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U.S. ATOMIC ENERGY COMMISSION

# REGULATORY GUIDE

DIRECTORATE OF REGULATORY STANDARDS

## REGULATORY GUIDE 1.41

### PREOPERATIONAL TESTING OF REDUNDANT ON-SITE ELECTRIC POWER SYSTEMS TO VERIFY PROPER LOAD GROUP ASSIGNMENTS

#### A. INTRODUCTION

General Design Criterion 1, "Quality Standards and Records," of Appendix A to 10 CFR Part 50, "General Design Criteria for Nuclear Power Plants," requires that structures, systems, and components important to safety be tested to quality standards commensurate with the importance of the safety functions to be performed. Criterion XI, "Test Control," of Appendix B to 10 CFR Part 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," requires that a test program be established to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and performed. For on-site emergency power systems designed in accordance with Regulatory Guides 1.6 and 1.32 (Safety Guides 6 and 32) this guide describes an acceptable method of complying with the Commission's regulations with respect to verifying the proper assignments of redundant load groups to the related on-site power sources. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the Regulatory position.

#### B. DISCUSSION

An on-site electric power system designed in accordance with Regulatory Guides 1.6 and 1.32 (Safety Guides 6 and 32) will consist of redundant power sources and load groups that are independent of each other. Such a design will conform to the provisions of Section 5.2.2(5) of IEEE Std 308-1971.<sup>1</sup> Section 5.2.2(5) states: "Auxiliary devices that are required to operate dependent equipment shall be supplied from a related bus section to prevent the loss of electric power

<sup>1</sup> IEEE Std 308-1971, "Criteria for Class IE Electric Systems 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.

in one load group from causing the loss of equipment in another load group." The independence among redundant on-site power sources and their load groups should be such that the successful operation of any power source and its load group is in no way affected by the partial or complete failure of any other power source and its load group.

Since the reliability of an on-site power system of the kind discussed in this guide is predicated on the existence of this independence, a suitable preoperational test to detect any lack of independence should be performed. As a minimum, a suitable test should assure that each redundant on-site power source and its load group can function without any dependence upon any other redundant load group or portion thereof.

#### C. REGULATORY POSITION

As part of the initial preoperational testing program, and also after major modifications or repairs to a facility, those on-site electric power systems designed in accordance with Regulatory Guides 1.6 and 1.32 (Safety Guides 6 and 32) should be tested as follows to verify the existence of independence among redundant on-site power sources and their load groups.

1. The plant electric power distribution system, not necessarily including the switchyard and the startup and auxiliary transformers, should be isolated from the off-site transmission network. Preferably, this isolation should be effected by direct actuation of the undervoltage-sensing relays within the on-site system.

2. Under the conditions of C.1. above, the on-site electric power system should be functionally tested successively in the various possible combinations of power sources and load groups with all d-c and on-site a-c power sources for one load group at a time completely disconnected. Each test should include injection of simulated accident signals, startup of the

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on-site power source(s) and load group(s) under test, sequencing of loads, and the functional performance of the loads. Each test should be of sufficient duration to achieve stable operating conditions and thus permit the onset and detection of adverse conditions which could

result from improper assignment of loads, e.g., the lack of forced cooling of a vital device.

3. During each test, the d-c and on-site a-c buses and related loads not under test should be monitored to verify absence of voltage at these buses and loads.