issued August 2016 (Ref. 16) in the development and update of this RG.