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REGULATORY GUIDE

OFFICE OF STANDARDS DEVELOPMENT

REGULATORY GUIDE 1.100

SEISMIC QUALIFICATION OF ELECTRIC EQUIPMENT FOR NUCLEAR POWER PLANTS

A. INTRODUCTION

Criterion III, "Design Control," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Licensing of Production and Utilization Facilities," requires, among other things, that design control measures provide for verifying the adequacy of design such as by the performance of a suitable testing program. Where a test program is used to verify the adequacy of a specific design feature, it is required to include suitable qualification testing of a prototype unit under the most adverse design conditions. This regulatory guide describes a method acceptable to the NRC staff for complying with the Commission's regulations with respect to verifying the adequacy of the seismic design of electric equipment for all types of nuclear power plants.

B. DISCUSSION

IEEE Std 344-1975[1] (revision of IEEE Std 344-1971), "IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations," dated January 31, 1975, was prepared by Working Group 2.5 (Seismic Qualification) of Subcommittee 2 (Equipment Qualification) of the Institute of Electrical and Electronics Engineers (IEEE) Nuclear Power Engineering Committee, and was subsequently approved by the IEEE Standards Board on December 20, 1974.

The provisions of this standard include principles, procedures, and methods of seismic qualification which, when satisfied, will confirm the adequacy of the equipment design for the performance of Class 1E functions during and after the time the equipment is subjected to the forces resulting from one safe shutdown earthquake (SSE) preceded by a number of operating basis earthquakes (OBEs). The standard contains requirements indicated by the verbs "shall" and "must" and recommendations indicated by "should."

The standard, which is an ancillary standard of IEEE Std 323-1974, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations," (endorsed, with exceptions, by Regulatory Guide 1.89), supplements part of the test methods required and references the margins given in IEEE Std 323-1974.

C. REGULATORY POSITION

Conformance with the requirements and recommendations specified by IEEE Std 344-1975[1] for conducting seismic qualification of Class 1E Equipment is accepted and, when such qualification is performed in conjunction with Regulatory Guide 1.89, provides an adequate basis for complying with design verification requirements of Criterion III of Appendix B to 10 CFR Part 50 with respect to verifying the seismic adequacy of electric equipment, subject to the following:

1. As indicated in Section 5.3, "Static Coefficient Analysis," a static coefficient of 1.5 is used for equipment analysis to take into account the effects of both multifrequency excitation and multimode response. The use of 1.5 as a static coefficient should not be considered acceptable unless justified by analysis.

Basis: There is no adequate evidence presented in Section 5.3 to substantiate the validity of a static

[1] IEEE Std 344-1975, "IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations." Copies may be obtained from the Institute of Electrical and Electronics Engineers, United Engineering Center, 345 East 47th Street, New York, N.Y. 10017.

coefficient of 1.5, or one greater or less than 1.5, in its application to equipment analysis.

2. Section 6.6.2.1, "Derivation of Test Input Motion," (concerning single frequency test input motion) states that, for equipment with more than one predominant frequency, the shake table motion should produce a test response spectrum (TRS) acceleration at the test frequencies equal to 1.5 times the acceleration given by the specified required response spectrum (RRS) or less if justified. The section also states that the TRS need not envelop the RRS provided the factor of 1.5 is used. The use of a factor of 1.5 and the concept that the TRS need not envelop the RRS should not, in the absence of justification, be considered acceptable.

Basis: These provisions violate the general requirements stated in Section 6.6.1 of the standard for justifiable test input.

3. In the absence of justification, those portions of Section 6.6.2.5, "Sine Sweep Test," which indicate that, for qualifying equipment using the sine sweep test input, the TRS must envelop the RRS according to the criteria described in Section 6.6.2 and 6.6.2.1 should not be considered acceptable.

Basis: Sections 6.6.2 and 6.6.2.1 do not provide specific guidelines concerning a justifiable methodology to define the TRS for a sweep input motion and therefore violate the general requirements stated in Section 6.6.1 for a justifiable test input.

4. The requirements given in Section 8, "Documentation," should be supplemented by the following:

8.6 Malfunction Data.

If a malfunction is defined in Section 2, "Definitions," is experienced during any test, the effect of that malfunction should be determined and documented in the test report.

Basis: This is a logical extention of Section 8, "Documentation," and provides added emphasis on the need to document all malfunctions that might result in consequences adverse to safety.

D. IMPLEMENTATION

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

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used in the evaluation of submittals for construction permit applications docketed after November 15, 1976, unless this guide is revised as a result of suggestions from the public or additional staff review.

If an applicant wishes to use this regulatory guide in developing submittals for applications docketed on or before November 15, 1976, the pertinent portions of the application will be evaluated on the basis of this guide.