Chapter 14 Initial Test Program

14.1 Initial Test Program for Preliminary Safety Analysis Reports

This section of the referenced DCD is incorporated by reference with no departures or supplements.

14.2 Initial Plant Test Program for Final Safety Analysis Reports

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

14.2.1.4 Organization and Staffing

Add the following at the end of this section.

EF3 SUP 14.2-1

Section 13.1 provides additional information regarding responsibilities, qualifications, and organization for implementing the pre-operational and startup testing program.

14.2.2.1 Startup Administrative Manual

Replace the first two paragraphs with the following.

STD COL 14.2-1-A

STD COL 14.2-2-A

A description of the Initial Test Program (ITP) administration is provided in **Appendix 14AA.** The Startup Administrative Manual (SAM) will be developed and made available for review 60 days prior to scheduled start of the preoperational test program.

14.2.2.2 Test Procedures

Replace the last sentence in this section with the following.

STD COL 14.2-3-A

Approved test procedures for satisfying this section will be developed and available for review no later than 60 days prior to their intended use for preoperational tests and scheduled fuel loading for initial startup tests.

14.2.2.5 **Test Records**

Add the following at the end of this section.

STD SUP 14.2-2

Startup test reports are prepared in accordance with RG 1.16.

14.2.7 **Test Program Schedule And Sequence**

Replace the last paragraph with the following.

STD COL 14.2-4-A

The detailed testing schedule will be developed and made available for review prior to actual implementation. The schedule may be updated and continually optimized to reflect actual progress and subsequent revised projections. The implementation milestones for the Initial Test Program are provided in Section 13.4.

14.2.8.1.36 **AC Power Distribution System Preoperational Test General Test Methods and Acceptance Criteria**

Add the following at the end of this section.

STD-SUP 14.2-4

Proper operation of the automatic transfer capability of the normal preferred power source to the alternate preferred power source.

14.2.8.1.51 **Plant Service Water System Preoperational Test Purpose**

Replace the first paragraph with the following.

EF3 SUP 14.2-4

The objective of this test is to verify proper operation of the PSWS including the AHS and its ability to supply design quantities of cooling water to the RCCWS and TCCWS heat exchangers.

General Test Methods and Acceptance Criteria

Add the following after the last bullet.

EF3 SUP 14.2-4

- Proper operation of control interlocks and equipment protective devices in AHS fans, motors, and valves;
- Proper operation of the AHS fans, motors, and valves in all design operating modes;
- Automatic transfer between PSWS trains and components in response to Anticipated Operational Occurrences (AOOs); and
- Proper operation of water hammer mitigating design feataures.

Replace the second sentence of the last paragraph with the following.

EF3 SUP 14.2-4

However, due to insufficient heat loads during the preoperational test phase, the heat exchanger and the AHS performance verification is deferred until the startup phase.

14.2.8.2.18 Plant Service Water System Performance Test Purpose

Replace the first paragraph with the following.

EF3 SUP 14.2-5

The objective of this test is to verify performance of the PSWS including the AHS along with the RCCWS, and the TCCWS under expected reactor power operation load conditions.

Description

Replace the second sentence with the following.

EF3 SUP 14.2-5

Pertinent parameters shall be monitored in order to provide a verification of proper system flow balancing and heat exchanger and AHS performance under near design or special conditions, as appropriate.

14.2.9 Site-Specific Preoperational and Startup Tests

Replace the second and third paragraphs with the following.

EF3 COL 14.2-5-A This section describes the site specific preoperational and initial startup tests not addressed in DCD Section 14.2.8.

EF3 COL 14.2-6-A Specific testing to be performed and the applicable acceptance criteria for each preoperational and startup test are documented in test procedures to be made available to the NRC approximately 60 days prior to their intended use for preoperational tests, and not less than 60 days prior to scheduled fuel load for initial startup tests. Sites-specific preoperational tests are in accordance with the system specifications and associated equipment specifications for equipment in those systems provided by the licensee that are not part of the standard plant described in DCD Section 14.2.8. The tests demonstrate that the installed equipment and systems perform within the limits of these specifications.

14.2.9.1 Site-Specific Pre-Operational Tests

Replace this section with the following.

EF3 SUP 14.2-3

14.2.9.1.1 Station Water System Pre-Operation Test

Purpose

The objective of this test is to verify proper operation of the SWS and its ability to supply design quantities and quality of water to the CIRC, PSWS cooling tower basin, MWS, and FPS.

Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and approved the initiation of testing. Electrical power, the CIRC, PSWS, MWS and FPS, instrument air, Chemical Storage and Transfer System, and other required interfacing systems are available, as needed, to support the specified testing.

General Test Methods and Acceptance Criteria

Performance is observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

- Proper operation of instrumentation and equipment in appropriate design combinations of logic and instrument channel trip;
- Proper functioning of instrumentation and alarms used to monitor system operation and availability;

- Proper operation of pumps, motors, and valves in all design operating modes;
- Proper operation of traveling screens and motorized self-cleaning strainers;
- Proper system flow paths and flow rates, including pump capacity and discharge head;
- Proper operation of interlocks and equipment protective device in pump, motor, and valve controls;
- Proper operation of freeze protection methods and devices, where installed; and
- Acceptability of pump/motor vibration levels.

14.2.9.1.2 **Cooling Tower Preoperational Test**

Purpose

The objective of this test is to verify proper operation of the waste heat rejection portion of the CIRC (i.e., the hyperbolic cooling tower and basin). Testing of the balance of the CIRC is addressed in DCD Section 14.2.8.1.50.

Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and approved the initiation of testing. Electrical power, the CIRC, SWS, Instrument Air System, Chemical Storage and Transfer System, and other required interfacing systems are available, as needed, to support the specific testing.

General Test Methods and Acceptance Criteria

Because of insufficient heat loads during the preoperational test phase, cooling tower performance evaluations are performed during the startup phase with the turbine generator on line.

Operation is observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

- Proper operation of instrumentation and equipment in appropriate design combinations of logic and instrument channel trip;
- Proper functioning of instrumentation and alarms used to monitor system operation and availability;

- Proper operation of pumps, fans, motors, and valves in all design operating modes;
- Proper system flow paths and flow rates, including pump capacity and discharge head;
- Proper operation of interlocks and equipment protective devices in pump, motor, and valve controls;
- Proper operation of freeze protection methods and devices, where installed; and
- Acceptability of pump/motor vibration levels.

14.2.9.1.3 **[Deleted]**

14.2.9.1.4 **[Deleted]**

14.2.9.2 Site-Specific Startup Tests

Replace this section with the following.

EF3 SUP 14.2-2

14.2.9.2.1 Cooling Tower Performance Test

Purpose

The objective of this test is to demonstrate acceptable performance of the waste heat rejection portion of the CIRC (i.e., the hyperbolic cooling tower and basin), particularly its ability to cool design quantities of circulating water to design temperature under expected operational load conditions.

Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and approved the initiation of testing. The plant is in the appropriate operational configuration for the scheduled testing. The necessary instrumentation is checked or calibrated.

Description

Power ascension phase testing of the waste heat rejection portions of the CIRC is necessary to the extent that fully loaded conditions could not be approached during the preoperational phase. Pertinent parameters are monitored in order to provide a verification of proper system flow balancing and performance of the hyperbolic cooling tower.

Criteria

System performance is consistent with design requirements.

14.2.10 **COL Information**

14.2-1-A **Description – Initial Test Program Administration**

STD COL 14.2-1-A This COL Item is addressed in Section 14.2.2.1 and Appendix 14AA

14.2-2-A **Startup Administrative Manual**

STD COL 14.2-2-A This COL Item is addressed in Section 14.2.2.1.

14.2-3-A **Test Procedures**

STD COL 14.2-3-A This COL Item is addressed in Section 14.2.2.2.

14.2-4-A **Test Program Schedule and Sequence**

STD COL 14.2-4-A This COL Item is addressed in Section 14.2.7.

14.2-5-A **Site Specific Tests**

EF3 COL 14.2-5-A This COL Item is addressed in Section 14.2.9.

14.2-6-A **Site Specific Test Procedures**

EF3 COL14.2-6-A This COL Item is addressed in Section 14.2.9

14.3 Inspections, Tests, Analyses, and Acceptance Criteria

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

14.3.8 **Overall ITAAC Content for Combined License Applications**

Replace the last paragraph with the following.

STD COL 14.3-1-A The requirements for inclusion of Emergency Planning ITAAC (EP-ITAAC) in a COLA are provided in 10 CFR 52.80(a). In SRM-SECY-05-0197, the NRC approved generic EP-ITAAC for use in COL and ESP applications. This set of EP-ITAAC was considered in the development of the plant-specific EP-ITAAC, which are tailored to the ESBWR design. The plant-specific EP-ITAAC are included in a separate part of the COLA.

14.3.9 Site-Specific ITAAC

Delete the last sentence of the first paragraph and add the following at the end of this section.

STD COL 14.3-2-A

The selection criteria and methodology provided in this section of the referenced DCD were utilized as the site-specific selection criteria and methodology for ITAAC. These criteria and methodology were applied to those site-specific (SS) systems that were not evaluated in the referenced DCD. The entire set of ITAAC for the facility, including DC-ITAAC, EP-ITAAC, PS-ITAAC, and SS-ITAAC, is included in COLA Part 10.

14.3.10 COL Information

14.3-1-A Emergency Planning ITAAC

STD COL 14.3-1-A

This COL item is addressed in Section 14.3.8.

14.3-2-A Site-Specific ITAAC

STD COL 14.3-2-A

This COL item is addressed in Section 14.3.9.

Appendix 14.3A Design Acceptance Criteria ITAAC Closure Process

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

14.3A.1 Design Acceptance Criteria ITAAC Closure Options

Replace the last two sentences of the second paragraph with the following

EF3 COL 14.3A-1-1

- **[START COM 3.10-003]** Detroit Edison shall submit to the NRC, no later than 1 year after issuance of the combined license or at the start of construction as defined in 10 CFR 50.10(a), whichever is later, its implementation schedules for completing of the following ITAACs. Detroit Edison shall submit updates to the ITAAC schedules every 6 months thereafter and, within 1 year of its scheduled date for initial loading of fuel, shall submit updates to the ITAAC schedules every 30

days until the final notification is provided to the NRC under paragraph (c)(1) of this section. **[END COM 3.10-003]**

- **[START COM 14.3-001]** For piping DAC; (1) The ASME Code design reports for risk-significant piping packages and (2) The Pipe Break Analysis Report may be completed on a system-by-system basis for applicable systems in order to support closure of the Design Acceptance Criteria ITACC. Information will be made available for NRC review, inspection, and audit on a system basis. Information will be made available to the NRC to facilitate reviews, inspections, and audits throughout the process. **[END COM 14.3-001]**
- **[START COM 14.3-002]** For human factors engineering DAC, HFE Design Acceptance Criteria ITAAC consists of a series of results summary reports which verify that the specific associated Design Commitment is met. The summary reports will be made available at each stage for NRC review, inspection, and audit on a system basis. Information (procedures and test programs) will be made available to the NRC to facilitate reviews, inspections, and audits throughout the process. **[END COM 14.3-002]**
- **[START COM 14.3-003]** For instrumentation and controls DAC, the set of ESBWR digital I&C Design Acceptance Criteria ITAAC establishes a phased Design Acceptance Criteria ITAAC closure process. Procedures and test programs necessary to demonstrate that the Design Acceptance Criteria ITAAC requirements are met will be used at each phase to certify to the NRC that the design is in compliance with the certified design. Information will be made available for NRC review, inspection, and audit on a system basis. Information will be made available to the NRC to facilitate reviews, inspections, and audits throughout the process. **[END COM 14.3-003]**

14.3A.5 COL Information

14.3A-1-1 Establish a Schedule for Design Acceptance Criteria ITAAC Closure

EF3 COL 14.3A-1-1 This COL item is addressed in Appendix 14.3A.1.

STD COL 14.2-1-A

Appendix 14AA Description of Initial Test Program Administration

14AA.1 Summary of Test Program and Objectives

14AA.1.1 Applicability

This appendix provides the requirements to be included in the Startup Administrative Manual (SAM), as discussed in DCD Sections 14.2.2.1 and 14.2.2.3. The information in and referenced in this appendix meets the ITP criteria of NUREG-0800 and is formatted to follow RG 1.206, Section C.I.14.2.

The ITP is applied to structures, systems, and components that perform the functions described in the RG 1.68 evaluation in Section 1.9. The ITP is also applied to other structures, systems, and components that meet any of the following criteria, even if not included in RG 1.68, Appendix A:

- Will be used for shutdown and cool down of the reactor under normalplant conditions, and for maintaining the reactor in a safe condition for an extended shutdown period.
- Will be used for shutdown and cool down 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.
- Will be used to establish conformance with safety limits or limiting conditions for operation that will be included in the facility's Technical Specifications.
- Are classified as engineered safety features or will be relied on to support or ensure the operation of engineered safety features within design limits.
- Are assumed to function, or for which credit is taken, in the accident analysis of the facility, as described in the FSAR.
- Will be used to process, store, control, or limit the release of radioactive materials.

The SAM includes a list of the ESBWR structures, systems, and components to which the ITP is applied.

14AA.1.2 Phases of the Initial Test Program

The ITP (per RG 1.68) has the following five phases:

1. Preoperational Testing
2. Initial Fuel Loading and Pre-Criticality Tests
3. Initial Criticality
4. Low-Power Tests
5. Power Ascension Tests

These phases are described in further detail in DCD Section 14.2 and in Section 14.2, and are referred to collectively as Startup Tests.

14AA.1.3 Objectives of Preoperational and Startup Testing

Objectives of Preoperational Testing are in DCD Section 14.2.1.2. Objectives of Startup Testing are in DCD Section 14.2.1.3.

14AA.1.4 Testing of First of a Kind Design Features

First of a kind (FOAK) testing may occur in any of the phases depending on the nature of the testing and required sequencing of the tests. When testing FOAK design features, applicable operating experience from previous test performance on other ESBWR plants is reviewed where available and the ITP modified as needed based on those lessons learned.

14AA.1.5 Credit for Previously Performed Testing of First of a Kind Design Features

In some cases, FOAK testing is required only for the first of a new designor for the first few plants of a standard design. In such cases, credit may be taken for the previously performed tests. A discussion is included in the startup test reports of the results of those tests that are credited.

14AA.2 Organization and Staffing

Administration of the ITP is governed by procedures in the SAM.

14AA.2.1 Organizational Description

The operating and technical support organization is described in Section 13.1. General preoperational responsibilities and a description of preoperational and startup testing are provided in Appendix 13AA.2. DCD Section 14.2.1.4 provides a description of the Startup Group

organization.

The Startup Group has two internal groups: the Preoperational Test Group, which is responsible for conducting and documenting preoperational tests; and the Startup Test Group, which is responsible for conducting and documenting initial startup testing. Both groups consist of personnel drawn from various organizations such as the operating staff, technical support staff, EPC personnel including the reactor technology vendor and A/E staff, and other contractors, vendors and consultants.

The manager in charge of the Startup Group reports to the plant manager and has the qualifications of Preoperational Testing Supervisor as set forth in Table 13.1-201.

The Preoperational Test Group consists of Preoperational Testing Supervisors (i.e., NSSS, BOP, Electrical, and others, as required), each of whom reports to the manager in charge of the Startup Group. Preoperational Testing Engineers are assigned to this group and report to one of the Preoperational Testing Supervisors. Qualifications of Preoperational Testing Supervisors and Preoperational Testing Engineers are set forth in Table 13.1-201.

The Startup Test Group consists of Startup Testing Supervisors who report to the manager in charge of the Startup Group. Startup Test Engineers are assigned to this group and report directly to one of the Startup Testing Supervisors. Qualifications of Startup Testing Supervisors and Startup Test Engineers are set forth in Table 13.1-201. Figure 14AA-201 illustrates the organizational structure of the Startup Group.

14AA.2.2 Responsibilities

The manager in charge of Operations coordinates with the manager in charge of the Startup Group during the ITP to provide operations personnel to coordinate, support, and participate in preoperational testing. The manager in charge of Operations is a voting member of the Joint Test Group (JTG) and the Independent Review Body (IRB). The manager in charge of Operations is responsible for safe operation of the plant and ensuring tests are performed efficiently and effectively

14AA.2.2.1 Startup Group Manager

The manager in charge of the Startup Group is responsible for:

- Staffing within the Startup Group.
- Developing procedures associated with ITP.
- Acting as Chairman of the JTG.
- Acting as an advisor to the IRB for all matters associated with startup testing.
- Managing contracts associated with the ITP.
- Coordinating with station and construction department heads for assignment of staff personnel to accomplish the test program objectives.
- Establishing and maintaining the startup group measuring and test equipment (M&TE) program required by Appendix 17AA, Part II, Section 12.

14AA.2.2.2 Reactor Technology Vendor Resident Site Manager

The reactor technology vendor resident site manager is responsible for technical direction during the ITP. Qualifications of the reactor technology vendor resident site manager are equivalent to the qualifications described in ANSI/ANS-3.1-1993 for a Preoperational Testing Supervisor. Specific responsibilities are:

- Acting as liaison with the reactor technology vendor on testing matters involving reactor technology vendor-supplied equipment.
- Reviewing preoperational and startup test procedures, with emphasis on the Nuclear Steam Supply System (NSSS).
- Assisting in data reduction, analysis, and evaluation for completed tests.
- Acting as a voting member of JTG.
- Providing administrative support and supervision to reactor technology vendor onsite personnel involved in the test program.

14AA.2.2.3 Vendor Site Representative

A vendor site representative is responsible for technical direction during the preoperational phase of the test program. This position is filled as needed based on the scope of non-reactor technology vendor supplied equipment that requires preoperational or startup testing. Specific responsibilities are:

- Acting as liaison with vendor on testing matters involving vendor supplied equipment
- Reviewing preoperational tests with emphasis on vendor-supplied equipment.
- Assisting in data reduction, analysis, and evaluation for preoperationa. tests.
- Providing administrative support and supervision to vendor onsite personnel involved in the test program.

14AA.2.2.4 Preoperational Testing Supervisor

Preoperational Testing Supervisors are responsible for:

- Supervising the Preoperational Testing Engineers assigned to them.
- Coordinating and scheduling test preparation and test activities.
- Acting as voting member of JTG.
- Preparing, reviewing, and performing preoperational test procedures.
- Reviewing preoperational test results and making recommendations based on the results.
- Resolving deficiencies identified during preoperational inspection and test activities.
- Ensuring Preoperational Testing Engineers are not the same personnel who designed or are responsible for satisfactory performance of the system(s) or design features(s) being tested.

14AA.2.2.5 Startup Testing Supervisor

Startup Testing Supervisors are responsible for:

- Supervising the Startup Test Engineers assigned to them.
- Coordinating and scheduling test preparation and test activities.
- Coordinating and directing testing for their shift via the Operations Shift Supervisor for all initial startup testing.

- Assisting with preparing, reviewing, and performing startup test procedures.
- Reviewing, analyzing, and evaluating test results and data.
- Assisting in the resolution of deficiencies identified during startup testing activities.
- Coordinating with the planning and scheduling group for initial startup activities.
- Expediting testing progress as necessary to support project schedule.
- Ensuring Startup Test Engineers are not the same personnel who designed or are responsible for satisfactory performance of the system(s) or design features(s) being tested.

14AA.2.2.6 Preoperational Testing Engineer

Preoperational Testing Engineers are responsible for:

- Determining the nature and degree of testing required for assigned systems.
- Developing test activity milestones, target dates, and manpower requirements.
- Following construction progress to support test program requirements.
- Ensuring that the required detailed preoperational test procedures are available for review and approval.
- Identifying special or temporary equipment or services needed to support testing.
- Assuring test identification tagging and station tagging are implemented as necessary to support testing and turnover.
- Directing all participating groups during preparation for the execution of assigned tasks.
- Identifying and assisting in the resolution of deficiencies and problems found during the construction and testing of assigned systems and areas.
- Reviewing and evaluating test results and preparing test summaries.

14AA.2.2.7 Startup Test Engineer

Startup Test Engineers are responsible for:

- Preparing the required detailed startup test procedures and making them available for review and approval.
- Identifying special or temporary equipment or services needed to support testing.
- Directing all participating groups during preparation for the execution of assigned tasks.
- Identifying and assisting in the resolution of deficiencies found during the construction and testing of assigned systems.
- Reviewing and evaluating the test results and data.
- Coordinating with Operations during the execution of assigned tasks.
- Assisting in the supervision and inspection of Balance of Plant (BOP)work, reviewing installation and performance tests, and providing general advice on startup tests.
- Providing engineering support activities and services during startup turbine generator testing and Main Turbine Electro-Hydraulic Control (EHC) System testing.

14AA.2.2.8 Joint Test Group

The JTG is the primary review and approval organization during the preoperational test phase of the test program and is equivalent to the group referred to in DCD Section 14.2.1.4 as the Startup Controlling Group (SCG). The required JTG quorum is described in an administrative procedure in the SAM. The JTG is responsible for:

- Performing duties delineated in the SAM.
- Reviewing and approving all preoperational test procedures prior to testing.
- Reviewing and approving all major changes or revisions to JTG-approved test procedures.
- Reviewing and approving the overall preoperational test schedule and sequence.
- Reviewing and approving the results of preoperational tests.
- Recommending the disposition of test deficiencies.
- Recommending retests or supplemental tests as required.

- Determining system readiness for turnover to operations.

14AA.2.2.9 Document Control Coordinator

A document control coordinator reports to the manager in charge of the Startup Group and has the qualifications described in ANSI/ANS-3.l-1993 for a Startup Test Engineer. The document control coordinator is responsible for:

- Tracking test procedure changes.
- Reviewing, approving and tracking document changes (including drawings, vendor tech manuals, procedures, design changes, etc.).
- Verifying that the test schedules are up to date with regard to latest testing results.
- Processing final test packages through review and approval by the IRB.

14AA.2.2.10 Independent Review Body

Upon initial fuel load, the IRB assumes responsibility for tasks previously assigned to the JTG. The IRB is responsible for review of all procedures that require a regulatory evaluation under 10 CFR 50.59 and 10 CFR 72.48, as well as all tests and modifications that affect nuclear safety. The IRB is responsible for review of all startup test procedures.The organizational structure, functions, and responsibilities of IRB are described in Appendix 17AA. During the startup test phase, the IRB is advised by the manager in charge of the Startup Group and the reactor technology vendor resident site manager. The IRB may be addressed by other titles such as Plant Operations Review Committee (PORC), On-site Safety Review Committee, or Plant Safety Review Committee (PSRC).

14AA.2.3 Operating and Technical Staff Participation

Staff qualifications and experience requirements are:

- Operating and technical support staff qualification and experience requirements are in Chapter 13 and in this appendix.
- Contractor qualification and experience requirements are in this appendix and in approved contractor procedures.
- Vendor staff qualification and experience requirements are in this appendix and in approved vendor procedures.

- EPC contractor staff qualification and experience requirements are in this appendix and in approved EPC contractor procedures.

Operating and technical support staff participates in all phases of the ITP. Operating and technical support that participate include but are not limited to: Quality Assurance staff, Quality Control staff, Operations staff, Maintenance staff, Engineering staff, Planning, Scheduling and Outage planning staff, and Work Management staff, including work planners and schedulers. Operations staff participates in preoperational testing as part of gaining experience as described in Appendix 13BB. Refer to Figure 14AA-201 for identification of organizations that have one or more participants in the ITP.

14AA.2.4 Conflict of Interest

Members of the Startup Group responsible for formulating and conducting preoperational and startup tests are not the same individuals who designed or are responsible for satisfactory performance of the systems or design features being tested. This does not preclude members of the design organizations from participating in test activities.

14AA.2.5 Training Requirements

Training on the overall test program is conducted prior to scheduled preoperational and initial startup testing and as new employees are added to the test groups. A training program for each functional group in the organization is developed, with regard to the scheduled preoperational and startup testing, to ensure that the necessary operating and technical support staff is ready for commencement of the ITP. Additional discussion on staff training is found in Section 13.2, Appendix 13AA.2, and Appendix 13BB, and Figure 13.1-202. The training program includes:

- Systems to be tested.
- Training by selected major equipment vendors (e.g., turbine, plant control).
- A review of test program administration.
- Content of test procedures, including acceptance criteria review.
- Test sequence.
- Test conduct and closure.

Specific Just-In-Time (JIT) training is conducted for operating crews and other personnel conducting certain startup tests. This JIT training may involve simulator training. Criteria to be considered when determining if JIT is used for a test include complexity of the test and plant response,such as tests that result in plant trips or other transients, or where theymay occur. Accredited training program procedures describe the process for determining training topics to be conducted. The intention is to be aswell prepared as possible to operate the plant safely.

14AA.3 Test Procedures

14AA.3.1 Procedure Development

DCD Sections 14.2.2.2 and 14.2.2.4 provide a general discussion concerning test procedure development and review. Section 13.5 provides detailed requirements for developing, reviewing, and scheduling administrative procedures.

Test procedures are written in accordance with a technical procedure writer's guide. This writer's guide provides for procedure validation. This validation may, in some cases, be through the use of an available plant reference simulator. The suitability of using the simulator to validate a test procedure is evaluated on a case by case basis. It may not be suitable, for example, to use the simulator to validate a procedure whose results are required to validate the simulator modeling.

Test procedures maximize the use of plant operating and maintenance procedures for test tasks. This can take the form of referencing a plant procedure to perform a task, or extracting the steps from the plant procedure for use in the preoperational and startup test procedures. This includes the use of emergency procedures for verifying appropriate emergency actions as described in DCD Section 14.2.5 . Step-by-step instructions on how to conduct the applicable test are described and are coordinated with plant procedures wherever applicable in the test procedure. Test procedures contain cautions, warnings, and notes, using criteria established in the technical procedure writer's guide.

14AA.3.2 Procedure Format and Content Requirements

DCD Section 14.2.8.1 discusses technical information to be provided by GEH and others that form the technical basis for test procedure objectives and acceptance criteria.

Each preoperational and startup test procedure includes the following:

- Cover page

The cover page provides approval signatures and effective dates (signatures may be maintained on file and may not appear on the cover page). The title and the unit designator water mark appear on the cover page. If the test is considered an infrequently performed test, this would appear on the cover page.

- Table of Contents

- Purpose and Test Objectives Section

This section identifies the goal of the specific preoperational/startup test. This is established by stating those systems, subsystems, or components that are included in the test, and a series of summarized specific functions to be demonstrated during the test. Objectives ofthe test are stated. Many systems tests are intended to demonstrate that each of several initiating events produces one or more expected responses. These initiating events and the corresponding responses are identified.

- Description Section

This section describes the power plateau, specific testing activities, operability impacts, systems affected, RPS trips, containment isolation, etc.

- Reference Section

This section lists documents used to prepare or revise the pre-operational or startup test procedure and any documents used or referred to while performing the procedure.

- Special Tools and Equipment (Temporary Equipment Installations) Section

This section lists test equipment and special tools not routinely carried, plus any unusual expendable items recommended to perform the procedure. This section also identifies temporary test equipment installations and test equipment instructions.

- Precautions and Limitations Section

The test procedure highlights and clearly describes any and all precautions needed to ensure a reliable test or the safety of personnel or equipment including termination criteria for the test. Included are any special actions to be taken if the test is terminated at critical points in the test.

- Initial Conditions Section

This section lists the plant conditions required to perform the test. Example: verify that the plant is operating at the 75 percent (+0, –5 percent) rod line. Each test of the operation of a system requires that certain other activities be performed first (e.g., completion of construction, construction and/or preliminary tests, inspections, and certain other preoperational tests or operations). Where appropriate,

instructions are given pertaining to the system configuration, components that should or should not be operating, and other pertinent conditions that might affect the operation of the given system. The preoperational testing procedures include, as appropriate, these specific prerequisites, as illustrated by the following examples:

••Confirm that construction activities associated with the system have been completed and documented.

••Field inspections have been conducted to ensure that the equipment is ready for operation, including inspection for proper fabrication and cleanliness, checkout of wiring continuity and electrical protective devices, adjustment of settings on torque-limiting devices and calibration of instruments, verification that all instrument loops are operable and respond within required response times, and adjustment and settings of temperature controllers and limit switches.

•• Confirm that test equipment is operable and properly calibrated.

•• Confirm communications systems are functional for conducting the test.

•• Access control is in place for personnel safety.

•• Support or interface systems are functional.

•• Confirm that prerequisite tests are conducted on individual components or subsystems to demonstrate that they meet their functional requirements.

Special environmental conditions are included in this section. Test procedures include provisions to test the equipment under environmental conditions as close as practical to those the equipment will experience in both normal and accident situations. However, many tests are conducted at ambient conditions due to the impracticality of achieving normal and accident conditions during preoperational testing.

- System Testing Section

This section provides detailed step-by-step instructions for each test.To the extent practical, the test procedures use approved normal plant operating procedures. Expected plant result is explicitly or implicitly stated in the instructions through verification or measurement steps. Each procedure requires necessary nonstandard arrangements to be restored to their normal status after the test is completed. Control measures such as jumper logs and check-off lists are specified

Nonstandard bypasses, valve configurations, and instrument settings are identified and highlighted for return to normal. Nonstandard arrangements are carefully examined to ensure that temporaryarrangements do not invalidate the test by interfering with proper testing of the as-built system.

- Data Collection Section

The test procedures prescribe the data to be collected and the form in which the data are to be recorded. All entries are permanent. The administrative controls include an acceptable method for correcting an entry.

- Acceptance Criteria Section

The test procedures clearly identify the criteria against which the success or failure of the test is judged, and account for measurement errors and uncertainties. In some cases, these are qualitative criteria. Where applicable, quantitative values with appropriate tolerances are designated as acceptance criteria. This section includes acceptance criteria for judgment of plant and system performance (as described in the applicable test specification). Those test criteria that show compliance with the Combined License ITAAC are identified in this section. When a test criterion for a preoperational test is not met, the Preoperational Testing Engineer documents the failure through the corrective action process and contacts the applicable preoperational test supervisor to determine actions to take (e.g., submitting a work request).

For the startup test program, criteria are divided into three categories, depending on the significance of the parameter or function. The following paragraphs describe each kind of test criterion, and the actions to be taken by the Startup Test Engineer after an individual test criterion is not satisfied.

•• Level I Criteria: Level I criteria relate to the values of process variables assigned in the design or analysis of the plant and component systems or associated equipment. Violation of these Level I criteria may have plant operational or plant safety implications. If a Level I test criterion is not satisfied, the plant must be placed in a suitable hold condition that is judged to be satisfactory to safety based on the results of prior testing. The Startup Test Engineer notifies the on-shift SRO, (who may declare the equipment inoperable), notifies the Startup Group manager/Startup Testing Supervisor, enters the

condition in the corrective action program, and issues work requests as needed. Plant operating or test procedures or the Technical Specifications guide the decision on the direction to be taken. Startup tests compatible with this hold condition may be continued. Resolution of the problem must be documented and pursued by appropriate equipment adjustments or through engineering support personnel. Following resolution, the applicable test portion must be repeated to verify that the Level I requirement is ultimately satisfied. A description of the problem resolution shall be included in the report documenting the successful test.

•• Level 2 Criteria: Level 2 criteria are specified as key plan performance requirements that are equipment design specification values or requirements for the measured response. The expected plant response is predicted by best estimate computer code and the desired trip avoidance margins. Level 2 failures that occur during tuning and system adjustment must be documented in the test report and following resolution, the applicable test portion must be repeated (retesting could occur at a higher power level with IRB approval) to verify that the Level 2 criterion requirement is satisfied. If a Level 2 criterion requirement is not satisfied after a reasonable effort, then the cognizant design and engineering organization shall document the results in the corrective action program with a full explanation of their recommendations. In order for the system as a whole to be acceptable, all Level 2 requirements must be satisfied or documentation provided that either modifies Level 2 requirements or changes specific design criteria.

•• Level 3 Criteria: Level 3 criteria are associated with specifications on the expected or desired performance of individual control loop components. Meeting Level 3 criteria helps assure that overall system and plant response requirements are satisfied. Therefore, Level 3 criteria are to be viewed as highly desirable rather than required to be satisfied. Good engineering judgment is appropriate in the application of these rules. Since overall system performance is a mathematical function of its individual components, one component whose performance is slightly worse than specified can be accepted provided that a system adjustment elsewhere will positively overcome the deficiency. Large deviations from Level 3 performance requirements are not allowable. If a Level 3 criterion requirement is

not satisfied, the subject component or inner loop shall be analyzed closely. However, if all Level I and Level 2 criteria are satisfied, then it is not required to repeat the transient test to satisfy the Level 3 performance requirements. The occurrence of this Level 3 criterion failure shall be documented in the test report and entered into the corrective action program.

- Follow-on Task Section

This section includes activities that must be performed to complete the test procedure.

•• Completion Notification

This section is included to identify persons to be notified that the procedure has been satisfactorily or unsatisfactorily completed.

•• Procedure Reviews

This section is included to specify required reviews and comments by various personnel.

•• Records Disposition

Records disposition guidance is described in site-specific procedures.

•• Attachments

Test procedure attachments provide supporting information and equations and evaluation methods to be used to analyze the obtained data. This attachment lists the signals to be recorded by the data collection equipment. Analysis and evaluation attachments outline the calculations to be performed and provide for an evaluation of the test. Upon completion of a given test, a preliminary evaluation is performed which confirms acceptability for continued testing. Smaller transient changes are performed initially, gradually increasing to larger transient changes. Test results at lower powers are extrapolated to higher power levels to determine acceptability of performing the test at higher powers.

•• Documentation of Test Results

Records identify each observer and/or data recorder participating in the test, as well as the type of observation, identifying numbers of test or measuring equipment, results, acceptability, and action taken to correct any deficiencies. Administrative procedures specify the retention period of test result summaries, and require permanent retention of documented summaries and evaluations.

14AA.3.3 Other Startup Test Procedures

The need for special startup tests may arise due to unplanned conditions.

The format and content requirements for preoperational and startup tests apply to these procedures.

14AA.3.4 Test Procedure Changes

If it is determined that procedure corrections (including changes in test sequence) are required before or during the conduct of the test, the test engineer suspends testing and notifies operations and test personnel of the required change. For all such corrections, the test engineer prepares and processes a procedure change request as delineated in a site-specific procedure for processing procedure changes. Revisions are classified into two categories based on the intent of the change. The intent of a procedure is the specific task or goal that is to be accomplished by the procedure.

Intent changes are changes to:

- Purpose.
- Initial conditions (or prerequisites).
- Acceptance criteria or tolerances.
- Scaling or setpoints.
- The method for meeting a commitment identified in the procedure.
- Step verification (independent or concurrent).
- System/component as-left condition(s).
- Reactivity management (changes that impact the operator's ability to monitor, control, or manipulate the reactor).
- Add or delete a subsection.
- Decrease personnel safety or fire protection effectiveness.
- Delete, relocate, or add a hold point.
- Caution or warning statements.
- Startup test procedure testing sequence.

Non-intent changes and revisions do not change the intent of the procedure (e.g., typographical error corrections). Review and approval requirements for procedure changes that do not change the intent are established in administrative procedures in the SAM.

Procedure changes that change the intent of the procedure receive the same level of review and approval as the original procedure. All test procedure intent changes will be revised against the following criteria (consistent with 10 CFR 50.59 and the design certification rule):

- Departure from Tier 1 information.
- Departure from Tier 2 information that significantly decreases the level of safety in accordance with 10 CFR 50.59(c)(1) and meets any one of eight criteria in 10 CFR 50.59(c)(2)(i) through (viii) or 10 CFR 52, Design Certification Appendix, Section VIII.B.5.b.
- Departure from Tier 2* information.
- Departure from Technical Specifications.

Preoperational test procedure intent changes involving Tier 1, Tier 2*, Technical Specifications, or Tier 2 that require a license amendment must be approved by the NRC prior to procedure completion and approval. Startup test procedure intent changes involving Tier 1, Tier 2*, Technical Specifications, or Tier 2 that require a license amendment must be approved by the NRC prior to procedure use. Timely notification of the NRC is made when procedures are changed that have been sent to the NRC.

14AA.4 Conduct of Initial Test Program

14AA.4.1 Administrative Controls

ITP conduct is described in DCD Section 14.2.2.3. The SAM governs the ITP and will be issued no later than 60 days prior to the beginning of the pre-operational phase. Testing during all phases of the test program is conducted using approved test procedures.

14AA.4.2 Procedure Verification

Because procedures may be approved for implementation weeks ormonths in advance of the scheduled test date, a review of the approvedtest procedure is required before commencement of testing. The test engineer is responsible for ensuring:

- Drawing and document revision numbers listed in the reference section of the test procedure agree with the latest revisions.
- The procedure text reflects any design change(s) made since the procedure was originally approved for implementation in the areas of acceptance criteria, FSAR, Technical Specifications, piping changes, etc.
- Any new Operating Experience lessons learned (since preparation of the procedure) are incorporated into individual test procedures.

Procedures require signoff of verification for prerequisites and instruction steps. This signoff includes identification of the person doing the signoff and the date and time of completion.

Test engineers maintain chronological logs of test status to facilitate turnover and aid in maintaining operational configuration control. These logs become part of the test documentation.

There is a documented turnover process to ensure that test status and equipment configuration are known when personnel transfer responsibilities, such as during a shift change.

Test briefings are conducted for each test in accordance with administrative procedures. When a shift change occurs before test completion, another briefing occurs before resumption or continuation of the test.

Data collected is marked or identified with test, date, and person collecting data. This data becomes part of the test documentation. The plant corrective action program is used to document all deficiencies,

discrepancies, exceptions, nonconformances and failures (collectively known as test exceptions) identified in the ITP. The corrective action documentation becomes part of the test documentation. The reactor technology vendor and/or other design organizations participate in the resolution of design-related problems that result in, or contribute to, a failure to meet test acceptance criteria.

The plant manager approves proceeding from one test phase to the next during the ITP. Approvals are documented in an overall ITP governance document.

Administrative procedures detail the test documentation review and approval. Review and approval of test documentation includes the test engineer, testing supervisor, Startup Group manager, reactor technology vendor resident site manager or appropriate vendor, and JTG or IRB. Final approval is by the plant manager. Plant readiness reviews are conducted to assure that the operating or technical support staff and equipment are ready to proceed to the next test phase or plateau.

14AA.4.3 Work Control

The Startup Group is responsible for preparing work requests when Construction organization assistance is required. Work requests are issued in accordance with a site-specific procedure governing the work management process. The operating or technical support staff, upon identifying a need for Construction organization assistance, coordinates their requirements through the appropriate Startup Test Engineer.

Activities requiring Construction organization work efforts are performed under the plant tagging procedures. Tagging requests are governed by a site-specific procedure for equipment clearance. Tagging procedures shall be used for protection of personnel and equipment and for jurisdictional or custodial conditions that have been turned over in accordance with the turnover procedure.

The Startup Group is responsible for supervising minor repairs and modifications, changing equipment settings, and disconnecting and reconnecting electrical terminations as stipulated in a specific test procedure. Startup Test Engineers may perform independent verification of changes made in accordance with approved test procedures.

14AA.4.4 Measuring and Test Equipment (M&TE)

During the preoperational test program, as well as the startup test program, most activities that lead to plant commercial operation involve design value verifications. M&TE used during these activities are properly controlled, calibrated, and adjusted at specified intervals to maintain accuracy within necessary limits. M&TE is governed by a site-specific procedure for control of M&TE. M&TE includes portable tools, gauges, instruments, and other measuring and testing devices not permanently installed, for example, startup test instruments prepared by the Preoperational Test Group as well as those provided by the Construction organization or by vendors.

A calibration program is implemented. For standard M&TE equipment, calibration procedures are prepared for each type of M&TE calibrated onsite. Calibration intervals are established for each item of M&TE. However, if the calibration requirement of a particular piece of M&TE is beyond the capabilities or resources of the operating staff, this M&TE is sent to an offsite certified calibration or testing agency. If special test equipment is necessary only for the ITP, the responsible vendor provides this equipment with the appropriate calibration documentation.

14AA.4.5 System Turnover

During the construction phase, systems, subsystems, and equipment are completed and turned over in an orderly and well-coordinated manner. Guidelines are established to define the boundary and interface between related system/subsystem and are used to generate boundary scope documents; for example, marked-up piping and instrument diagrams (P&IDs), electrical schematic diagrams, for scheduling and subsequent development of component and system turnover packages. The system turnover process includes requirements for the following:

- Documenting inspections performed by the construction organization (e.g., highlighted drawings showing areas inspected).
- Documenting results of construction testing.
- Determining the construction-related inspections and tests that need to be completed before preoperational testing begins. Any open items are evaluated for acceptability of commencing preoperational testing.
- Developing and implementing plans for correcting adverse conditions and open items, and means for tracking such conditions and items.

- Verifying completeness of construction and documentation of incomplete items.

14AA.4.6 Preoperational Testing

During preoperational testing, it may be necessary to return system control to Construction organization to repair or modify the system or to correct new problems. Administrative procedures include direction for:

- Means of releasing control of systems and or components to construction.
- Methods used for documenting actual work performed and determining impact on testing.
- Identification of required testing to restore the system to operability/functionality/availability status, and to identify tests to be re-performed based on the impact of the work performed.
- Authorizing and tracking operability and unavailability determinations.
- Verifying retests stay in compliance with ITAAC.

14AA.4.7 Startup Testing

The startup testing program is based on increasing power in discrete steps. Major testing is performed at discrete power levels as described in DCD Section 14.2.7. The first tests during power ascension testing that verify movements and expansion of equipment are in accordance with design, and are conducted at a power level as low as practical (approximately 5 percent).

The governing power ascension test plan requires the following operations to be performed at appropriate steps in the power-ascension test phase:

- Conduct any tests that are scheduled at the test condition or power plateau.
- Confirm core performance parameters (core power distribution) are within expectations.
- Determine reactor power by heat balance, calibrate nuclear instruments accordingly, and confirm the existence of adequate instrumentation overlap between the startup range and power range detectors.

- Reset high-flux trips, just prior to ascending to the next level, to a value no greater than 20 percent beyond the power of the next level unless Technical Specification limits are more restrictive.
- Perform general surveys of plant systems and equipment to confirm that they are operating within expected values.
- Check for unexpected radioactivity in process systems and effluents.
- Perform reactor coolant leak checks.
- Review the completed testing program at each plateau; perform preliminary evaluations, including extrapolation core performance parameters for the next power level; and obtain the required management approvals before ascending to the next power level or test condition.

Upon completion of a given test, a preliminary evaluation is performed that confirms acceptability for continued testing. Smaller transient changes are performed initially, gradually increasing to larger transient changes. Test results at lower powers are extrapolated to higher power levels to determine acceptability of performing the test at higher powers. This extrapolation is included in the analysis section of the lower power procedure.

Surveillance test procedures may be used to document portions of tests, and ITP tests or portions of tests may be used to satisfy Technical Specifications surveillance requirements in accordance with administrative procedures. At Startup Test Program completion, a plant capacity warranty test is performed to satisfy the contract warranty and to confirm safe and stable plant operation.

14AA.4.8 Conduct of Modifications during the Initial Test Program

Temporary modifications may be required to conduct certain tests. These modifications are documented in the test procedure. The test procedures contain restoration steps and retesting required to confirm satisfactory restoration to required configuration. Modifications may be performed by the EPC contractor or the operating and technical support staff prior to NRC issuance of the 10 CFR 52.103(g) finding. If the modification invalidates a previously completed ITAAC, then that ITAAC is re-performed. Each modification is reviewed to determine the scope of post-modification testing that is to be performed. Testing is conducted and documented to ensure that preoperational testing and ITAAC remain

valid. Modifications made following NRC issuance of the 10 CFR 52.103(g) finding are in accordance with plant staff processes and meet license conditions. Modifications that require change of ITAAC require NRC approval of the ITAAC change.

14AA.4.9 Conduct of Maintenance during the Initial Test Program

All corrective or preventive maintenance activities are reviewed to determine the scope of post-maintenance testing to be performed. Prior to NRC issuance of the 10 CFR 52.103(g) finding, post-maintenance testing is conducted and documented to ensure that associated preoperational testing and ITAAC remain valid. Maintenance performed following NRC issuance of the 10 CFR 52.103(g) finding is in accordance with plant processes and meets license conditions.

14AA4.10 Audits

A comprehensive system of planned and periodic audits is carried out to verify compliance with the ITP in accordance with the Quality Assurance Program Description. Follow-up actions, including re-audit of deficient areas, are taken where indicated.

14AA.5 Review Evaluation and Approval of Test Results

14AA.5.1 Review and Approval Responsibilities

The reactor technology vendor is responsible for reviewing and approving the results of all tests of supplied equipment. Architect Engineer representatives review and approve the results of all tests of supplied equipment. Other vendors' representatives review and approve the results of all tests of supplied equipment. Operating and technical support staff review and approval responsibilities are in Appendix 14AA.2. Final approval of individual test completion is by the plant manager after approval by the JTG or IRB.

14AA.5.2 Technical Evaluation

Each completed test package is reviewed by technically qualified personnel to confirm satisfactory demonstration of plant, system or component performance and compliance with design and license criteria.

14AA.6 Test Records

Records retention requirements are in DCD Section 14.2.2.5 and in the Quality Assurance Program Description.

14AA.6.1 Startup Test Reports

Startup test reports are generated describing and summarizing the completion of tests performed during the ITP. A startup report is required per RG 1.16 at the earliest of: 1) 9 months following initial criticality,

2) 90 days after completion of the ITP, or 3) 90 days after start of commercial operations. If one report does not cover all three events, then supplemental reports are submitted every three months until all three events are completed. These reports:

- Address each ITP test described in the FSAR.
- Provide a general description of measured values of operating conditions or characteristics obtained from the ITP as compared to design or specification values.
- Describe any corrective actions that were required to achieve satisfactory operation.
- Include any other information required to be reported by license conditions due to regulatory guide commitments.

14AA.7 Test Program Conformance with Regulatory Guides

Section 1.9 provides the evaluation of ITP conformance with the following RGs:

- RG 1.30, “Quality Assurance Requirements for Installation, Inspection and Testing of Instrumentation and Electrical Equipment (Safety Guide 30).”
- RG 1.37, “Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water-Cooled Nuclear Power Plants.”
- RG 1.68, “Initial Test Program For Water-Cooled Nuclear Power Plants.”
- RG 1.78, “Evaluating the Habitability of a Nuclear Power Plant Control Room during a Postulated Hazardous Chemical Release.”
- RG 1.116, “Quality Assurance Requirements for Installation, Inspection, and Testing of Mechanical Equipment and Systems.”
- RG 1.139, “Guidance for Residual Heat Removal.”
- RG 1.152, “Criteria for Digital Computers in Safety Systems of Nuclear Power Plants.”

- RG 1.168, “Verification, Validation, Reviews, and Audits for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.”

These RGs contain guidance that is included in the content of test procedures.

14AA.8 Utilization of Operating Experience

Administrative procedures provide methodologies for evaluating and initiating action for operating experience information (OE). DCD Section 14.2.4 describes the general use of operating experience by GEH in the development of the ITP.

14AA.8.1 Sources and Types of Information Reviewed for ITP Development

Multiple sources of operating experience were reviewed to develop this description of the ITP administration program. These included:

- INPO Operating Experience Reports.
- INPO 06-001, “Operating Experience.”
- INPO 06-001 Addendum.
- INPO 07-003, “INPO/ Utility Benchmarking for New Plant Deployment.”
- INPO 07-003 Addendum.
- INPO 86-023, “Guidelines for Nuclear Power Construction Projects.”
- INPO 94-005, “Standard Operation Support of Nuclear Plants.”
- INPO 94-03, “Review of Commercial Nuclear Power Industry Standardization Experience.”
- INPO Document AP-909, “Construction of Standard Nuclear Plants.”
- INPO NX-1067, “Browns Ferry Nuclear Plant Unit I Restart Operational Readiness Lessons Learned.”
- NRC RG 1.68, “Initial Test Programs For Water-Cooled Nuclear Power Plants.”
- SER 24-85, “Xenon Tilt Oscillation Following Control Rod Insertion Test (05-24-1985).”
- SER 29-86, “Inadvertent Rapid Cooldown and Depressurization During a Remote Shutdown Test (08-12-1986).”

- SOER 87-01, “Core Damaging Accident Following an Improperly Conducted Test (03-06-1987).”
- SOER 91-01, “Conduct of Infrequently Performed Tests or Evolutions.”

14AA.8.2 Conclusions from Review

The following conclusions are a result of the OE review conducted to develop this ITP administration program description:

- The test procedures should provide guidance as to the expected plant response and instructions concerning what conditions warrant aborting the test. Errors and problems with the procedures should be anticipated. A means for prompt but controlled approval of changes to test procedures is needed. Critical test procedures should provide specific criteria for test termination and specific steps to ensure termination is conducted in a safe and orderly manner. Providing procedural guidance for aborting the test could prevent delays in plant restoration. Conservative guidance for actions to be taken should be included in the procedures.
- Plant simulators may prove useful in preparing for special tests and verifying procedures.
- Appropriate component/system operability should be verified prior to critical tests.
- The need to perform physics tests that can produce severe power tilts should be evaluated, particularly if tests at other similar reactors have provided sufficient data to verify the adequacy of the nuclear physics analysis.
- Implement compensatory measures in accordance with guidance for infrequently performed tests or evolutions where appropriate.

14AA.8.3 Summary of Test Program Features Influenced by the Review

The conclusions from the preceding section were incorporated in Appendix 14AA.3.1 and Appendix 14AA.3.2.

14AA.8.4 Use of OE during Test Procedure Preparation

Administrative procedures require review of recent internal and external operating experience when preparing test procedures.

14AA.8.5 Use of OE during Conduct of ITP

Administrative procedures require discussion of operating experience when performing pre-job briefs immediately prior to the conduct of a test.

14AA.9 Trial Use of Plant Operating Procedures and Emergency Procedures

14AA.9.1 Use of Plant Procedures during Initial Test Program

Whenever practical, plant procedures are used to perform system and component operation during the conduct of a test.

14AA.9.2 Operator Training and Participation during Certain Initial Tests (TMI Action Plan Item I.G.1, NUREG-0737)

The objectives of operator participation are to increase the capability of shift crews to operate facilities in a safe and competent manner by assuring that training for plant changes and off-normal events is conducted.

The major objective of TMI Action Plan Task I.G.1 was to use the preoperational and startup test programs as a training exercise for operating crews. NUREG-0933 contains a discussion of the proposed actions and the conclusions made. NUREG-0800, Section 14 was revised to address the original issue of this action item. NUREG-0933 discusses three anticipated operational occurrences applicable to the ESBWR. These are pressure controller failed high, pressure controller failed low, and stuck-open safety/relief valve. These events are addressed in the abnormal operating procedures. Operators receive training on them as part of their initial training. Operators participate in preoperational and startup testing.

Operators are trained on the specifics of the ITP schedule, administrative requirements and tests. Specific JIT training is conducted for selected startup tests.

The ITP may result in discovery of acceptable plant or system response differing from expected response. Test results are reviewed to identify these differences and the training for operators is changed to reflect them. Training is conducted as soon as is practicable in accordance with training procedures.

14AA.10 Initial Fuel Loading and Initial Criticality

14AA.10.1 Prerequisites for Fuel Loading

- Preoperational tests are completed or justification is documented and approved for test exceptions and tests that have not been performed.
- All ITAAC are complete and the NRC has issued 10 CFR 52.103g declaration.
- Technical Specifications required for fuel load are met.
- License Conditions are met to allow fuel load.
- Licensed operators are stationed in the control room and for supervision of core alterations.
- Composition, duties, and emergency procedure responsibilities of the fuel handling crew are specified.
- Persons are technically qualified in accordance with plant procedures.
- Radiation monitors, nuclear instrumentation, manual initiation, and other devices are tested and verified to be operable to actuate the building evacuation alarm and ventilation control.
- Status of each system required for fuel loading is specified.
- Inspections of fuel and control rods are complete and all identified issues with installed fuel and control rods are resolved.
- Nuclear instruments are calibrated, operable and properly located (source-fuel-detector geometry). One operating channel has audible indication or annunciation in the control room.
- A response check of nuclear instruments to a neutron source consistent with the Technical Specifications surveillance frequency for source range nuclear instruments in the refueling mode is complete.
- Required status of containment is specified and met.
- Required status of the reactor vessel is specified and met.
- Components are either in place or out of the vessel, as specified, to be capable of receiving fuel.
- Vessel water level is established, and the minimum level for fuel loading and unloading is specified.
- The standby liquid control system is operable.
- Fuel handling equipment is confirmed functional and operable through surveillance and other tests, including dry runs.

- The status of protection systems, interlocks, mode switches, alarms, and radiation protection equipment is prescribed and verified.
- Water quality is established within prescribed limits.

14AA.10.2 **Fuel Loading Procedure Details**

The fuel loading procedure includes instructions or information for the following areas:

- Loading sequence and pattern for fuel, control rods, and other components, with guidance regarding fuel addition increments so that the reactivity worth of added individual fuel assemblies becomes less as the core is assembled.
- Maintenance of a display for indicating the status of the core and fuel pool, as well as appropriate records of core loading.
- Proper seating and orientation of fuel and components (the procedure specifies a visual check of each assembly in each core position).
- Functional testing of each control rod immediately following fuel loading.
- Nuclear instrumentation and neutron source requirements for monitoring subcritical multiplication, including source or detector relocation and normalization of count rate after relocation.
- Flux monitoring, including counting times and frequencies and rules for plotting inverse multiplication and interpreting plots (the counting period for count rates is specified, and an inverse multiplication plot is maintained).
- The expected subcritical multiplication behavior.
- The minimum shutdown margin is proved periodically during loading and at the completion of loading. Shutdown margin verifications do not involve planned approach to criticality using nonstandard rod patterns or with operational interlocks bypassed.
- Actions (especially those pertaining to flux monitoring) for periods when fuel loading is interrupted.
- Maintenance of continuous voice communication between the control room and loading station.
- Minimum crew required to load fuel (the procedure requires the presence of at least two persons at any location where fuel handling is

taking place, and a senior reactor operator with no other concurrent duties be in charge).

- Crew work time limits per 10 CFR 26 are in effect.
- Approvals required for changing the procedure.

14AA.10.3 Fuel Loading Procedure Limitations and Actions

- The fuel loading procedure includes the following limits and instructions: Established criteria for stopping fuel loading. Some circumstances that might warrant this are unexpected subcritical multiplication behavior, loss of communications between the control room and fuel loading station, inoperable source-range detector, and inoperability of the emergency boration system.
- Established criteria for emergency boron injection.
- Established criteria for containment evacuation.
- Actions to be performed in the event of fuel damage.
- Actions to be performed and/or approvals to be obtained before routine loading may resume after one of the above limitations has been reached or invoked.

14AA.10.4 Initial Criticality Procedure Requirements

The format and content requirements for preoperational tests apply to the initial criticality procedure. Plant operations are in accordance with plant operating procedures to the maximum extent possible. This procedure includes steps to ensure that the startup proceeds in a deliberate and orderly manner, changes in reactivity are continuously monitored, and inverse multiplication plots are maintained and interpreted.

The initial criticality procedure includes the following requirements:

- A critical rod position is predicted so that any anomalies may be noted and evaluated.
- All systems needed for startup are aligned and in proper operation.
- The standby liquid control system is operable.
- Procedural, license and Technical Specification requirements are met for initial criticality.
- Nuclear instruments are calibrated. A neutron count rate (of at least one-half count per second) should register on neutron monitoring channels before the startup begins, and the signal-to-noise ratio

should be known to be greater than two. A conservative startup rate limit (no shorter than approximately a 30-second period) is established.

14AA.11 Plant Procedure Development Schedule

The milestone schedule for developing plant operating procedures is presented in Table 13.5-202 and discussed in Section 13.5.2.1. The operating and emergency procedures are available prior to start of licensed operator training and, therefore, are available for use during the ITP. Required or desired procedure changes may be identified during their use. Administrative procedures describe the process for revising plant operating procedures.

14AA.12 Individual Test Descriptions

Individual test descriptions can be found in DCD Section 14.2.8 and in Section 14.2.9.
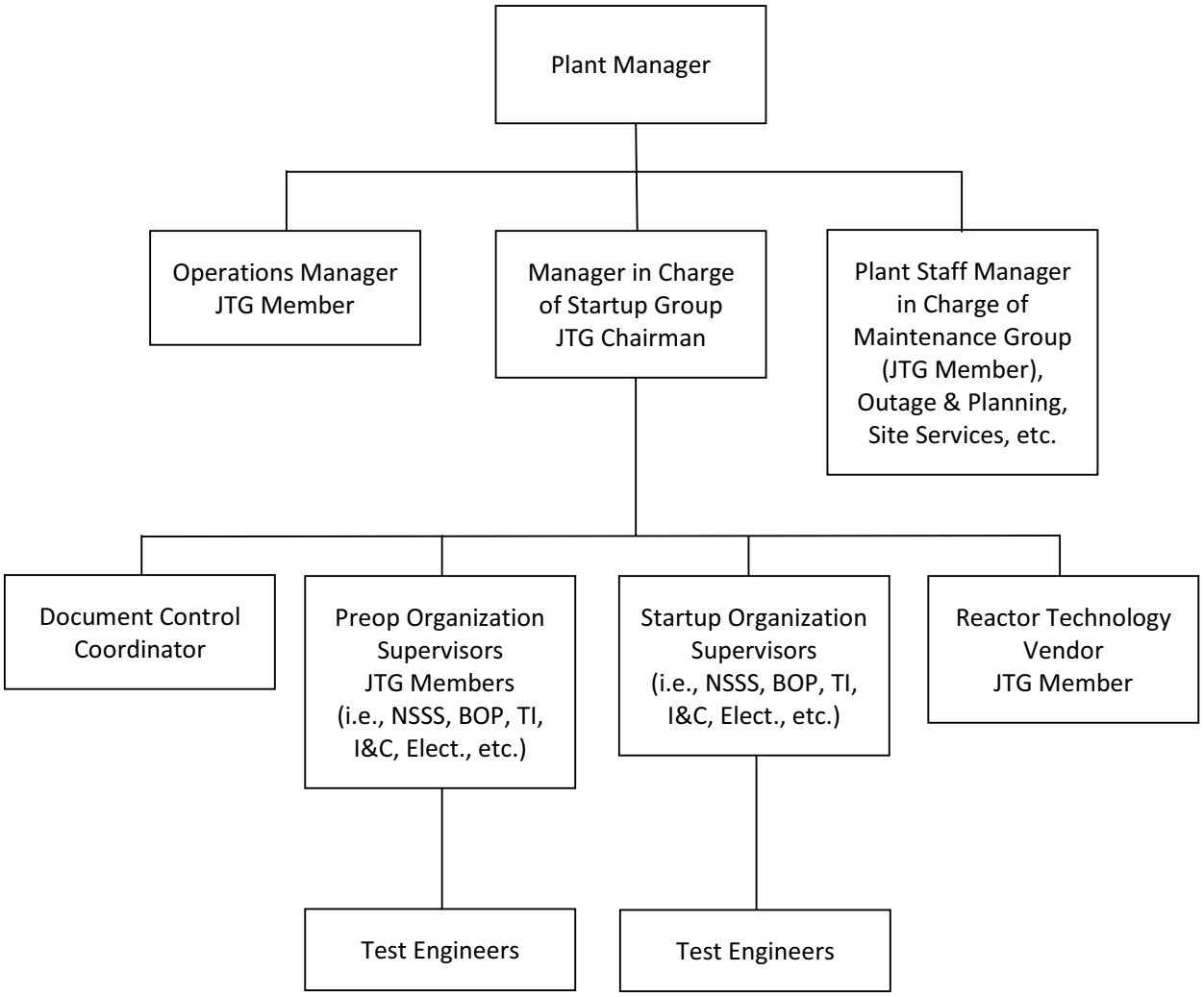
Figure 14AA-201 Preoperational and Startup Test Organization (Typical)