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DRAFT REGULATORY GUIDE

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(Proposed Revision 3 of Regulatory Guide 1.32)

CRITERIA FOR POWER SYSTEMS FOR NUCLEAR POWER PLANTS

A. INTRODUCTION

General Design Criterion 17, "Electric Power Systems," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires an onsite electric power system and an offsite electric power system be provided to permit functioning of certain structures, systems, and components. In addition, General Design Criterion 18, "Inspection and Testing of Electric Power Systems," of Appendix A to 10 CFR Part 50 specifies requirements for periodic inspection, testing, and testability of electric power systems.

This regulatory guide describes a method acceptable to the NRC staff for complying with the NRC's regulations for the design, operation, and testing of electric power systems in nuclear power plants. Specifically, it provides guidance for meeting the General Design Criteria for the safety-related portions of systems and equipment in the alternating current power systems, direct current power systems, and instrumentation and control power systems. This revision will endorse IEEE Std. 308-2001, "Criteria for Class 1E Power Systems for Nuclear Power Generating Stations," an updated version of the standard.

Regulatory guides are issued to describe to the public methods acceptable to the NRC staff for implementing specific parts of the NRC's regulations, to explain techniques used by the staff 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. Regulatory guides are issued in draft form for public comment to involve the public in developing the regulatory positions. Draft regulatory guides have not received complete staff review; they therefore do not represent official NRC staff positions.

¹IEEE standards are available from

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 complete staff review or approval and does not represent an official NRC 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 Rules and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. Comments may be submitted electronically or downloaded through the NRC's interactive web site at <WWW.NRC.GOV> through Rulemaking. Copies of comments received may be examined at the NRC Public Document Room, 11555 Rockville Pike, Rockville, MD. Comments will be most helpful if received by **July 31, 2003**.

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The information collections contained in this draft regulatory guide are covered by the requirements of 10 CFR Part 50, which were approved by the Office of Management and Budget (OMB), approval number 3150-3011. The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

B. DISCUSSION

IEEE Std. 308-2001, "Criteria for Class 1E Power Systems for Nuclear Power Generating Stations," was prepared by Working Group 4.1 of Subcommittee 4, "Auxiliary Power," of IEEE Nuclear Power Engineering Committee and was approved by the IEEE Standards Board on December 6, 2001. This standard provides guidance for design of nuclear power plant electrical power systems that are specifically related to protection of the health and safety of the public. The major role of the safety-related power system is to provide electric power to the reactor trip system, engineered safety features, and auxiliary supporting features; therefore, the safety-related power system is an auxiliary supported feature. The safety-related power system is unique because it extends throughout the plant, having far more complex interfaces than other auxiliary supporting features. Characteristic of the complex interfaces of the safety-related power system is the fact that it is an auxiliary supporting feature; other auxiliary features are auxiliary supporting features for it, and the safety-related power system may provide support for non-safety-related equipment as well as provide the means for the execution of the safety system protective actions.

IEEE Std. 308-2001 provides (1) the principal design criteria and the design features for the safety-related power systems that enable the systems to meet their functional requirements under the conditions produced by the postulated design basis events, (2) methods for tests and surveillance of the safety-related power systems, (3) criteria for sharing safety-related power systems in multi-unit nuclear power plants, and (4) provisions for documentation of the safety-related power systems.

Section 7.1 of IEEE Std. 308-2001 states that shared Class 1E (safety-related) power systems are permissible in multi-unit stations provided certain rigorous conditions for sharing are met. However, Regulatory Guide 1.81, "Shared Emergency and Shutdown Electric Systems for Multi-Unit Nuclear Power Plants," states that dc power systems in multi-unit nuclear power plants should not be shared. Sharing of dc power systems and their interactions between units could compromise safe shutdown. Rather, independent dc power systems for each unit of multi-unit stations have the following advantages: (1) they are simple; (2) they provide overall excellence; (3) they are less prone to error and thus, provide overall reliability; and (4) they involve simplified maintenance and operation. In advanced reactors, such as AP600/AP1000 or SWR 1000 designs, dc power systems are heavily relied upon for a safe shutdown in case of an accident or abnormal operational occurrence. Therefore, the NRC does not endorse the IEEE Std. 308-2001 criteria for sharing safety-related dc power systems in multi-unit nuclear power plants.

IEEE Std. 308-2001 references several industry standards. Unless these referenced standards are specifically incorporated by reference in the NRC regulations, they are not mandatory requirements. If a referenced standard has been endorsed in a regulatory guide, the standard constitutes a method acceptable to the NRC of meeting a regulatory requirement as described in the regulatory guide. If a referenced standard has not been endorsed in a regulatory

guide, licensees and applicants may consider and use the information in a referenced standard consistent with current regulatory practice.

C. REGULATORY POSITION

Conformance with the requirements of IEEE Std. 308-2001, "Criteria for Class 1E Power Systems for Nuclear Power Generating Stations," is acceptable to the NRC staff for satisfying the NRC's regulations with respect to the design, operation, and testing of safety-related power systems for nuclear power plants, except for sharing of dc power systems at multi-unit nuclear power plants, as described in Regulatory Guide 1.81, "Shared Emergency and Shutdown Electric Systems for Multi-Unit Nuclear Power Plants."

D. IMPLEMENTATION

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

This proposed revision has been released to encourage public participation in its development. Except when an applicant proposes an acceptable alternative method for complying with specified portions of the NRC's regulations, the method to be described in the final guide (reflecting public comments) will be used in the evaluation of submittals in connection with applications for construction permits, design certifications, operating licenses, and combined licenses. It will also be used to evaluate submittals from operating reactor licensees who voluntarily propose to initiate power system modifications if there is a clear nexus between the proposed modifications and this guidance.

REGULATORY ANALYSIS

BACKGROUND

IEEE Std. 308-2001, "Criteria for Class 1E Power Systems for Nuclear Power Generating Stations," is a revision of IEEE Std. 308-1991. In February 1977, the NRC staff issued Revision 2 of Regulatory Guide 1.32, "Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants," which endorses an earlier version of the standard, IEEE Std. 308-1974, with two exceptions.

1. PROBLEM

Nuclear power plant licensees have been using various editions of IEEE Std. 308 when making power system modifications to their plants. The guidance in Revision 2 of Regulatory Guide 1.32 has become outdated.

2. OBJECTIVE

The objective of the regulatory action is to update NRC guidance on power systems. Issuing a regulatory guide is consistent with the NRC policy of evaluating the latest versions of national consensus standards in terms of their suitability for endorsement by regulatory guides. This approach would also comply with the NRC's directive that standards developed by consensus bodies be utilized per Public Law 104-113, "National Technology and Transfer Act of 1995."

3. TECHNICAL APPROACH

There have been numerous changes to the 1974 version of the IEEE Std. 308. The following is a summary of the significant changes.

IEEE Std. 308-1978

This revision clarified the interface between the functional requirements of the Class 1E auxiliary power system and the safety system for elements of the protective action system that are in the Class 1E power system. In addition, this revision was undertaken to address a number of areas in which additional guidance was needed, such as:

- (1) Design bases for Class 1E power systems
- (2) Application of the single-failure criterion to Class 1E power systems
- (3) Connection of non-Class 1E loads to Class 1E buses
- (4) Independence of Class 1E power systems
- (5) Requirements for circuits that penetrate containment
- (6) Pre-operational testing of Class 1E power systems
- (7) Multi-unit station considerations
- (8) Surveillance requirements for Class 1E systems.

IEEE Std. 308-1980

This revision implemented the recommendations of the IEEE 308/603 Ad Hoc Committee appointed by the Nuclear Power Engineering Committee (NPEC). The charter of the Ad Hoc Committee was to:

- (1) Develop a written interpretation of the IEEE Std. 308/IEEE Std. 603 scope diagram and determine its adequacy,
- (2) Give direction to Subcommittee 4 and Subcommittee 6 for revision of the diagram and of IEEE Std. 603, if appropriate, and
- (3) Determine what sections of IEEE Std. 603 apply to the Class 1E power system and define those supplementary requirements needed in IEEE Std. 308.

The Ad Hoc Committee recommended revision of the 308/603 scope diagram and provided definitions and text changes to agree with a new safety system scope diagram. Specific Class 1E equipment and components were fitted to the new scope diagram to aid its understanding. Applicability of the Safety System requirements to the Class 1E Power System were reviewed, and revisions to IEEE Std. 603 were recommended to make it consistent with the new scope diagram. Additionally, supplementary requirements and modifications to IEEE Std. 308 were identified to make it consistent with IEEE Std. 603. These recommendations are incorporated into this revision. The Ad Hoc committee concluded that a safety system, by definition, must encompass all of the elements required to achieve a protective or safety function.

IEEE Std. 308-1991

This was a general revision to update the document and make it current. The standard was expanded to include the criteria for interfacing the Class 1E power system with IEEE Std. 765-1983, "IEEE Standard for the Preferred Power Supply for Nuclear Power Generating Stations," and IEEE Std. 741-1990, "IEEE Standard Criteria for the Protection of Class 1E Power Systems and Equipment in Nuclear Power Generating Stations." The standard was also updated to reflect the latest requirements of IEEE Std. 387-1984, "IEEE Standard Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations"; IEEE Std. 946-1985, "IEEE Recommended Practice for the Design of Safety-Related DC Auxiliary Power Systems for Nuclear Power Generating Stations"; and the recommendations of the NPEC Ad Hoc Committee on Shared Safety Systems. These recommendations resulted in a complete rewrite of Section 8, "Multi-Unit Station Considerations."

IEEE Std. 308-2001

This revision adds criteria for documentation of the design and testing of Class 1E power systems, including verification and validation. This revision expands the criteria for power quality to include potential effects of harmonic distortion and degraded grid conditions. A general update was made to the references and definitions within the document. In addition, non-substantial clarifications were made within the document to facilitate readability and understanding of the content.

IEEE Std. 308-2001 addresses the regulatory positions and issues identified in Revision 2 of Regulatory Guide 1.32 (February 1977). The NRC staff has worked with IEEE in developing IEEE Std. 308-2001, and the two original exceptions taken in Revision 2 of the Regulatory Guide 1.32 have been satisfactorily resolved. Thus, IEEE Std. 308-2001 is a much improved national consensus standard and it reflects the current state of technology.

4. CONCLUSION

The NRC should revise Regulatory Guide 1.32 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 it will result in an improved process for the design, operation, and testing of the power systems. Further, the staff sees no adverse effects associated with revising

Regulatory Guide 1.32. Use of this revision is optional by licensees of currently operating nuclear power plants.

BACKFIT ANALYSIS

The regulatory guide does not require a backfit analysis as described in 10 CFR 50.109(c) because the use of this revision of Regulatory Guide 1.32 is voluntary by the licensees of currently operating nuclear power plants.