



U.S. NUCLEAR REGULATORY COMMISSION  
**STANDARD REVIEW PLAN**  
OFFICE OF NUCLEAR REACTOR REGULATION

SECTION 14.2 INITIAL PLANT TEST PROGRAM - FINAL SAFETY ANALYSIS REPORT

REVIEW RESPONSIBILITIES

Primary - Procedures and Test Review Branch (PTRB)

Secondary - None

I. AREAS OF REVIEW

The PTRB reviews items 1 through 8 below, relating to initial plant test programs, described in Chapter 14 of the final safety analysis report (FSAR) submitted by the applicant as part of its operating license (OL) application.

1. Summary of Test Program and Objectives

The summary descriptions for each major phase of the test program and the specific objectives for each major phase are reviewed.

2. Test Procedures

The system the applicant will use to develop, review, and approve individual test procedures is reviewed. The responsibilities of the organizational units that will perform these activities, the designated functions of each organizational unit, and the general steps to be followed in conducting these activities are reviewed. The type and source of design performance information that will be, or is being, used in the development of detailed test procedures is reviewed. The format for the test procedures is also reviewed.

3. Test Programs' Conformance with Regulatory Guides

The applicant's plans pertaining to conformance with regulatory guides applicable to initial test programs (see subsection V) are reviewed to establish the extent of conformance. Exceptions to regulatory positions in applicable regulatory guides are reviewed, along with the justification provided, for each guide.

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USNRC STANDARD REVIEW PLAN

Standard review plans are prepared for the guidance of the Office of Nuclear Reactor Regulation staff responsible for the review of applications to construct and operate nuclear power plants. These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required. The standard review plan sections are keyed to the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants. Not all sections of the Standard Format have a corresponding review plan.

Published standard review plans will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience.

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20555.

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4. Utilization of Reactor Operating and Testing Experiences in the Development of the Test Program

A summary of the principal conclusions or findings from the applicant's review of operating and testing experiences at other reactor facilities and their effect on the test program are reviewed.

5. Trial Use of Plant Operating and Emergency Procedures

The information pertaining to how, and to what extent, the plant operating, emergency, and surveillance procedures will be use-tested during the test program is reviewed. This will include operator training described in TMI Action Plan Item I.G.1, described in NUREG-0660 and NUREG-0737.

6. Initial Fuel Loading and Initial Criticality

The procedures that will guide initial fuel loading and initial criticality, including the prerequisites and precautionary measures to be used to assure safety, are reviewed.

7. Test Program Schedule and Sequence

The schedule for conducting each phase of the testing program relative to the fuel loading date, is reviewed. Information pertaining to anticipated schedule overlap of the test program with test program schedules for any other reactor facilities at the site is reviewed. The sequence for conducting the tests planned for the startup test phase is reviewed. The time available between approval of testing procedures and their intended use is reviewed.

8. Individual Test Descriptions

The individual test abstracts for each test phase are reviewed to establish the degree of conformance with applicable tests identified in Regulatory Guide 1.68, other applicable regulatory guides, and other special testing requirements for the facility, including those identified for special or unique plant features. The objectives for each test, summary of prerequisites and test method, and specific acceptance criteria for each test are reviewed to establish that the functional adequacy of those structures, systems, or components involved will be verified.

The PTRB reviews the information provided to assure that the test objectives, test methods, and the acceptance criteria are acceptable and consistent with the design requirements for the facility. Certain tests, such as those for the reactor containment system, the electrical power systems, and the emergency core cooling systems are reviewed by those branches responsible for reviewing the design of that system. In some cases, special tests may be required to verify the adequacy of the design. The PTRB will maintain a list of all special test requirements and all tests that are reviewed wholly or in part by other branches. The PTRB is responsible for ensuring that all initial plant tests are reviewed in accordance with this SRP section and will provide the coordination and supplementary review necessary to accomplish a complete review of all initial plant tests including those that may be referenced in a standard plant design.

## II. ACCEPTANCE CRITERIA

PTRB acceptance criteria are based on meeting the relevant requirements of the following regulations:

1. 10 CFR Part 30, §30.53 as it relates to testing radiation detection equipment and monitoring instruments.
2. 10 CFR Part 50, §50.34(b)(6)(iii) as it relates to the licensee providing information associated with preoperational testing and initial startup operations.
3. 10 CFR Part 50, Appendix B, Section XI as it relates to test programs to demonstrate that structures, systems, and components will perform satisfactorily.
4. 10 CFR Part 50, Appendix J, Section III.A.4 as it relates to the pre-operational leakage rate testing of the reactor primary containment building.

Regulatory Guide 1.68 provides information, recommendations and guidance, and in general describes a basis acceptable to the staff that may be used to implement the requirements of the regulations identified above. In addition, the following list of Regulatory Guides provides more detailed information pertaining to the test called for in Regulatory Guide 1.68 and this supplementary information is used to help determine whether the objectives of certain plant tests are likely to be accomplished by performing the test in the proposed manner.

- a. Regulatory Guide 1.18, "Structural Acceptance Test for Concrete Primary Reactor Containments."
- b. Regulatory Guide 1.20, "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing."
- c. Regulatory Guide 1.30, "Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment (Safety Guide 30)."
- d. Regulatory Guide 1.37, "Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water-Cooled Nuclear Power Plants."
- e. Regulatory Guide 1.41, "Preoperational Testing of Redundant Onsite Electric Power Systems to Verify Proper Load Group Assignments."
- f. Regulatory Guide 1.52, "Design, Testing, and Maintenance Criteria for Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants."
- g. Regulatory Guide 1.56, "Maintenance of Water Purity in Boiling Water Reactors."

- h. Regulatory Guide 1.72, "Spray Pond Piping Made from Fiberglass-Reinforced Thermosetting Resin."
- i. Regulatory Guide 1.79, "Preoperational Testing of Emergency Core Cooling Systems for Pressurized Water Reactors."
- j. Regulatory Guide 1.80, "Preoperational Testing of Instrument Air Systems."
- k. Regulatory Guide 1.95, "Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release."
- l. Regulatory Guide 1.108, "Periodic Testing of Diesel Generators Used as Onsite Electric Power Systems at Nuclear Power Plants."
- m. Regulatory Guide 1.116, "Quality Assurance Requirements for Installation, Inspection, and Testing of Mechanical Equipment and Systems."
- n. Regulatory Guide 1.128, "Installation Design and Installation of Large Lead Storage Batteries for Nuclear Power Plants."
- o. Regulatory Guide 1.139, "Guidance for Residual Heat Removal (For Comment)."
- p. Regulatory Guide 1.140, "Design, Testing, and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants."

Specific criteria necessary to meet the relevant requirements of §30.53, §50.34, and Appendices B and J to 10 CFR Part 50 are as follows:

1. Summary of Test Program and Objectives

The applicant's description should establish that the major phases of the program and the objectives for each phase are consistent with the general guidelines and applicable regulatory positions contained in Regulatory Guide 1.68 or the justification provided for any exceptions should be found to be acceptable by the reviewer.

2. Test Procedures

The format for the test procedures should be similar to the format contained in Regulatory Guide 1.68 or the justification for exceptions should be found to be acceptable by the reviewer.

3. Test Program's Conformance with Regulations and Regulatory Guides

The applicant should establish and describe an initial test program that is consistent with regulatory positions in Regulatory Guide 1.68. If exceptions to regulatory positions are taken, the applicant should specifically identify all exceptions, and provide suitable justification. Exceptions to regulatory positions will be reviewed for acceptability on a case-by-case basis. The applicant should address all applicable regulatory guides and identify them by guide number and revision number.

4. Utilization of Reactor Operating and Testing Experiences in the Development of the Test Program

The applicant's review of operating and testing experiences at other facilities should have recognized categories of reportable occurrences that are repeatedly being experienced and other operating experiences of safety concern. The applicant should describe how this was utilized in its initial test program.

5. Trial Use of Plant Operating and Emergency Procedures

The applicant should incorporate the plant operating, emergency, and surveillance procedures into the test program or otherwise verify these procedures through use to the extent practicable during the test program. In addition to verifying the adequacy of plant operating and emergency procedures to the extent practicable during the startup program, the licensee shall also provide additional operator training during the performance of certain initial tests. This will include training for plant cooldown by means of natural circulation. An acceptable program will satisfy the requirements described in TMI Action Plan Item I.G.1 of NUREG-0660, NUREG-0694, and NUREG-0737.

6. Initial Fuel Loading and Initial Criticality

The procedures that will guide initial fuel loading and initial criticality should include precautions, prerequisites, and measures consistent with the guidelines and regulatory positions contained in Regulatory Guide 1.68 or exceptions should be found to be acceptable by the reviewer.

7. Test Program Schedule and Sequence

- a. At least nine months should be allowed for conducting preoperational testing.
- b. At least three months should be allowed for conducting startup testing including fuel loading, low power tests, and power ascension tests.
- c. Overlapping test program schedules (for multi-unit sites) should not result in significant divisions of responsibilities or dilutions of the staff provided to implement the test program.
- d. The sequential schedule for individual startup tests should establish, insofar as practicable, that test requirements will be completed prior to exceeding 25% power for all plant structures, systems, and components that are relied upon to prevent, to limit, or to mitigate the consequences of postulated accidents.

The schedule should also establish that, insofar as practicable, testing will be accomplished as early in the test program as feasible and that the safety of the plant will not be totally dependent on the performance of untested systems, components, or features.

- e. Approved test procedures should be in a form suitable for review by regulatory inspectors at least 60 days prior to their intended use, and for fuel loading and startup test procedures, at least 60 days prior to fuel loading.

### 8. Individual Test Descriptions/Abstracts

The applicant should provide abstracts of planned tests for structures, systems, components, and design features that will provide assurance of testing of those items that meet any of the criteria listed below. Abstracts should be provided for those structures, systems, components or design features that:

- a. Will be used for safe shutdown and cooldown of the reactor under normal plant conditions and for maintaining the reactor in a safe condition for an extended shutdown period; or
- b. Will be used for safe shutdown and cooldown of the reactor under transient (infrequent or moderately frequent events) conditions and postulated accident conditions and for maintaining the reactor in a safe condition for an extended shutdown period following such conditions; or
- c. Will be used for establishing conformance with safety limits or limiting conditions for operation that will be included in the facility technical specifications; or
- d. Are classified as engineered safety features or will be used to support or ensure the operations of engineered safety features within design limits; or
- e. Are assumed to function or for which credit is taken in the accident analysis for the facility, as described in the FSAR; or
- f. Will be used to process, store, control, measure, or limit the release of radioactive materials.

The abstracts should include objectives, prerequisites, test methods, significant parameters and plant performance characteristics to be monitored, and acceptance criteria in sufficient detail to establish that the functional adequacy of structures, systems, components, and design features will be demonstrated by tests.

If the method for testing of a structure, system, or component will not subject the item or system under test to representative design operating conditions, the test abstract should contain sufficient information to justify the test method to be used.

### III. REVIEW PROCEDURES

Preparation for the review of Chapter 14 of the FSAR should include the following:

1. Review of the Commission's Safety Evaluation Report that was issued upon review of the Construction Permit application. This review is conducted for the purpose of familiarization with the principal design criteria for the facility and to identify any specific staff or ACRS concerns or unique design features that may warrant special test consideration.
2. Review of Chapters 1 through 12 of the FSAR for the purpose of familiarization with the facility design and the nomenclature that is applied to structures, systems, and components within the facility.
3. Review of Chapter 13 of the FSAR for the purpose of familiarization with the applicant's organizational structure, qualifications, and administrative controls as these apply to or impact on the initial test program.
4. Review of Chapter 15 of the FSAR to identify assumptions pertaining to performance characteristics that can and should be verified by testing and to identify all structures, systems, components, and design features that are assumed to function (either explicitly or implicitly) in the accident analysis that can and should be tested.
5. Review the results of studies by AEOD and OEEB of Licensee Event Reports for operating reactors of similar design to identify potentially serious events and chronic or generic problems that warrant special test consideration. Computerized information on Licensee Event Reports can be obtained through the Office of Management and Program Analysis.
6. Review of the Standard Technical Specifications for the type facility to identify all structures, systems, and components that will be relied upon for establishing conformance with safety limits or limiting conditions for operation.
7. The reviewer should be familiar with the results of startup tests for reactors of similar design (reported to the Commission in Startup Test Reports) to assure that problem areas will be appropriately factored into the review of the initial test program.
8. The reviewer should be familiar with regulatory guides that are applicable to initial test programs.

The review consists of comparison of the information in Chapter 14 or, if applicable, other chapters in the FSAR with the acceptance criteria provided in subsection II above. Each element of the SAR information is to be reviewed against this SRP section. Although plant test programs are not rigidly fixed, experience has shown that certain elements are common to and necessary for all plants. The reviewer's judgment during the review is to be based on an inspection of the material presented, whether items of special safety significance are involved, and the magnitude and uniqueness of the project. The reviewer should recognize that certain structures, systems, and components are more important to safety than others. The review of individual tests should be conducted in a graded manner to assure that the most emphasis is placed on structures, systems, and components that are considered to be engineered safety features. Any exceptions or alternatives are to be carefully reviewed to assure that they are clearly defined and that an adequate basis exists for acceptance. Coordination of the review with the assigned reviewer for Chapter 13

may be necessary for item 3 with the project manager and other branches as deemed necessary by the reviewer. In general, the appropriate branch will be requested by the PTRB to review proposed testing for special, unique, or first-of-a-kind design features to establish the adequacy of proposed testing including the validity of test methods. The PTRB reviewer is responsible for review and evaluation of all subsequent amendments to the FSAR up to the time the Operating License is issued to assure that any changes in design or commitments that impact on the initial test program continue to satisfy the acceptance criteria described in subsection II above.

#### IV. EVALUATION FINDINGS

When the review of the information in the FSAR is complete and the reviewer has determined that it is satisfactory and in accordance with the acceptance criteria in subsection II above, a statement of the following type should be provided for the staff's Safety Evaluation Report:

The staff concluded that the initial plant test program is acceptable and meets the following requirements: 10 CFR Part 30, §30.53 with regard to initial testing of radiation detection and monitoring instruments; 10 CFR Part 50, §50.34(b)(6)(iii) that requires inclusion of plans for pre-operational testing and initial operations in the FSAR; 10 CFR Part 50, Appendix B, Section XI that requires a test program to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents; and 10 CFR Part 50, Appendix J, Section III.A.4 that requires a preoperational measurement of the overall integrated leak-tightness of the primary reactor containment building under specified pressure conditions.

The staff has reviewed the information provided in the Final Safety Analysis Report on the applicant's test program in accordance with SRP Section 14.2. This review included an evaluation of: (1) The applicant's requirements pertaining to the trial-use of plant operating and emergency procedures during the test program; (2) the schedule for conducting the test program; (3) the sequence of startup testing to be followed; (4) the methods for conducting individual tests and the acceptance criteria to be used in evaluating the test results for plant structures, systems, and components; and (5) the test programs' conformance with applicable regulations, regulatory guides, and TMI requirements. The review also included an evaluation of the results of the applicant's review of reactor plant operating experiences, conducted to determine where improvement or emphasis was warranted in the initial test program. The staff has concluded that the information provided in the application meets the acceptance criteria in Section 14.2 of the SRP and describes an acceptable initial test program, the successful completion of which will demonstrate the functional adequacy of plant structures, systems, and components.

#### V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP section.

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 by the staff in its evaluation of conformance with Commission regulations.

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides and NUREGs.

## VI. REFERENCES

1. Regulatory Guide 1.68, "Initial Test Programs for Water-Cooled Reactor Power Plants."
2. Regulatory Guide 1.68.1, "Preoperational and Initial Startup Testing of Feedwater and Condensate Systems for Boiling Water Reactor Power Plants."
3. Regulatory Guide 1.68.2, "Initial Startup Test Program to Demonstrate Remote Shutdown Capability for Water-Cooled Nuclear Power Plants."
4. Regulatory Guide 1.18, "Structural Acceptance Test for Concrete Primary Reactor Containments."
5. Regulatory Guide 1.20, "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing."
6. Regulatory Guide 1.30, "Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment (Safety Guide 30)."
7. Regulatory Guide 1.37, "Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water-Cooled Nuclear Power Plants."
8. Regulatory Guide 1.41, "Preoperational Testing of Redundant Onsite Electric Power Systems to Verify Proper Load Group Assignments."
9. Regulatory Guide 1.52, "Design, Testing, and Maintenance Criteria for Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants."
10. Regulatory Guide 1.56, "Maintenance of Water Purity in Boiling Water Reactors."
11. Regulatory Guide 1.72, "Spray Pond Piping Made from Fiberglass-Reinforced Thermosetting Resin."
12. Regulatory Guide 1.79, "Preoperational Testing of Emergency Core Cooling Systems for Pressurized Water Reactors."
13. Regulatory Guide 1.80, "Preoperational Testing of Instrument Air Systems."
14. Regulatory Guide 1.95, "Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release."
15. Regulatory Guide 1.108, "Periodic Testing of Diesel Generators Used as Onsite Electric Power Systems at Nuclear Power Plants."

16. Regulatory Guide 1.116, "Quality Assurance Requirements for Installation, Inspection, and Testing of Mechanical Equipment and Systems."
17. Regulatory Guide 1.128, "Installation Design and Installation of Large Lead Storage Batteries for Nuclear Power Plants."
18. Regulatory Guide 1.139, "Guidance for Residual Heat Removal."
19. Regulatory Guide 1.140; "Design, Testing, and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants."
20. 10 CFR Part 30, §30.53, "Tests."
21. 10 CFR Part 50, §50.34, "Contents of Applications; Technical Information."
22. 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."
23. 10 CFR Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water Cooled Power Reactors."
24. NUREG-0660, "NRC Action Plan Developed as a Result of the TMI-2 Accident."
25. NUREG-0694, "TMI-Related Requirements for New Operating Licensees."
26. NUREG-0737, "Clarification of TMI Action Plan Requirements."