



DRAFT REGULATORY GUIDE

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DRAFT REGULATORY GUIDE DG-1236 (Proposed Revision 2 of Regulatory Guide 1.68.2, dated July 1978)

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

A. INTRODUCTION

This guide describes an initial startup test program acceptable to the staff of the U.S. Nuclear Regulatory Commission (NRC) for demonstrating hot shutdown capability and the potential for cold shutdown from outside the control room. This guide is applicable to water-cooled nuclear power plants.

Title 10, of the *Code of Federal Regulations*, Part 50, “Domestic Licensing of Production and Utilization Facilities” (10 CFR Part 50) (Ref. 1), and 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants” (Ref. 2), 10 CFR 50.34, “Contents of Applications; Technical Information,” and 10 CFR 52.79, “Contents of Application; Technical Information in Final Safety Analysis Report,” require, in part, that an applicant for a license to operate a production or utilization facility provide a safety analysis report that includes the principal design criteria for the proposed facility. The introduction to Appendix A, “General Design Criteria for Nuclear Power Plants,” to 10 CFR Part 50 states that these principal design criteria are to establish the necessary design, fabrication, construction, testing, and performance requirements for structures, systems, and components (SSCs) important to safety (i.e., SSCs that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public).

Criterion 1, “Quality Standards and Records,” of Appendix A to 10 CFR Part 50, 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 and Fuel Reprocessing Plants,” to 10 CFR Part 50 requires that a program be established to ensure that all testing necessary to demonstrate that SSCs will perform satisfactorily in service be identified and

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 final staff review or approval and does not represent an official NRC final 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 Rulemaking and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; e-mailed to nrcprep_resource@nrc.gov; submitted through the NRC’s interactive rulemaking Web page at <http://www.nrc.gov>; or faxed to (301) 492-3446. Copies of comments received may be examined at the NRC’s Public Document Room, 11555 Rockville Pike, Rockville, MD. Comments will be most helpful if received by October 9, 2009.

Electronic copies of this draft regulatory guide are available through the NRC’s interactive rulemaking Web page (see above); the NRC’s public Web site under Draft Regulatory Guides in the Regulatory Guides document collection of the NRC’s Electronic Reading Room at <http://www.nrc.gov/reading-rm/doc-collections/>; and the NRC’s Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>, under Accession No. ML091210435.

conducted. General Design Criterion (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 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 Test Programs for Water-Cooled Nuclear Power Plants” (Ref. 3), describes a method acceptable to the NRC staff for complying with its regulations with regard to preoperational and initial startup testing of nuclear power plant SSCs. Part of Regulatory Guide 1.68 states that both of the requirements of GDC 19 should be demonstrated as part of the initial startup test program.

The NRC issues regulatory guides to describe to the public methods that the staff considers acceptable for use in implementing specific parts of the agency’s regulations, to explain techniques that the staff uses in evaluating specific problems or postulated accidents, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations, and compliance with them is not required.

This regulatory guide contains information collection requirements covered by 10 CFR Part 50 that the Office of Management and Budget (OMB) approved under OMB control number 3150-0011. The NRC may neither conduct nor sponsor, and a person is not required to respond to, an information collection request or requirement unless the requesting document displays a currently valid OMB control number.

B. DISCUSSION

Background

The staff has identified the need for additional guidance on the startup test program and the role of additional personnel in the control room during testing. The startup test program should include a demonstration of both of the requirements of GDC 19 (i.e., the ability of equipment outside the control room to (1) safely shut down the reactor, bring it to a hot shutdown condition, and maintain the unit in a safe condition during the hot shutdown, and (2) bring the reactor to a cold shutdown condition).

The ability to bring the reactor to a cold shutdown from outside the control room 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 unusable for an indeterminate length of time, no danger to the health and safety of the public would result from the potential loss of controlled residual heat removal capability. Although the likelihood of large-scale control room damage from any postulated event is considered to be 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 licensees take all practical steps 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 role of additional personnel in the control room during testing is discussed in Regulatory Position 3 below. The staff has determined that licensees should perform the test with the minimum of personnel required to be at the reactor unit at any one time. The number of personnel in the control room may exceed the minimum shift complement, as specified in 10 CFR 50.54(m), and the minimum complement of personnel who are not licensed operators, as required by unit technical specifications,

provided the additional personnel perform nonsafety-related activities that would not be required during an actual emergency shutdown.

Additional Guidance

The NRC staff has concluded that additional guidance should be provided regarding the scope of testing, the documentation of procedures, and the reporting of test results pertaining to the demonstration of remote shutdown capability. The purpose of the guidance is threefold:

1. demonstrate that the design of the plant is adequate to meet the requirements of GDC 19,
2. 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. 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

The regulations in GDC 19 and Criterion XI require licensees of water-cooled nuclear power plants to develop and conduct a test program to demonstrate remote shutdown capability for each unit. The test program should contain the following elements:

1. Objectives
 - a. Verify that the nuclear power plant can be safely shut down from outside the control room.
 - b. Verify that the nuclear power plant can be maintained in a hot shutdown condition from outside the control room.
 - c. Verify that the nuclear power plant can be safely cooled from hot shutdown 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. Licensees should make provisions for the following:
 - (1) Assume control of the plant if an emergency or unsafe condition develops during the testing that cannot be managed by the shutdown crew.

- (2) Perform nonsafety-related activities that would not be required during an actual remote shutdown. These could include the protection of nonsafety-related equipment from mechanical damage during the transient and the placement of equipment into shutdown status when no longer required. Licensees should have previously defined and evaluated such activities to ensure that, if they were not performed during an actual remote shutdown, safe shutdown of the plant could still be achieved. Any additional activities should be recorded and reviewed following the test to assess their impact on the validity of the total test performance. Individuals in addition to those comprising the minimum shift crew described in Regulatory Position 3 may carry out these activities.
- d. Licensees should have completed preoperational testing of plant instrumentation, controls, and systems to be used at remote shutdown locations. This preoperational testing should include 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) and that communication could be established and maintained among the personnel who will be performing the shutdown operation. In addition, if applicable to the plant design, licensees should verify that it is not possible to control transferred components from the control room after control of these components has been established at the remote shutdown locations. Licensees can verify much of this in conjunction with other tests, such as preoperational tests on individual systems or components. Once successfully completed, these verification tests need not be repeated.

3. Hot Shutdown Demonstration Procedure

Licensees should initiate the test from a location outside the control room with the reactor at a moderate power level (10–25 percent), sufficiently high that plant systems are in their normal configuration with the turbine generator in operation. Licensees should perform the test with the minimum of personnel required to be at the reactor unit at any one time (i.e., the minimum number of reactor operators and senior reactor operators onsite per shift, as required by 10 CFR 50.54(m) and the minimum complement of personnel who are not licensed operators, as required by unit technical specifications). Data obtained at locations outside the control room should verify:

- a. that the plant has achieved hot shutdown status, and
- b. that the plant can be maintained under stable hot shutdown conditions for at least 30 minutes.

During the demonstration, licensees should use only that equipment for which credit would be taken in performing an actual remote shutdown. Personnel in excess of the minimum requirements may be present, provided the additional personnel perform only nonsafety-related activities that would not be required during an actual emergency shutdown.

4. Cold Shutdown Demonstration Procedure

Licensees do not need to demonstrate cold shutdown capability immediately following the test to achieve and maintain a safe hot shutdown from outside the control room. Rather, licensees may combine this cooldown portion of the test 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 the plant's cold shutdown capability by partially cooling down the plant from the hot shutdown condition using controls and instrumentation located outside the control room. This cooldown demonstration may use additional personnel who could be made available to the unit before the time when the cooldown would have to be initiated. Each licensee should establish the number and level of such personnel 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. The reactor coolant temperature can be reduced approximately 28 degrees Celsius (50 degrees Fahrenheit) using this decay heat removal system, at a rate that would not exceed technical specification limits. This cooldown test should show that cold shutdown can be achieved from outside the control room.

During the demonstration, the licensee should use only that equipment for which credit would be taken to perform an actual remote shutdown. Personnel in excess of the minimum requirements may be present, provided the additional personnel perform only nonsafety-related activities that would not be required during an actual emergency shutdown.

5. Reporting

The licensee should retain the testing procedures and results from the hot and cold shutdown demonstration as part of the plant's historical record. In addition, the historical record should include a summary of the testing in a startup report, as discussed in Appendix A, "Technical Specifications," to Regulatory Guide 1.16, "Reporting of Operating Information." This summary should include the following information:

- a. a description of the method and objectives for each test;
- b. a comparison of applicable test data with the related acceptance criteria, including the systems' responses to major plant transients (such as reactor scram and turbine trip);
- c. a description of all design- and construction-related deficiencies discovered during testing, system modifications, the corrective actions required to correct those deficiencies, and the schedule for implementing these modifications and corrective actions, unless previously reported to the NRC;
- d. justification for the acceptance of systems or components that are not in conformance with design predictions or performance requirements; and
- e. conclusions regarding system or component adequacy.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC's plans for using this draft regulatory guide. The NRC does not intend or approve any imposition or backfit in connection with its issuance.

The NRC has issued this draft guide to encourage public participation in its development. The NRC will consider all public comments received in development of the final guidance document. In some cases, applicants or licensees may propose an alternative or use a previously established acceptable alternative method for complying with specified portions of the NRC's regulations. Otherwise, the methods described in this guide will be used in evaluating compliance with the applicable regulations for license applications, license amendment applications, and amendment requests.

REGULATORY ANALYSIS

Statement of Problem

Revision 1 of Regulatory Guide 1.68.2 was issued in July 1978. Staff experience and interaction with applicants since that time have identified deficiencies in the guide that should be corrected in a new revision. For example, some applicants did not understand that GDC 19 requires the licensee to demonstrate the ability to trip the reactor from outside the control room as well as maintain it in a safe condition during hot shutdown. Additionally, questions and comments from licensees identified the need for clarification on the role of additional personal in the control room during the testing. These individuals may be performing non-safety-related activities that would not be required during an actual emergency. Finally, many of the initial startup test programs submitted for review did not fully address the second requirement in GDC 19, namely, the ability to take a reactor from hot shutdown to 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 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.

Therefore, this regulatory guidance should be revised as follows:

1. The technical term "hot standby," as defined in the standard technical specifications, will be replaced with the technical term "hot shutdown," because the term "hot shutdown" is used in GDC 19, which is the regulation. This regulatory guide should use the same term, to be consistent with the regulation.
2. Regulatory Position Item 1.b. will be revised to read as follows: "Verify that the nuclear power plant can be maintained in a hot shutdown condition from outside the control room."
3. Regulatory Position 1.c. will be modified to read as follows: "Verify that the nuclear power plant can be safely cooled from hot shutdown to cold shutdown conditions from outside the control room."
4. Revision 1 of this guide stated that licensees should perform the hot shutdown demonstration with a minimum of personnel. Licensees requested clarification of the phrase "minimum of personnel." This guide will be revised to define "minimum of personnel" as the minimum onsite

complement of licensed operators required by 10 CFR 50.54(m). This guidance position allows the use of operators that are on site but may not have been required to be in the control room.

Objective

The objective of this revision is to provide clear and up-to-date guidance for developing and conducting a test program to demonstrate remote shutdown capability.

Alternative Approaches

The staff considered the following alternative approaches:

Do not revise Regulatory Guide 1.68.2.
Revise Regulatory Guide 1.68.2.

Alternative 1: Do Not Revise Regulatory Guide 1.68.2

Under this alternative, the staff would not revise this guidance, and the original version of this regulatory guide would be retained. This alternative is considered the baseline or “no action” alternative and, as such, involves no value or impact considerations.

Alternative 2: Revise Regulatory Guide 1.68.2

Under this alternative, the staff would revise Regulatory Guide 1.68.2, taking into consideration the technical language used in the regulations and this regulatory guide. The guide would be revised for consistency with the regulations and to clarify the definition of the term “minimum of personnel.” The terms “hot standby” and “hot shutdown” would be corrected and used consistently in the guide. The term “hot shutdown,” as used in GDC 19, corresponds to the term “hot standby,” as defined in the standard technical specifications. The term “hot shutdown” would be used in this guide to be consistent with the regulation. In addition, the guide would be revised to define the minimum shift crew as the minimum onsite complement of licensed operators, as required by 10 CFR 50.54(m).

The costs to the NRC would be the one-time cost of issuing the revised regulatory guide (which is expected to be relatively small), and licensees would incur little or no cost.

Conclusion

Based on this regulatory analysis, the NRC staff recommends the revision of Regulatory Guide 1.68.2.

REFERENCES¹

1. 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” U.S. Nuclear Regulatory Commission, Washington, DC.
2. 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants,” U.S. Nuclear Regulatory Commission, Washington, DC.
3. Regulatory Guide 1.16, “Reporting of Operating Information,” U.S. Nuclear Regulatory Commission, Washington DC.
4. Regulatory Guide 1.68, “Initial Test Programs for Water-Cooled Nuclear Power Plants,” U.S. Nuclear Regulatory Commission, Washington DC.

¹ Publicly available NRC-published documents, such as Regulations, Regulatory Guides, NUREGs, and Generic Letters, listed herein are available electronically through the Electronic Reading Room on the NRC’s public Web site at: <http://www.nrc.gov/reading-rm/doc-collections/>. Copies are also available for inspection or copying for a fee from the NRC’s Public Document Room (PDR) at 11555 Rockville Pike, Rockville, MD; the mailing address is USNRC PDR, Washington, DC 20555; telephone 301-415-4737 or (800) 397-4209; fax (301) 415-3548; and e-mail PDR.Resource@nrc.gov.