

## 14. VERIFICATION PROGRAMS

This chapter of the Safety Analysis Report (SAR) should provide information on the initial test program for structures, systems, components, and design features for both the nuclear portion of the plant and the balance of the plant. The information provided should address major phases of the test program, including preoperational tests, initial fuel loading and initial criticality, low-power tests, and power-ascension tests. The SAR should describe the scope of the combined license applicant's initial test program. The SAR should also describe the combined license applicant's general plans for accomplishing the test program in sufficient detail to show that due consideration has been given to matters that normally require advance planning. The SAR should describe the technical aspects of the initial test program in sufficient detail to show that the test program will adequately verify the functional requirements of plant structures, systems, and components and that the sequence of testing is such that the safety of the plant will not be dependent on untested structures, systems, or components. The SAR should also describe measures which ensure that (1) the initial test program will be accomplished with adequate numbers of qualified personnel, (2) adequate administrative controls will be established to govern the initial test program, (3) the test program will be used, to the extent practicable, to train and familiarize the plant operating and technical staff in the operation of the facility, and (4) the adequacy of plant operating and emergency procedures will be verified, to the extent practicable, during the period of the initial test program.

This chapter of the SAR should also provide information on the inspections, tests, analyses and acceptance criteria (ITAAC) that the combined license applicant proposes to demonstrate that, when performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the Atomic Energy Act, and NRC regulations.

### 14.1 Specific Information To Be Addressed For The Initial Plant Test Program

An initial plant test program should be designed to include the relevant requirements of the following regulations:

- A. 10 CFR Part 30, §30.53 as it relates to testing radiation detection equipment and monitoring instruments.
- B. 10 CFR Part 50, §50.34(b)(6)(iii) as it relates to the applicant providing information associated with preoperational testing and initial operations.
- C. 10 CFR 50 Part 50, Appendix B, Section XI as it relates to test programs to demonstrate that structures, systems, and components (SSCs) will perform satisfactorily.
- D. 10 CFR Part 50, Appendix J, Section III.A.4 as it relates to the preoperational leakage rate testing of the reactor primary containment.
- E. 10 CFR Part 52, § 52.79 as it relates to preoperational testing and initial operations
- F. 10 CFR 52, Subparts as they relate to the ITAAC that need to be submitted by the applicant and reviewed by the NRC staff.

The combined license applicant should provide detailed information in Section 14.2 to address the following areas associated with the initial plant test program:

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- Summary of Test Program and Objectives
- Organization and Staffing
- Test Procedures
- Conduct of the Test Program
- Review, Evaluation, and Approval of Test Results
- Test Records
- Test Program's Conformance with Regulatory Guides
- Utilization of Reactor Operating and Testing Experiences in the Development of the Test Program
- Trial Use of Plant Operating and Emergency Procedures
- Initial Fuel Loading and Initial Criticality
- Test Program Schedule and Sequence
- Individual Test Descriptions

### 14.2 Initial Plant Test Program

#### 14.2.1 Summary of Test Program and Objectives

The SAR should describe how the initial test program will be applied to the nuclear portion as well as the balance-of-plant portion of the facility. The combined license applicant should describe the major phases of the initial test program and the specific objectives to be achieved for each major phase. The general prerequisites for each major phase should also be discussed.

The descriptions of the major phases of the program and the objectives should be demonstrated to be consistent with the general guidelines and applicable regulatory positions contained in Regulatory Guide 1.68 or justifications should be provided for any exceptions.

#### 14.2.2 Organization and Staffing

The combined license applicant should provide a description of the organizational units and any augmenting organizations or other personnel that will manage, supervise, or execute any phase of the test program. This description should discuss the organizational authorities and responsibilities, the degree of participation of each identified organizational unit and principal participants. The SAR should describe how, and to what extent, the applicant's plant operating and technical staff will participate in each major test phase. Information pertaining to the experience and qualification of supervisory personnel and other principal participants that will be responsible for management, development, or conduct of each test phase should be provided in this section. The applicant should develop a training program for each fundamental group in the organization relative to the scheduled for preoperational testing and initial startup testing to ensure necessary plant staff are ready for commencement of the test program.

#### 14.2.3 Test Procedures

The combined license applicant should describe the system that will be used to develop,

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review, and approve individual test procedures, including the organizational units or personnel that are involved in performing these activities and their responsibilities. The SAR should describe the designated functions of each organizational unit, and the general steps, including interface with other participants involved in the test program, to be followed in conducting these activities. The type and source of design performance requirements and acceptance criteria that will be, or is being, used in the development of detailed test procedures for testing plant structures, systems, and components should be described. Controls should be in place to ensure test procedures include appropriate prerequisites, test objectives, safety precautions, test initial conditions, methods to direct and control test performance, and the acceptance criteria by which the test is to be evaluated. The applicant should utilize system designers to provide the test objectives and acceptance criteria used in developing detailed test procedures. The participating system designers should include the nuclear steam supply system vendor, architect-engineer, and other major contractors, subcontractors, and vendors, as applicable. Test procedures should be developed and reviewed by personnel with appropriate technical backgrounds and experience. Final procedure review and approval will be performed by persons filling designated management positions within the applicants organization. The SAR should also describe the format of individual test procedures and should include a discussion that demonstrates the individual test procedure format to be similar to or consistent with the format contained in Regulatory Guide 1.68 or should include justifications for any exceptions. Approved test procedures will be in a form suitable review by the NRC staff at least 60 days prior to their intended use.

### 14.2.4 Conduct of Test Program

The combined license applicant should provide a description of the administrative controls that will govern the conduct of each major phase of the test programs. A description of the specific administrative controls that will be used to ensure that necessary prerequisites are satisfied for each major phase and for individual tests should also be provided. The SAR should describe the methods to be followed in initiating plant modifications or maintenance that are determined to be required by the test program. The description should include the methods that will be used to ensure retesting following such modifications or maintenance and the involvement of design organizations and the applicant in the review and approval of proposed plant modifications. In addition, the description should include methods to ensure retesting that is required for modifications or maintenance remains in compliance with ITAAC commitments. The administrative controls pertaining to adherence to approved test procedures during the conduct of the test program and the methods for effecting changes to approved test procedures should be described.

### 14.2.5 Review, Evaluation, and Approval of Test Results

The combined license applicant should provide a description of the specific controls to be established for the review, evaluation, and approval of test results for each major phase of the program by appropriate personnel/organization. The specific controls to be established to ensure notification of affected and responsible organizations or personnel when test acceptance criteria are not met and the controls established to resolve such matters should

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also be described. A discussion should be provided on the applicant's plans pertaining to (1) approval of test data for each major test phase before proceeding to the next test phase and (2) approval of test data at each power test plateau (during the power-ascension phase) before increasing power level. Provisions should be in place to retain test reports which include test procedures and results as part of the plant historical records. Startup test reports should be prepared in accordance with Reg. Guide 1.16.

### 14.2.6 Test Records

The combined license applicant should provide a description of their requirements pertaining to the disposition of test procedures and test data following completion of the test program.

### 14.2.7 Conformance of Test Programs with Regulatory Guides

The combined license applicant should provide a discussion of the initial test program that demonstrates consistency with the regulatory positions in Regulatory Guide 1.68. The combined license applicant should include a list of all those regulatory guides applicable to the development of the initial test programs. If the regulatory guidance is not followed, the SAR should identify any exceptions to the regulatory guidance and describe specific alternative methods along with justifications for their use.

Regulatory Guide 1.68 provides information, recommendations and guidance, and in general describes a basis acceptable to the NRC that may be used to implement the requirements of the regulations referenced in Section 14.1. In addition, the list of Regulatory Guides provided in Table 14.2-1 provides more detailed information pertaining to the tests called for in Regulatory Guide 1.68 and this supplementary information may be used to help determine whether the objectives of certain plant tests are likely to be accomplished by performing the tests in the proposed manner.

### 14.2.8 Utilization of Reactor Operating and Testing Experiences in Development of Test Program

The combined license applicant should provide a description of their program for reviewing available information on reactor operating and testing experiences and discuss how this information was used in the development of the initial test program. The sources and types of information reviewed, the conclusions or findings, and the effect of the program on the initial test program should be described.

The combined license applicant should provide a summary description of preoperational and/or startup testing that is planned for each unique or first-of-a-kind principal design feature that may be included in the facility design. The summary test descriptions should include the test method, test objective, and test frequency (e.g., first-plant-only test, first-three-plant tests, etc.) necessary to validate design or analysis assumptions. Justification for not including preoperational and/or startup testing for unique or first-of-a-kind design features shall be included in the combined license application. The combined license applicant shall provide

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information, as applicable, sufficient to credit previously performed testing for identical unique or first-of-a-kind design features at other NRC-licensed production facilities.

### 14.2.9 Trial Use of Plant Operating and Emergency Procedures

The combined license applicant should provide a schedule for development of plant procedures as well as a description of how, and to what extent, the plant operating, emergency, and surveillance procedures will be use-tested during the initial test program. In addition, the combined license applicant should identify the specific operator training to be conducted, as part of the use-testing, during the special low-power testing program related to the resolution of TMI Action Plan Item I.G.1, described in NUREG-0660, NUREG-0694, and NUREG-0737.

### 14.2.10 Initial Fuel Loading and Initial Criticality

The combined license applicant should describe the procedures that will guide initial fuel loading and initial criticality, including the prerequisites and precautionary measures to be established to ensure safe operation, consistent with the guidelines and regulatory positions contained in Reg. Guide 1.68. Prerequisites should include the successful completion of all ITAAC associated with preoperational tests prior to fuel load, adherence to technical specification requirements, and actions to be taken in the event of unanticipated errors or malfunctions.

### 14.2.11 Test Program Schedule

The combined license applicant should provide a schedule, relative to the fuel loading date, for conducting each major phase of the test program. If the schedule will overlap initial test program schedules for other reactors at the site, a discussion should be provided on the effects of such schedule overlaps on organizations and personnel participating in the initial test program. The sequential test schedule for testing individual plant structures, systems, and components should be provided. Each test required to be completed before initial fuel loading should be identified. In addition, each test required to be completed before initial fuel loading, or portion thereof, that is and/or designed to satisfy the requirements for completing ITAAC should be identified and cross-referenced by the COL applicant and provided with the COL application or be made available for audit during NRC review of the application.

The schedule for the development of test procedures for each major phase of the initial test program, including the anticipated time that will be available for review of the approved procedures by NRC field inspectors, prior to their use, should be discussed. The following guidance for test program scheduling and sequencing should be considered:

- 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.

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- 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 SSCs that are relied upon to prevent, or limit, or to mitigate the consequences of postulated accidents.

The schedule should 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.

### 14.2.12 Individual Test Descriptions

The combined license applicant should provide test abstracts for each individual test that will be conducted during the initial test program. Emphasis should be placed on structures, systems, and components (SSCs) and design features that:

(1) will be used for the 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

(2) will be used for the 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

(3) will be used for establishing conformance with safety limits or limiting conditions for operation that will be included in the facility technical specifications; or

(4) are classified as engineered safety features or will be used to support or ensure the operations of engineered safety features within design limits; or

(5) are assumed to function or for which credit is taken in the accident analysis for the facility, as described in the SAR; or

(6) will be used to process, store, control, measure, or limit the release of radioactive materials; or

(7) will be used in the special low power testing program to be conducted at power levels no

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greater than 5 percent for the purposes of providing meaningful technical information beyond that obtained in the normal startup test program as required for the resolution of TMI Action Plan Item I.G.1; or

(8) are identified as risk significant in the facility-specific probabilistic risk assessment.

The abstracts should identify each test by title, specify the prerequisites and major plant operating conditions necessary for each test (such as power level and mode of operation of major control systems), provide a summary description of the test objectives and method, significant parameters and plant performance characteristics to be monitored, and provide a summary of the acceptance criteria, for each test, that are established to ensure the functional adequacy of those SSCs involved in the test will be verified. The test abstract should contain sufficient information to justify the test method specified if such method does not subject the SSC under test to representative design operating conditions. In addition, test abstracts should identify precautions that are pertinent for individual tests, as necessary (e.g., minimum flow requirements or reactor power level that must be maintained).

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Table 14.2-1

Regulatory Guide References for Initial Plant Test Program

1. Regulatory Guide 1.9, "Selection, Design, and Qualification of Diesel-Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants."
2. Regulatory Guide 1.20, "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing."
3. Regulatory Guide 1.30, "Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment (Safety Guide 30)."
4. Regulatory Guide 1.37, "Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water-Cooled Nuclear Power Plants."
5. Regulatory Guide 1.41, "Preoperational Testing of Redundant Onsite Electrical Power Systems to Verify Proper Load Group Assignments."
6. 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."
7. Regulatory Guide 1.56, "Maintenance of Water Purity in Boiling Water Reactors."
8. Regulatory Guide 1.68, "Initial Test Programs for Water-Cooled Nuclear Power Plants"
8. Regulatory Guide 1.68.1, "Preoperational and Initial Startup Testing of Feedwater and Condensate Systems for Boiling Water Reactor Power Plants."
9. Regulatory Guide 1.68.2, "Initial Startup Test Program to Demonstrate Remote Shutdown Capability for Water-Cooled Nuclear Power Plants."
10. Regulatory Guide 1.68.3, "Preoperational Testing of Instrument and Control Air Systems."
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 1.95, "Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release."

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14. Regulatory Guide 1.108, "Periodic Testing of Diesel Generators Used as Onsite Electric Power Systems at Nuclear Power Plants."
15. Regulatory Guide 1.116, "Quality Assurance Requirements for Installation, Inspection, and Testing of Mechanical Equipment and Systems."
16. Regulatory Guide 1.128, "Installation Design and Installation of Large Lead Storage Batteries for Nuclear Power Plants."
17. Regulatory Guide 1.136, "Materials, Construction, and Testing of Concrete Containments (Articles CC-1000, -2000, and 4000 through 6000 of the "Code for Concrete Reactor Vessels and Containments")."
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."

### 14.3 Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)

The requirements of 10CFR52.80(b) specify that the contents of a combined license application must include the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria which are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act , and NRC regulations.

The combined license applicant should provide their proposed selection methodology and criteria for establishing the ITAAC which are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act , and NRC regulations. The combined license applicant should provide their proposed ITAAC as part of the COL application, however, ITAAC are not considered as part the of FSAR for the facility. Successful completion of all ITAAC is a pre-requisite for fuel load and a condition of the license. Therefore, following the Commission finding, in accordance with § 52.103(g), that the facility ITAAC have been successfully completed and fuel load is authorized, the ITAAC will no longer exist and the license condition will be satisfied. In recognition of the finite aspect of ITAAC, the COL application content requirements identify ITAAC in § 52.80 as additional technical required in the application.

Guidance for developing ITAAC for a COL application is contained in Section C.II.2 of this regulatory guide. The guidance assumes that the COL application does not reference a design that has been certified in accordance with 10 CFR Part 52, Subpart B. However, the guidance does recognize and discuss the format and content of ITAAC from previously certified designs as acceptable to the NRC.

Since COL applications may incorporate by reference early site permits (ESPs), design certification documents (DCDs), neither, or both, the scope of ITAAC development for a COL applicant will differ depending on which of these documents are referenced in the COL application. However, the COL applicant must propose a complete set of ITAAC that addresses the entire facility, including ITAAC on emergency planning and ITAAC on physical security hardware. Guidance specific to Emergency Planning ITAAC is provided in Section C.I.13.3 of this regulatory guide and guidance specific to Physical Security ITAAC is provided in Section C.I.13.6 of this regulatory guide. The complete set of facility ITAAC (or COL ITAAC) will be incorporated into the COL as a license condition, as discussed above, to be satisfied prior to fuel load. Guidance on ITAAC for COL applicants that reference an ESP, a DCD, or both is provided in Section C.III.7.