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REGULATORY GUIDE

OFFICE OF STANDARDS DEVELOPMENT

REGULATORY GUIDE 1.68.2

INITIAL STARTUP TEST PROGRAM TO DEMONSTRATE REMOTE SHUTDOWN CAPABILITY FOR WATER-COOLED NUCLEAR POWER PLANTS

A. INTRODUCTION

General Design Criterion (GDC) 1, "Quality Standards and Records," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," 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, "Quality Assurance Criteria for Nuclear Power Plants," to 10 CFR Part 50 requires that a program be established to ensure that all testing necessary to demonstrate that structures, systems, and components will perform satisfactorily in service be identified and conducted. GDC 19, "Control Room," of Appendix A to 10 CFR Part 50 requires that equipment at appropriate locations outside the control room be provided (1) with a design capability for prompt hot shutdown[1] of the reactor, including necessary instrumentation and controls to maintain the unit in a safe condition during hot shutdown, and (2) with a potential capability for subsequent cold shutdown of the reactor through the use of suitable procedures.

Regulatory Guide 1.68, "Initial Startup Test Programs for Water-Cooled Reactor Power Plants," describes a method acceptable to the NRC staff for complying with the Commission's regulations with regard to preoperational and initial startup testing of nuclear power plant structures, systems, and components.

This guide describes an initial startup test program acceptable to the NRC staff for demonstrating hot standby capability and the potential for cold shutdown from outside the control room. This guide is applicable to water-cooled nuclear power plants. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

B. DISCUSSION

Regulatory Guide 1.68 lists as one of its initial startup tests the demonstration of "shutdown from outside the control room," the capability for which is required by GDC 19. Experience in the application of Regulatory Guide 1.68 has shown that amplification of guidance for initial test programs in this area is desirable. For example, some applicants have not construed this provision of Regulatory Guide 1.68 to include demonstration of reactor trip capability from outside the control room, but only maintenance of the hot standby condition. Further guidance has also been required to clarify the role of additional personnel located in the control room during the demonstration, whose function would be to perform non-safety-related activities that would not be required during an actual emergency shutdown. Finally, no initial startup test programs reviewed to date have included provisions to fully demonstrate the requirements of the second part of paragraph two of GDC 19, namely, the potential for cold shutdown from outside the control room. This last provision is of considerable importance since demonstration of this capability lends the added assurance that, in the event a fire or other event causes the control room to become

[1] The term "hot shutdown" used in GDC 19 corresponds to the term "hot standby" as defined in the Standard Technical Specifications. The term "hot standby" will be used in this guide. "Cold shutdown" is also defined in the Standard Technical Specifications.

* Lines indicate substantive changes from previous issue.

unusable for an indeterminate length of time, no danger to the health and safety of the public from potential loss of controlled residual heat removal capability would result. Although it is considered that the likelihood of large-scale control room damage from any postulated event is very small, the "defense-in-depth" concept practiced in the design, testing, and inspection of nuclear power plants (specifically, in the case of remote shutdown capability, as set forth in GDC 19) mandates that all practical steps be taken to ensure that the plant can be maintained in a safe condition at all times, even in the event of highly unlikely, but foreseeable, incidents.

The NRC staff has thus concluded that additional guidance should be provided regarding the scope of testing, documentation of procedures, and the reporting of test results pertaining to demonstration of remote shutdown capability. The purpose of the demonstration is threefold: (1) to demonstrate that the design of the plant is adequate to meet the requirements of GDC 19; (2) to demonstrate that the procedures to be used in performing the shutdown from outside the control room are sufficiently clear and comprehensive and that the operating personnel are familiar with their application; and (3) to demonstrate that the number of personnel available to conduct the shutdown operation is sufficient to perform the many actions required by the procedure in a timely, coordinated manner.

C. REGULATORY POSITION

Licensees of water-cooled nuclear power plants should develop and conduct a test program to demonstrate remote shutdown capability for each unit of their plants. The test program should contain the following elements:

1. Objectives

a. Verification that the nuclear power plant can be safely shut down from outside the control room.

b. Verification that the nuclear power plant can be maintained in a hot standby condition from outside the control room.

c. Verification that the nuclear power plant has the potential for being safely cooled from hot standby to cold shutdown conditions from outside the control room.

2. Prerequisites

a. Approved operating procedures for performing a remote shutdown should be available, including approved procedures for conducting the test.

b. Communications should exist between the control room observers and the remote shutdown locations.

c. The authority and responsibility of the control room observers should be established and documented in the test procedure. Provision should be made for the following actions:

(1) Assumption of control of the plant if an emergency or unsafe condition develops during the testing that cannot be managed by the shutdown crew.

(2) Performance of non-safety-related activities that would not be required during an actual remote shutdown. These could include protection of non-safety-related equipment from mechanical damage during the transient and the placement of equipment into standby status when no longer required. Such activities should have been previously defined and evaluated to ensure that, if they were not performed during an actual remote shutdown, safe shutdown of the plant could still be achieved. Any activities in addition to these should be recorded and reviewed subsequent to the test to assess their impact on the validity of the total test performance.

d. Preoperational testing of plant instrumentation, controls, and systems to be used at remote shutdown locations should have been completed. This preoperational testing should have included verification that all systems to be used during shutdown operation from outside the control room are operable in the manner in which they would be used during the operation (i.e., control from remote stations, manual operation, use of available power supplies, etc.) and that communication could be established and maintained among the personnel who will be performing the shutdown operation. Additionally, if applicable to the plant design, verification should have been made that control of transferred components from the main control room is not possible after control of these components from the remote shutdown stations has been established. Much of this verification can be done in conjunction with other tests, such as individual system or component preoperational tests. If successfully completed, these verification tests need not be repeated.

3. Hot Standby Demonstration Procedure

The test should be initiated from a location outside the control room with the reactor at a moderate power level (10-25%) sufficiently high that plant systems are in the normal configuration with the turbine-generator in operation. The test should be performed with the minimum of personnel required to be at the reactor unit at any one time (minimum shift crew). Data should be obtained at locations outside the control room to verify:

a. That the plant has achieved hot standby status.

b. That the plant can be maintained at stable hot standby conditions for at least 30 minutes.

During the demonstration, only that equipment for which credit would be taken in performing an actual remote shutdown should be used.

4. Cold Shutdown Demonstration Procedure

The demonstration of cold shutdown capability need not necessarily be performed immediately following the demonstration of achieving and maintaining safe hot standby from outside the control room. Rather, this cooldown portion of the test may be combined with another startup test requiring the reactor to be cooled down, as long as the procedures and acceptance criteria for the combined test meet all the elements of each individual test.

The licensee should demonstrate a potential capability for cold shutdown by partially cooling down the plant from the hot standby condition using controls and instrumentation located outside the control room. This cooldown demonstration may be accomplished using additional personnel who could be made available to the unit prior to the time that cooldown would have to be initiated. The number and level of such personnel should be established by each applicant in the remote shutdown procedure. The test should demonstrate that:

a. The reactor coolant temperature and pressure can be lowered sufficiently to permit the operation of the core decay heat removal system that is to be ultimately used to place the reactor in a refueling shutdown mode.

b. Operation of this decay heat removal system can be initiated and controlled.

c. A heat transfer path to the ultimate heat sink can be established.

d. Reactor coolant temperature can be reduced approximately 50°F using this decay heat removal system at a rate that would not exceed technical specification limits. This cooldown should show that the potential for achieving cold shutdown from outside the control room is available.

During the demonstration, only that equipment for which credit would be taken to perform an actual remote shutdown should be used.

5. Reporting

See Regulatory Position 9 in Regulatory Guide 1.68 for a listing of the information that should be included for this test in the startup report.

D. IMPLEMENTATION

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

This guide reflects current NRC staff practice. Therefore, 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 is being and will continue to be used in the evaluation of submittals for operating license or construction permit applications until this guide is revised as a result of suggestions from the public or additional staff review.