C.I.14 Verification Programs

In Chapter 14 of the FSAR, the COL applicant should provide information concerning its initial test program for SSCs and design features for both the nuclear portion of the facility and the balance of 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. In so doing, the COL applicant should describe the scope of the initial test program as well as its general plans for accomplishing the test program in sufficient detail to demonstrate that due consideration has been given to matters that normally require advance planning.

The COL applicant should also describe the technical aspects of the initial test program in sufficient detail to show that (1) the test program adequately verifies the functional requirements of plant SSCs and (2) the sequence of testing is such that the safety of the plant does not depend on untested SSCs. In addition, the COL applicant should describe measures to ensure that (1) the initial test program is accomplished with adequate numbers of qualified personnel, (2) adequate administrative controls will be established to govern the initial test program, (3) the test program is used, to the extent practicable, to train and familiarize the plant's operating and technical staff in the operation of the facility, and (4) the adequacy of plant operating and emergency procedures is verified, to the extent practicable, during the period of the initial test program.

In Chapter 14 of the FSAR, the COL applicant should also provide information on the ITAAC that it proposes to demonstrate that, when the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformance with the COL, the Atomic Energy Act, and NRC regulations.

C.I.14.1 Specific Information To Be Addressed for the Initial Plant Test Program

The design of the COL applicant's initial plant test program should address the relevant requirements of the following regulations:

- 10 CFR 30.53, "Tests," as it relates to testing radiation detection equipment and monitoring instruments
- 10 CFR 50.34(b)(6)(iii), as it relates to providing information associated with preoperational testing and initial operations
- Section XI of Appendix B to 10 CFR Part 50, as it relates to test programs to demonstrate that SSCs will perform satisfactorily
- Section III.A.4 of Appendix J to 10 CFR Part 50, as it relates to preoperational leakage rate testing of the reactor primary containment
- 10 CFR 52.79
- Subpart A, Subpart B, and Subpart C of 10 CFR Part 52 ,as they relate to the ITAAC that the applicant must submit.

C.I.14.2 Initial Plant Test Program

In Section 14.2 of the FSAR, the COL applicant should provide detailed information to address the following 12 areas associated with the initial plant test program:

(1) summary of test program and objectives
(2) organization and staffing
(3) test procedures
(4) conduct of the test program
(5) review, evaluation, and approval of test results
(6) test records
(7) test program's conformance with regulatory guides
(8) utilization of reactor operating and testing experiences in test program development
(9) trial use of plant operating and emergency procedures
(10) initial fuel loading and initial criticality
(11) test program schedule and sequence
(12) individual test descriptions

C.I.14.2.1 ***Summary of Test Program and Objectives***

The COL applicant should describe how the initial test program is applied to the nuclear portion of the facility as well as the balance of plant. In so doing, the COL applicant should describe the major phases of the initial test program as well as the general prerequisites and specific objectives to be achieved for each phase. The descriptions of the major phases and their objectives should be consistent with the general guidelines and applicable regulatory positions contained in RG 1.68. Applicants should justify any exceptions.

C.I.14.2.2 ***Organization and Staffing***

The COL applicant should describe the organization that manages, supervises, or executes any phase of the test program. This description should address the organizational authorities and responsibilities, the degree of participation of each identified organizational unit, and the principal participants. The COL applicant should also describe how, and to what extent, the plant's operating and technical staff participate in each major test phase. This description should include information pertaining to the experience and qualification of supervisory personnel and other principal participants who is responsible for managing, developing, or conducting each test phase. In addition, the COL applicant should implement measures to ensure that personnel formulating and conducting test activities are not the same personnel who designed or are responsible for satisfactory performance of the system(s) or design features(s) being tested. This provision does not preclude members of the design organization from participating in test activities. In addition, the COL applicant should develop a training program for each fundamental group in the organization, with regard to the scheduled preoperational and initial startup testing, to ensure that the necessary plant staff members are ready for commencement of the test program. The application should include sufficient information for the staff to make a determination and reasonable conclusion about the applicant's plans for personnel participation in the initial test program.

C.I.14.2.3 ***Test Procedures***

The COL applicant should describe the process used to develop, review, and approve individual test procedures, including the organizational units or personnel that are involved in performing these activities and their respective responsibilities. In so doing, the COL applicant should describe the designated functions of each organizational unit as well as the general steps (including interfaces with other participants involved in the test program) to be followed in conducting these activities. The COL applicant should also describe the types and sources of design performance requirements and acceptance criteria used to develop detailed procedures for testing plant SSCs. The COL applicant should have controls in place to ensure that test procedures include appropriate prerequisites, objectives, safety

precautions, initial test conditions, methods to direct and control test performance, and acceptance criteria by which the test will be evaluated. The applicant should also utilize system designers to provide the 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. Personnel with appropriate technical backgrounds and experience should develop and review test procedures. Persons filling designated management positions within the applicant's organization should perform final procedure review and approval. The COL applicant should also describe the format of individual test procedures and should include a discussion to demonstrate that the individual test procedure format is similar to, or consistent with, that contained in RG 1.68; alternatively, the COL applicant should provide justifications for any exceptions. In addition, approved test procedures should be in a form suitable for review by the NRC staff at least 60 days before their intended use.

C.I.14.2.4 ***Conduct of Test Program***

The COL applicant should describe the administrative controls that govern the conduct of each major phase of the test program. This description should include the administrative controls used to ensure that necessary prerequisites are satisfied for each major phase and for individual tests. The COL applicant should also describe the methods to be followed in initiating plant modifications or maintenance tasks that are determined to be necessary to conduct the test program. This description should include the methods used to ensure retesting following such modifications or maintenance. In addition, the description should discuss the involvement of design organizations and the applicant in reviewing and approving proposed plant modifications. The description should also include methods and identify provisions to ensure that retesting that is required for modifications or maintenance remains in compliance with ITAAC commitments. In addition, the COL applicant should describe the administrative controls pertaining to adherence to approved test procedures during the conduct of the test program as well as the methods for effecting changes to approved test procedures. The application should include sufficient information for the staff to make a determination and reasonable conclusion about the applicant's administrative controls.

C.I.14.2.5 ***Review, Evaluation, and Approval of Test Results***

The COL applicant should describe 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 and/or organizations. This description should include specific controls to be established to ensure notification of affected and responsible organizations or personnel when test acceptance criteria are not met, as well as the controls established to resolve such matters. The COL applicant should also provide a discussion of 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 the power level.

C.I.14.2.6 ***Test Records***

The COL applicant should describe its protocols pertaining to the disposition of test procedures and test data following completion of the test program. In addition, the COL applicant should have provisions in place to retain test reports that include test procedures and results as part of the plant historical records. Applicants should prepare startup test reports in accordance with RG 1.16, "Reporting of Operating Information—Appendix A Technical Specifications."

C.I.14.2.7 ***Conformance of Test Programs with Regulatory Guides***

The COL applicant should provide a discussion of the initial test program, which demonstrates conformance with the regulatory positions in RG 1.68. In so doing, the COL applicant should include a list of all regulatory guides applicable to development of the initial test programs. If the regulatory guidance is not followed, the COL applicant should identify the exceptions and should describe and justify specific alternative methods.

RG 1.68 provides information, recommendations, and guidance and generally describes a methodology acceptable to the NRC staff that the COL applicant may use to implement the regulations referenced in Section C.I.14.1 of this guide. In addition, the following 19 regulatory guides provide more detailed information pertaining to the tests called for in RG 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.

(1) RG 1.9, "Selection, Design, Qualification, and Testing of Emergency Diesel Generator Units Used as Class 1E Onsite Electric Power Systems at Nuclear Power Plants"

(2) RG 1.20, "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperation and Initial Startup Testing"

(3) RG 1.30, "Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment"

(4) RG 1.37, "Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water-Cooled Nuclear Power Plants"

(5) RG 1.41, "Preoperational Testing of Redundant On-Site Electric Power Systems To Verify Proper Load Group Assignments"

(6) RG 1.52, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants"

(7) RG 1.56, "Maintenance of Water Purity in Boiling Water Reactors"

(8) RG 1.68.1, "Preoperational and Initial Startup Testing of Feedwater and Condensate Systems for Boiling Water Reactor Power Plants"

(9) RG 1.68.2, "Initial Startup Test Program to Demonstrate Remote Shutdown Capability for Water-Cooled Nuclear Power Plants"

(10) RG 1.68.3, "Preoperational Testing of Instrument and Control Air Systems"

(11) RG 1.72, "Spray Pond Piping Made from Fiberglass-Reinforced Thermosetting Resin"

(12) RG 1.79, "Preoperational Testing of Emergency Core Cooling Systems for Pressurized-Water Reactors"

(13) RG 1.95, "Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release"

(14) RG 1.108, "Periodic Testing of Diesel Generators Used as Onsite Electric Power Systems at Nuclear Power Plants"

(15) RG 1.116, "Quality Assurance Requirements for Installation, Inspection, and Testing of Mechanical Equipment and Systems"

(16) RG 1.128, "Installation Design and Installation of Large Lead Storage Batteries for Nuclear Power Plants"

(17) RG 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) RG 1.139, "Guidance for Residual Heat Removal"

(19) RG 1.140, "Design, Testing, and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants"

C.I.14.2.8 ***Utilization of Reactor Operating and Testing Experiences in Test Program Development***

The COL applicant should describe its program for reviewing available information on reactor operating and testing experiences and should discuss how the applicant used this information in developing the initial test program. This description should include the sources and types of information reviewed, the conclusions or findings, and the effect of the review on the initial test program.

The COL applicant should also 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. This summary test description should include the test method, objective, and frequency (e.g., first-plant-only test, first-three-plant tests) necessary to validate design or analysis assumptions. The COL application should also include the justification for not including preoperational and/or startup testing for any unique or first-of-a-kind design features. In addition, the COL applicant should provide information, as applicable, that is sufficient to credit previously performed testing for identical unique or first-of-a-kind design features at other NRC-licensed production facilities.

C.I.14.2.9 ***Trial Use of Plant Operating and Emergency Procedures***

The COL 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 COL 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, as described in the following reports:

- NUREG-0660, "NRC Action Plans Developed as a Result of the TMI-2 Accident," Revision 1, August 1980
- NUREG-0694, "TMI-Related Requirements for New Operating Licenses," June 1980
- NUREG-0737, "Clarification of TMI Action Plan Requirements"

C.I.14.2.10 ***Initial Fuel Loading and Initial Criticality***

The COL applicant should describe its plans for 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 RG 1.68. Prerequisites should include successful completion of all ITAAC associated with preoperational tests prior to fuel load, adherence to TS requirements, and actions to be taken in the event of unanticipated errors or malfunctions.

C.I.14.2.11 ***Test Program Schedule***

The COL applicant should provide a schedule, relative to the fuel loading date, for conducting each major phase of the test program. If the schedule overlaps the initial test program schedules for other reactors at the site, the COL applicant should also discuss the effects of such overlaps on organizations and personnel participating in the initial test program. The applicant should also provide an overview of the initial test program and should identify each test required to be completed before initial fuel loading. In addition, the COL applicant should identify and cross-reference each test (or portion thereof) required to be completed before initial fuel loading designed to satisfy the requirements for completing ITAAC in accordance with 10 CFR 52.99(a).

The COL applicant should also include a schedule for development of test procedures for each major phase of the initial test program, including the anticipated time available for NRC field inspectors to review the approved procedures prior to their use. In so doing, the COL applicant should consider the following five guidance components for test program scheduling and sequencing:

(1) The applicant should allow at least 9 months to conduct preoperational testing.

(2) The applicant should allow at least 3 months to conduct startup testing, including fuel loading, low-power tests, and power-ascension tests.

(3) Overlapping test program schedules (for multiunit sites) should not result in significant divisions of responsibilities or dilutions of the staff provided to implement the test program.

(4) The sequential schedule for individual startup tests should establish, insofar as practicable, that test requirements should be completed prior to exceeding 25-percent power for all plant SSCs that are relied upon to prevent, limit, or mitigate the consequences of postulated accidents. The schedule should establish that, insofar as practicable, testing is accomplished as early in the test program as feasible and that the safety of the plant not be entirely dependent on the performance of untested systems, components, or features.

(5) Approved test procedures should be in a form suitable for review by regulatory inspectors at least 60 days prior to their intended use or at least 60 days prior to fuel loading for fuel loading and startup test procedures. Licensees should provide timely notification to the NRC of changes in approved test procedures that have been made available for NRC review.

C.I.14.2.12 ***Individual Test Descriptions***

The COL applicant should provide test abstracts for each individual test conducted during the initial test program. The applicant should emphasize SSCs and design features that meet any of the following eight criteria:

(1) used for safe shutdown and cooldown of the reactor under normal plant conditions and for maintaining the reactor in a safe condition during an extended shutdown period

(2) used for safe shutdown and cooldown of the reactor under transient (infrequent or moderately frequent event) conditions and postulated accident conditions and for maintaining the reactor in a safe condition during an extended shutdown period following such conditions

(3) establish conformance with safety limits or LCOs included in the facility's TS

(4) classified as ESF used to support or ensure the operation of EFS hin design limits

(5) assumed to function or for which credit is taken in the facility's accident analysis, as described in the FSAR

(6) process, store, control, measure, or limit the release of radioactive materials

(7) used in the special low-power testing program to be conducted at power levels no greater than 5 percent for the purposes of providing meaningful technical information beyond that obtained in the normal startup test program as required for resolution of TMI Action Plan Item I.G.1

(8) identified as risk-significant in the facility-specific PRA

The abstracts should (1) identify each test by title, (2) specify the prerequisites and major plant operating conditions necessary for each test (such as power level and mode of operation of major control systems), (3) provide a summary description of the test objectives and method, significant parameters, and plant performance characteristics to be monitored, and (4) provide a summary of the acceptance criteria established for each test to ensure that the test verifies the functional adequacy of the SSCs involved in the test. The abstracts should also contain sufficient information to justify the specified test method if such method does not subject the SSC under test to representative design operating conditions. In addition, the abstracts should identify pertinent precautions for individual tests, as necessary (e.g., minimum flow requirements or reactor power level that must be maintained).

C.I.14.3 Inspection, Test, Analysis, and Acceptance Criteria

In accordance with 10 CFR 52.80(a), a COL application must include the inspections, tests, and analyses, including those applicable to emergency planning, that the applicant proposes to perform as well as the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the proposed inspections, tests, and analyses are performed and the acceptance criteria are met, the facility has been constructed and will operate in conformance with the COL, the provisions of the Atomic Energy Act, and NRC regulations. Toward that end, the COL applicant should provide its proposed selection methodology and criteria for establishing the ITAAC that are necessary and sufficient to provide that reasonable assurance. The applicant should provide the proposed ITAAC as part of the COL application; however, ITAAC are not considered as part of the FSAR for the facility and should be submitted in a separate document from the FSAR.

Successful completion of all ITAAC is a prerequisite for fuel load and a condition of the license. Therefore, following the Commission's finding, in accordance with 10 CFR 52.103(g), that the facility's ITAAC have been successfully completed and fuel load is authorized, the ITAAC will no longer exist, and the license condition will be satisfied.

Section C.II.1 of this regulatory guide provides guidance for developing ITAAC for a COL application. That guidance assumes that the COL application does not reference a design certified in accordance with Subpart B of 10 CFR Part 52. Nonetheless, the guidance recognizes and discusses the format and content of ITAAC from previously certified designs as acceptable. Based on the guidance provided in Section C.II of this guide, the COL applicant should provide its proposed selection methodology and criteria for establishing the necessary ITAAC, in Section 14.3 of the FSAR portion of the application.

However, the COL applicant should propose a complete set of ITAAC that addresses the entire facility, including ITAAC on emergency planning and physical security design features. Section C.II.1 of this regulatory guide provides guidance specific to emergency planning ITAAC and physical security ITAAC.