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OFFICE OF NUCLEAR REGULATORY RESEARCH

REGULATORY GUIDE 1.53

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APPLICATION OF THE SINGLE-FAILURE CRITERION TO SAFETY SYSTEMS

A. INTRODUCTION

Section 50.55a, "Codes and Standards," of 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires in 10 CFR 50.55a(h) that the protection systems meet the requirements set forth in the Institute of Electrical and Electronics Engineers (IEEE) Criteria for Nuclear Power Plant Protection Systems (IEEE Std 279) or that the safety systems must meet the requirements set forth in IEEE Std 603-1991, "Criteria for Safety Systems for Nuclear Power Generating Stations."* Section 4.2 of IEEE Std 279-1971* states that any single failure within the protection system will not prevent proper protective action at the system level when required. Section 5.1 of IEEE Std 603-1991* states that the safety system must perform all safety functions required for a design basis event in the presence of (a) any single detectable failure within the safety systems concurrent with all identifiable but nondetectable failures, (b) all failures caused by the single failure, and (c) all failures and spurious system actions that cause or are caused by the design basis event requiring the safety functions.

The information collections contained in this 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.

* Copies may be purchased from the Institute of Electrical and Electronics Engineers, Inc., 445 Hoes Lane, Piscatway, NJ 08855-1331.

Regulatory guides are issued to describe and make available to the public such information as methods acceptable to the NRC staff for implementing specific parts of the NRC's regulations, techniques used by the staff in evaluating specific problems or postulated accidents, and data needed by the NRC staff in its review of applications for permits and licenses. Regulatory guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

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. Written comments may be submitted to the Rules and Directives Branch, ADM, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

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B. DISCUSSION

IEEE Std 379-2000, “Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems,” was prepared by Working Group SC 6.3 of IEEE Nuclear Power Engineering Committee and was approved by the IEEE Standards Board on September 21, 2000. The standard provides guidance on the application of the single-failure criterion to the electrical power, instrumentation, and control portions of nuclear power plant safety systems. The systems include the actuation and protection systems, as well as the sense, command, and execute features of the power system. The guidance in this standard has been developed for electrical systems. However, where the interface with mechanical systems is unavoidable (e.g., sensing lines), the mechanical portions are considered to be a part of the electrical system with which they interface.

The safety systems must perform all required safety functions for a design basis event in the presence of (1) any single detectable failure within the safety systems concurrent with all identifiable but nondetectable failures, (2) all failures caused by the single failures, or (3) all failures and spurious system actions that cause, or are caused by, the design basis event that requires the safety function. The single failure could occur prior to, or at any time during, the design basis event for which the safety system is required to function.

C. REGULATORY POSITION

Conformance with the requirements of IEEE Std 379-2000, “Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems,” provides methods acceptable to the NRC staff for satisfying the NRC’s regulations with respect to the application of the single-failure criterion to the electrical power, instrumentation, and control portions of nuclear power plant safety systems.

Section 2 of IEEE Std 379-2000 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 regulation. If the referenced standard has been endorsed by the NRC staff in a regulatory guide, the standard constitutes an acceptable method of meeting a regulatory requirement as described in the regulatory guide. If a referenced standard has been neither incorporated into the NRC’s regulations nor endorsed in a regulatory guide, licensees and applicants may consider and use the information in the referenced standard, if appropriately justified, consistent with regulatory practice.

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.

Except when 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 described in this guide 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 safety system (or protection system) modifications if there is a clear nexus between the proposed modifications and this guidance for applying single failure criterion.

REGULATORY ANALYSIS

A separate Regulatory Analysis was not prepared for this Revision 1 of Regulatory Guide 1.53. The Regulatory Analysis that was prepared for and printed with the draft of this guide, DG-1118, in May 2002 is still applicable. Copies of DG-1118, and therefore the Regulatory Analysis, are available in the NRC's Electronic Reading Room through ADAMS, accession number ML021160080. Copies are also available for inspection or copying for a fee from the NRC Public Document Room at 11555 Rockville Pike (first floor), Rockville, MD; the PDR's mailing address is USNRC PDR, Washington, DC 20555; telephone 301-415-4737 or 800-397-4209; fax 301-415-3548; email <PDR@NRC.GOV>.