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14.0 INTRODUCTION

This chapter is historical. It is recognized that although the verb tense is sometimes “future”, the initial test program was completed. This chapter will not be updated to correct tense, references, or editorial errors.

This chapter provides information on the initial test program for structures, systems, components, and design features for both the nuclear portion of the plant and the balance of the plant. The information addresses major phases of the test program, including selected acceptance tests, preoperational tests, initial fuel loading and initial criticality, low-power tests, and power-ascension tests. The technical aspects of the initial test program are described in sufficient detail to show that the test program will adequately verify the functional requirements of plant structures, systems, and components. The sequence of testing is such that the safety of the plant is not dependent on untested structures, systems, or components. Also described are the measures taken to ensure that (1) the initial test program will be accomplished with adequate numbers of qualified personnel, (2) adequate administrative controls are established to govern the initial test program, (3) the test program is used, to the extent practicable, to train and familiarize the plant operating and technical staff in the operation of the facility, and (4) the adequacy of plant operating and emergency procedures are verified during the period of the initial test program.

The Startup Manual is the basic administrative document which implements the provisions of this chapter. Detailed implementation instructions are provided in Startup administrative directives.

14.1 SPECIFIC INFORMATION TO BE INCLUDED IN PRELIMINARY SAFETY ANALYSIS REPORTS

The initial test program overall test objectives and general prerequisites were previously provided in the PSAR. The technical aspects of the initial test program are described in Section 14.2 in sufficient detail to show that the test program adequately verifies the functional requirements of plant structures, systems, and components so that the safety of the plant will not be dependent on untested structures, systems, or components.

14.2 INITIAL TEST PROGRAM

14.2.1 Summary of Test Program and Objectives

The initial test program covers the testing of structures, systems, and components.

The overall objectives of the initial test program are:

a. to ensure that construction is complete;

b. to demonstrate the capability of structures, components, and systems to meet performance requirements to satisfy design criteria;

c. to effect fuel loading in a safe manner;

d. to demonstrate, where practical, that the plant is capable of withstanding anticipated transients and postulated accidents;

e. to evaluate and demonstrate, to the extent possible, plant operating procedures and to provide assurance that the Plant Staff is knowledgeable about the plant and procedures and is fully prepared to operate the facility in a safe manner; and

f. to bring the plant to rated capacity and sustained power operation.

The test program is divided into four phases covering the period from construction through warranty tests of the plant. These phases represent activities within a system and are not chronologically based for the entire plant. On any given day during the test program, some systems may be in the Construction Phase, others may be in the Checkout and Initial Operation Phase, and still others may be undergoing Preoperational or Acceptance Tests. Startup Tests begin with fuel load and continue through final acceptance of the plant.

14.2.1.1 Construction Phase

The Construction Phase is that period during which structures and systems are being erected and tests or checks are performed to assure the adequacy of contractor installation, material, and workmanship prior to turning equipment over to Illinois Power Company (IP). Tests conducted during the Construction Phase are primarily tests which do not involve energization of permanent plant equipment. When the tests, checks, and services performed during the Construction Phase are complete, the equipment is turned over to Illinois Power Company so that subsequent testing and operation may begin. Baldwin Associates, the Constructor, is responsible for managing and performing the Construction Tests while Illinois Power Company performs a surveillance function during this phase.

Hydrostatic testing of ASME Section III piping and in some cases flushing of this piping will be conducted during the Construction Phase. Baldwin Associates will maintain overall responsibility for all ASME Section III code requirements and IP will act in a formal role as a "subcontractor" to BA. ASME Section III piping and components are not turned over to IP until after acceptance of pressure test results by Baldwin Associates.

14.2.1.2 Checkout and Initial Operation Phase

The Checkout and Initial Operation (C&IO) Phase is that period during which checkout and testing is normally completed as a prerequisite to Preoperational or Acceptance Tests. Tests will include, but not be limited to, initial equipment energization, flushing and cleaning, hydrostatic testing of non-ASME Section III piping, calibration of instrumentation, electrical wiring and equipment tests, valve testing, and initial operation of equipment and systems. Completion of this phase will assure that the system is ready for the Preoperational or Acceptance Test.

The Illinois Power Company Startup Group has the primary responsibility for managing and executing this phase. The IP Plant Staff, IP Nuclear Station Engineering, IP Project Management, Baldwin Associates, General Electric, Sargent & Lundy, vendors, and consultants will provide assistance as necessary.

14.2.1.3 Preoperational Phase

The Preoperational Phase is that period during which Preoperational and Acceptance Tests are performed. These tests, in general, verify the operational performance of equipment on a system or subsystem basis, including where applicable, backup or alternate methods of system operation and system failure modes.

Preoperational tests are performed on systems or subsystems that are designed to perform nuclear safety functions. Similar tests are performed on non-safety related systems and are defined as Acceptance tests. Where systems with overall functions of a non-safety related nature have specific components, (such as containment isolation valves) , which are of concern to safety, those Acceptance Tests are described in Section 14.2.12.3. Preoperational and Acceptance tests are similar in scope, however the administrative processing of these tests is different.

Testing during this phase verifies that systems are capable of operating in a safe and efficient manner compatible with the system design bases. These tests also establish baseline data for equipment and system performance which may be used for comparison with future tests to determine equipment or system degradation.

Concurrently, the Plant Staff will operate equipment and systems thus providing them the opportunity to become knowledgeable about the plant and the procedures to be used for actual operation. The plant operating procedures are evaluated to the extent possible during this phase. Maintenance during this phase is the responsibility of the Plant Staff. The IP Startup Group retains responsibility for test administration and coordination during this phase, and provides technical direction to the Plant Staff in the performance of Preoperational and Acceptance Tests.

14.2.1.4 Startup Phase

The Startup Phase begins with preparations for fuel loading and extends through warranty tests designed to verify safe and satisfactory integrated plant operation. This phase is subdivided into four parts: 1) fuel loading and open vessel tests; 2) initial heating to rated temperature and pressure; 3) testing from rated temperature and pressure to 100% of rated output, and 4) warranty demonstrations. Startup Tests are conducted to verify the performance of equipment under actual operating conditions. These tests also verify interrelated system performance and overall reactor and station operation and control. Systems and components which cannot be checked out fully during the Pre-operational Phase are tested during the Startup Phase.

In the Startup Phase, the Plant Staff assumes overall responsibility for plant operations. The Facility Review Group exercises test procedure review and recommended approval responsibilities beginning with Power Plant Manager approval for initial fuel load.

During this phase, reactor operator and senior reactor operator licenses must be held by the required number of personnel on each shift as described in Section 13.1.

During the Startup Phase, the IP Startup Group will write and prepare test procedures, coordinate tests and prepare and analyze test results. The Startup Group will also coordinate the interface, where required, with General Electric, Baldwin Associates, Sargent & Lundy, various vendors, and other groups within Illinois Power Company. The Startup personnel will coordinate test performance with the Shift Manager.

14.2.1.5 Startup Staff Experience

(Previously located in USAR Section 13.1.3.3)

The education, training, and commensurate experience for persons who conducted or supervised pre-operational and startup testing are described in the Project Position on Regulatory Guide 1.8 in Chapter 1. Table 14.2-6 describes the startup staff's certification levels.

Figure 14.2-1 shows the pre-operational training schedule for key staff personnel.

14.2.2 Organization and Staffing

Sargent & Lundy is the Architect-Engineer for the Clinton Power Station. General Electric Company is the Nuclear Steam Supply System (NSSS) Vendor, and Baldwin Associates the Constructor. All of these organizations plus various other vendors, contractors and consultants will be involved to varying degrees in each phase of the test program.

Overall test program coordination was the responsibility of the IP Startup Group.

14.2.2.1 Illinois Power Company Organization

The Illinois Power Company organizations involved in planning, construction, testing and operation of the Clinton Power Station were depicted in FSAR Figure 17.2-1.

To assure that the Startup Program is conducted in an efficient and timely manner, it was directed by the IP Startup Group which plans, executes, and documents the startup activities occurring between the construction phase and completion of warranty tests of the station. The Startup Group is also involved in scheduling, test definition, system boundary definition, and other activities that affect construction phase testing.

The Startup Group will include individuals assigned from various organizations and discplines within and outside Illinois Power Company. For matters relating to the Initial Test Program, all assigned individuals are considered a part of the Startup Group and are responsible to the Manager - Startup. Technical assistance is provided by personnel not directly assigned to the

Startup Group but who are knowledgeable in a specific area or are associated with other aspects of the Clinton Power Station activities.

Manager - Startup

The Manager - Startup reports to the Vice President and is directly responsible for the administration and coordination of all Startup Group activities.

Illinois Power Company Startup Group

The Startup Group is an ad hoc organization created solely for the purpose of effecting the startup program for Clinton Power Station. This organization is depicted in Figure 14.2-2. The Startup Group is responsible for the creation of and updating of the startup schedule, definition of systems for turnover and testing, accepting systems from the Constructor, completing and documenting the checkout and initial operation testing, ensuring that discrepancies are corrected, and releasing systems to the Plant Staff. Additionally, the Startup Group directs the preoperational and acceptance tests and provides support and assistance during performance of startup tests. The responsibility for C&IO test, preoperational test, acceptance test and startup test procedure preparation and review coordination rests with the Startup Group.

A Joint Test Group (JTG) will be established to facilitate coordination of review and approval of test procedures and results.

Power Plant Manager

The Power Plant Manager, who reports to a Vice President (Nuclear), is responsible for overall operation of the Clinton Power Station and for all operationally related activities at the station.

Assistant Power Plant Manager

The Assistant Plant Manager reports to the Power Plant Manager and is responsible for the day-to-day operation and supporting technical activities of the Clinton Power Station. During the startup program he will supply Plant Staff support and provide personnel to conduct testing under the technical direction of the Startup Group.

Plant Staff

The Plant Staff includes those permanent plant personnel responsible for commercial operation of CPS. A complete description of the Plant Staff organization and the qualifications of supervisory personnel are provided in Chapter 13. During the initial test program, the Plant Staff provides support to the Startup Group.

During the preoperational test phase, the operating procedures are evaluated and perfected to the extent possible without total integrated plant operation. During this phase, the Plant Staff has the opportunity to become thoroughly familiar with the plant and the procedures to be used when the plant is operating. Preoperational and acceptance tests are performed by the Plant Staff as directed by the Startup Group who retains the responsibility for test coordination and administration. Upon final release of the systems from Startup to Plant Staff, Plant Staff will assume responsibility for the operation and maintenance of plant systems.

At the beginning of the Startup Phase, the Plant Staff will have assumed overall responsibility for plant operation including equipment modification and system maintenance. The Plant Staff exercises test procedure review and approval recommendation responsibilities through the Facility Review Group (FRG). Membership requirements and responsibilities of the FRG are delineated in Section 13.4. Startup tests are performed with licensed Plant Staff personnel and with support and assistance of the Startup Group who retains the responsibility for test coordination and administration.

Nuclear Station Engineering Department

The Nuclear Station Engineering Department of IP will provide engineering support activities throughout the startup program. A description of this organization and the qualifications of supervisory personnel are provided in Chapter 13.

Illinois Power Quality Assurance

The Illinois Power Quality Assurance group will review administrative and test procedures, and conduct inspections, audits, and surveillances of startup test activities. A description of this organization is provided in Chapter 17.

14.2.2.2 Baldwin Associates Organization

Baldwin Associates (BA) has the primary responsibility for conducting construction tests. Figure 14.2-3 is a chart of the Baldwin Associates' Clinton Power Station construction organization as it relates to the test program.

The Chairman of the Board of Directors of Baldwin Associates is responsible for the overall direction and management of the construction project. The BA Project Manager and the Manager of Quality and Technical Services are located at CPS and report to the Chairman.

The Project Manager reports to the Chairman of the Board of Directors and has overall responsibility for the work performed by the Project Organization of Baldwin Associates at the Clinton Site other than Quality Assurance, Quality Control, and Technical Services. The Project Manager directs the operation of the field construction organization and is responsible for the formal project interface with Illinois Power Company. The Project Manager is the primary interface between the Quality and Technical Services Division and the Field Construction Organization.

The Baldwin Associates Clinton Power Station Manager of Quality and Technical Services is responsible for the activities of the Quality Assurance, Quality Control and Technical Services Departments. The Manager of Quality and Technical Services is the interface between the Baldwin Associates Quality organization and the IP Quality Assurance organization. The Manager of Quality and Technical Services receives project direction from the IP Vice President of matters related to quality.

14.2.2.3 Sargent & Lundy

Sargent & Lundy (S&L) is responsible for the engineering design of the Clinton Power Station and will provide technical information throughout the test program.

S&L will review preoperational and startup test procedures and acceptance tests identified in section 14.2.12.3. S&L will provide advice and assistance as requested by the Assistant Power Plant Manager - Startup. Should S&L personnel be directly involved in testing, they will be integrated into the Startup Group for startup program administrative purposes.

14.2.2.4 General Electric

A General Electric (GE) Resident Site Manager is assigned to the Clinton Power Station during construction and is responsible for all NSSS equipment disposition. At or near fuel load, GE will assign an Operations Manager to the Clinton Site.

14.2.2.4.1 General Electric Operations Manager

The GE Operations Manager is the senior NSSS vendor representative on site at or near fuel loading, and is the official site spokesman for GE for preoperational and startup testing. He coordinates with the Illinois Power Company Assistant Power Plant Manager - Startup for the performance of his duties which are as follows:

1. Provides technical direction in the form of guidance and counsel, and interpretation of the requirements, instructions and other documentation concerning the testing, maintenance and operation of the nuclear systems and equipment furnished by GE.

2. Reviews and comments on procedures and documents concerning testing, operation and safety of the nuclear plant and the nuclear systems and equipment furnished by GE.

3. Performs surveillance of the preoperational and startup test and initial fuel loading activities.

4. Reviews and provides GE concurrence with nuclear system test results and reports.

5. Provides advice in the on-the-scene training of nuclear plant operating personnel.

6. Obtains home-office and vendor assistance relative to equipment furnished by GE.

7. Provides administrative support to GE site personnel involved in the test program.

14.2.2.4.2 General Electric Test Personnel

Should GE personnel be directly involved in testing, they will be integrated into the Startup Group for startup program administrative purposes.

14.2.2.5 Staffing

Engineers involved in testing are certified as qualified per a Startup administrative directive which is based on NRC Regulatory Guide 1.8.

Levels of certification are assigned based on education and experience. Persons within the Startup Group are certified to at least the level required by the testing or other task to which they are assigned. A copy of the certification of each engineer assigned to the Startup Group is maintained in a controlled manner.

14.2.3 Test Procedures

In general, testing during all phases of the initial test program is conducted using written procedures to control the conduct of each test. Such test procedures include appropriate methods to control test performance (including the sequencing of testing), specify acceptance criteria by which the test is to be evaluated, and provide for or specify the format by which data or observations are to be recorded.

14.2.3.1 Test Procedure Preparation, Review and Approval

The details for preparation, review, and approval of test procedures are described in the Startup Manual and Startup administrative directives.

Construction Tests

Procedures related to construction testing are prepared and approved in accordance with the Baldwin Associates' Project Procedures Manual. In addition to review and approval by Baldwin Associates technical and QA personnel, when appropriate, test procedures and any revisions are reviewed and approved by Illinois Power Company, General Electric and/or Sargent & Lundy.

Checkout and Initial Operation Tests

Generic tests are used for the majority of component and other testing during the C&IO Phase. Generic test procedures are utilized to the extent possible for testing which employs a similar test method for components of a given type or for general types of testing for systems or subsystems. Specific procedures such as flushing and hydrostatic tests are utilized for C&IO phase testing which cannot be accomplished using generic test procedures. Procedures are developed at the direction of the Manager - Startup and reviews are provided by the Startup Group, and the IP Quality Assurance Department. The Manager - Startup provides approval.

Hydrostatic test procedures for ASME Section III piping are reviewed by the Startup Group. The Manager - Startup provides approval.

Approved ASME flush and hydrostatic test procedures are provided to Baldwin Associates for acceptance and implementation of quality requirements associated with ASME Section III system certification.

Preoperational Test

Preoperational tests are performed on systems or subsystems that are designed to perform nuclear safety functions. Preoperational test procedures are prepared at the direction of the Manager - Startup.

Reviews are provided by the Startup Group, Plant Staff, Quality Assurance Department, Nuclear Station Engineering Department, Sargent & Lundy. General Electric provides reviews as described in 14.2.2.4.1. Approval is the responsibility of the Manager - Startup.

Acceptance Tests

Acceptance tests are performed on systems or subsystems that are not specifically designed to perform nuclear safety functions. Acceptance test procedures are prepared at the direction of the Manager - Startup.

Reviews are provided by Startup Group, Quality Assurance Department, Nuclear Station Engineering Department and Plant Staff. Approval is the responsibility of the Manager - Startup.

Certain Acceptance Tests have been determined to be of concern to safety. These Acceptance Tests are identified in section 14.2.12.3. For these Acceptance Tests, reviews are provided by Startup Group, Plant Staff, Quality Assurance Department, Nuclear Station Engineering Department, Sargent & Lundy, and the Facility Review Group. General Electric provides reviews as described in 14.2.2.4.1 Approval is the responsibility of the Manager - Startup.

Startup Test

Startup test procedures are used to control testing during the startup phase. Startup test procedures are prepared at the direction of the Manager - Startup.

Reviews are provided by the Startup Group, Quality Assurance Department, Nuclear Station Engineering Department, Plant Staff, Facility Review Group, and Sargent & Lundy. General Electric provides reviews as described in 14.2.2.4.1. Approval is the responsibility of the Power Plant Manager.

14.2.3.2 Test Procedure Content and Format

Test procedure format is standardized to the extent possible for each application within the Test Program. The format used for preoperational, acceptance and startup tests is as follows:

1. Approval Cover Sheet

   The Approval Cover Sheet shall contain the title of the procedure which is descriptive of the nature of the test. The Approval Cover Sheet shall include a revision number, and indicate approval status.

2. Objectives

   This section shall clearly and concisely state the purpose of the test. This section also specifies the general method to be used to accomplish the stated objectives.

3. Acceptance Criteria

This section shall clearly identify the standards against which the success or failure of the test is judged. In some cases, qualitative criteria is given and in other cases quantitative values are designated as acceptance criteria.

4. References

This section includes the primary references used to prepare the test procedures.

5. Prerequisites

This section shall identify those independent action or procedures which shall be completed prior to conducting the test, and shall include a list of any special equipment, such as measuring and test equipment needed for the test.

6. Initial Conditions

This section shall list those conditions which must be satisfied just prior to commencement of testing. When appropriate, this shall include the configuration and operating status of components within the system undergoing testing. Where environmental conditions other than ambient are necessary for the test or a portion of the test, such conditions are specified in this section.

7. Special Precautions

This section lists any special precautions for the safety of personnel or equipment to be observed during the performance of the test.

8. Procedure

This section details the individual steps and test sequences and provides appropriate methods of documenting test data. This section includes verification signature blanks to document the performance of each test step as appropriate, and shall include the steps required for restoring the system to a normal or specified status at the conclusion of the test. This section further specifies data to be collected and the format in which it is to be recorded and retained.

9. Analysis (Startup Tests Only)

This section will analyze the data and perform the calculations necessary to verify the acceptance criteria are met.

10. Recorded Data

This section provides data sheets and forms for data required to be recorded during the test.

11. Appendices

This section provides additional information necessary to the performance of the test. Included are supporting procedures, check-off list, graphs, drawings, valve lineup or other appropriate information.

14.2.4 Conduct of Test Program

Administrative control of the Clinton Power Station initial test program is promulgated by the use of procedures throughout. Adherence to the program as delineated in administrative and test procedures assures that equipment is testable, the appropriate tests are performed, and the results are satisfactory. Each phase of the test program as it pertains to a system is sequenced such that completion of one phase fulfills most of the prerequisites for the next.

Construction Phase

Responsibilities and controls for testing safety-related equipment during this phase are delineated in the Baldwin Associates' Project Procedure Manual and Quality Assurance Manual. Written procedures conforming to the requirements of these manuals include objectives, prerequisites, test methods, and results documentation. Testing is subject to audit per the established Baldwin Associates' Quality Assurance program. Test results are available to Illinois Power Company for review.

Turnover to Illinois Power Company

Subsequent to completion of construction and construction testing of a defined system, formal turnover from Baldwin Associates to Illinois Power Company is effected. Turnover is by procedure which, when complete, assures all parties that checkout and initial operation phase efforts may be undertaken. Turnover effects the transfer of jurisdictional control of the designated equipment to the Illinois Power Company Startup Group. Turnover documentation defines the scope of the equipment to be turned over, defines the status of said equipment, indicates that official copies of completed tests, records, data, inspection reports and other documentation for the equipment being turned over are entered in the Document/Records System, and provides for any other software relevant to the equipment being turned over. A listing of outstanding construction incompletions and other items to be resolved subsequent to turnover are included. After turnover, responsibility for operation, maintenance, tagging, and testing rests with IP.

Area turnovers are made from Baldwin Associates to Illinois Power Company as necessary for occupancy, or when a significant portion of the systems in an area have been turned over.

Checkout and Initial Operation Phase

C&IO test is administered and performed using approved procedures. C&IO test are normally prerequisites to preoperational or acceptance test performance. Documentation of C&IO test results are reviewed and approved prior to preoperational or acceptance testing.

Preoperational Test Phase

During the preoperational phase procedures are implemented such that a section of a test cannot be performed until the prerequisites to that section have been verified to be complete.

Preoperational and acceptance tests must be released for performance by the Manager - Startup. This mechanism offers additional assurance that the system is ready for testing and that the procedure to be used is current.

Startup Test Phase

The Plant Staff assumes overall responsibility for plant operation beginning with the Startup Phase. Approval for fuel load will be forthcoming after a review of the test program. The Facility Review Group shall review the test results as a minimum on each power plateau during the startup test phase prior to recommending further power testing.

Power plateaus consist of each of the following related test conditions (see Figure 14.2.6):

a. Open vessel

b. Heat up to rated temperature and pressure

c. Test condition 1

d. Test conditions 2 and 3

e. Test conditions 4, 5, and 6

f. Warranty demonstration

Additionally, the Facility Review Group will review the prerequisites of planned tests, as specified in the individual test descriptions of Section 14.2.12.2. The Power Plant Manager approves continuation of testing.

Prerequisites applicable to a particular startup test will be specified in that test and verified prior to performance of the Startup Test. Each operating shift will have a required complement of licensed senior and reactor operators who are responsible for operation of the unit during Startup Testing.

Test Release

The mechanism used to authorize the performance of a test is the test release. With the exception of Generic Tests, no test shall be performed without a test release. A test release ensures that the approved test procedure has been evaluated against the as-built system and current plant conditions before authorization is given to commence testing. The review also ascertains that test data required as a prerequisite to performance of a test or change in power test plateau has been evaluated and approved.

Generic tests are not required to be released for performance since a specific component is turned over from the constructor ready to be checked out.

14.2.4.1 Field Problem Report (FPR)

The Field Problem Report provides a means for the Startup Group to identify a design question or problem. The FPR is routed to the Nuclear Station Engineering Department - Startup Engineering for disposition. NSED will initiate design modifications as required. Retesting required as a result of a design modification is accomplished using approved procedures and controls in the same manner as previously described testing.

14.2.4.2 Maintenance

Corrective maintenance performed on equipment under the IP jurisdictional control is initiated and administered by the use of work requests. Work requests are reviewed by responsible parties prior to and subsequent to the performance of maintenance. Retesting requirements are tracked until the retest is completed.

Preventative Maintenance (PM) performed on equipment under IP jurisdictional control is controlled and administered by utilizing an automated PM System. PM actions are reviewed by responsible parties prior to and subsequent to the performance of PM. Items which fail the PM criteria are corrected using Work Requests.

14.2.4.3 Performance of Tests

Test conduct is governed by the Startup Manual with additional detail provided by Startup administrative directives. All testing is accomplished by written procedure. Changes to the scope or intent of procedures are reviewed and approved by the individuals or groups that perform those functions for the original procedure. Any test procedure changes shall be approved and completed prior to approval of test results.

14.2.5 Review, Evaluation, and Approval of Test Results

Construction Phase

The responsibility for documenting and reviewing safety-related testing lies with the Baldwin Associates' Manager of Quality Control and/or the Manager of Technical Services and the IP Project Management Organization.

Checkout and Initial Operation Phase

Test results obtained during this phase are subject to an evaluation to determine whether test performance is accurately and completely documented, the test data is on proper forms, required data is supplied, test results satisfy the stated acceptance criteria, and that all incomplete items are clearly and properly identified.

Hydrostatic test procedure test results for ASME Section III piping are reviewed by the Startup Group, approved by the Manager - Startup and provided to Baldwin Associates for acceptance.

Other checkout and initial operating phase test results are reviewed by the Startup Group and the Quality Assurance Department.

Approval of results is the responsibility of the Manager - Startup.

Should test results prove unacceptable, the cause is determined and corrective action is initiated per Startup administrative directives.

Test results of other Checkout and Initial Operation phase tests are reviewed by the Startup Group and the Quality Assurance Department. Approval of results is the responsibility of the Manager - Startup.

Should test results prove unacceptable, the cause is determined and corrective action is initiated per Startup administrative directives.

Preoperational Phase

Preoperational Test Procedure results are reviewed by the Startup Group, and Quality Assurance Department, Nuclear Station Engineering Department, Plant Staff, and Sargent & Lundy. General Electric provides reviews as described in 14.2.2.4.1. Approval is the responsibility of the Manager - Startup.

Acceptance Test Procedure Results are reviewed by Startup Group, Quality Assurance Department, Nuclear Station Engineering Department, and Plant Staff. Approval is the responsibility of the Manager - Startup.

Certain Acceptance Tests have been determined to be of concern to safety. These Acceptance Tests are identified in section 14.2.12.3. For these Acceptance Tests, review is provided by Startup Group, Plant Staff, the Quality Assurance Department, Nuclear Station Engineering Department, and Sargent & Lundy. General Electric provides reviews as described in 14.2.2.4.1. Approval is the responsibility of the Manager - Startup.

Should test results prove un acceptable, the cause is determined and corrective action is initiated per Startup administrative directive.

Startup Phase

Startup phase results are evaluated by the Startup Group, Quality Assurance Department, Nuclear Station Engineering Department, Plant Staff, and Sargent & Lundy. General Electric provides reviews as described in 14.2.2.4.1. Approval is the responsibility of the Power Plant Manager.

Should test results prove unacceptable, the cause is determined and corrective action is initiated per Startup administrative directive.

Retests

When the cause of unacceptable test results has been resolved, a retest is performed covering the portion of the original test in question. Plant modifications and maintenance are reviewed to ensure that previous test results have not been invalidated by such work and retests are utilized as necessary. Retests will be accomplished per a Startup administrative directive.

14.2.6 Test Records

Completed test records are filed in the CPS Central File.

14.2.7 Conformance of Test Programs with Regulatory Guides

Table 14.2-1 contains a list of Regulatory Guides used in the development of the Initial Test Program. The program complies with the Regulatory Guides, with exceptions as described in Section 1.8.

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

The Clinton Power Station BWR-6 reactor plant is the latest stage in the evolutionary development of the BWR product line. General Electric factors information from experience with more than 25 operating BWR plants into its design and testing programs.

Available information on operating experience, including reportable occurrences at operating power reactors, will be used appropriately in the development and execution of the test procedures.

14.2.9 Trial Use of Plant Operating and Emergency Procedures

The schedule for the development of plant procedures is contained in Section 13.5.

Plant procedures, which include both operating and emergency procedures, are used to the extent possible by:

1. Utilizing them for establishing initial system conditions.
2. Establishing conditions for systems supporting a test.
3. Establishing conditions for retests.
4. Operation of systems on a day-to-day basis during the test program.
5. Performance of selected procedures for the specific purpose of Plant Staff familiarization.

14.2.10 Initial Fuel Loading and Initial Criticality

Fuel Loading and initial criticality are conducted in accordance with approved written procedures after all prerequisite tests are satisfactorily completed and the operating license has been issued.

14.2.10.1 Pre-Fuel Load Verification

Prior to NRC approval for fuel loading, the plant must be verified ready to load fuel by accomplishing the following steps.

14.2.10.1.1 Cold Functional Testing

Cold functional testing is the integrated operation of various plant systems prior to fuel loading. The intent of this testing is to observe unexpected operational problems of a hardware or procedural nature and provide an opportunity for Plant Staff familiarization with system operating characteristics and procedures.

Integrated systems operation takes place during various preoperational tests and during the integrated flush of systems connected directly and indirectly to the reactor.

14.2.10.1.2 Routine Surveillance Testing

There will be intervals of various lengths between the completion of specific preoperational tests and routine operation of the subject systems. The surveillance program undertaken to satisfy the requirements for the Technical Specifications will be instituted prior to fuel loading to ensure that routine checks are current at fuel loading and through subsequent plant operation.

14.2.10.2 Startup Checklists

Detailed lists of items that must be complete will be compiled and the items will be verified for completion just prior to fuel load and at significant milestones such as heatup, opening MSIV's and power operation.

14.2.10.3 Initial Fuel Loading

Fuel loading requires the movement of the full core complement of assemblies from the fuel pool to the core, with each assembly identified by number before being placed in the correct coordinate position. The procedure controlling this movement is arranged so that shutdown margin and subcritical checks are made at predetermined intervals throughout the loading, thus ensuring safe loading increments. Normal in-vessel neutron monitors provide continuous visual indication of count rate and subcriticality check as loading progresses. They also allow the recording of the core flux level as each assembly is added with the exception of the first sixteen bundles. A complete check is made of the fully loaded core to ascertain that all assemblies are properly installed, correctly oriented, and are occupying designated positions.

14.2.10.4 Zero Power Level Tests

At this point in the Initial Test Program a number of tests are conducted which are best described as initial zero power level tests. Chemical and radiochemical tests have been made in order to check the quality of the reactor water before fuel is loaded, and to establish base and background levels which will be required to facilitate later analysis and instrument calibrations. Plant and site radiation surveys are made at specific locations for later comparison with the values obtained at the subsequent operating power levels. Shutdown margin checks are repeated for the fully loaded core, and criticality is achieved with the prescribed rod sequence, data being recorded for each rod withdrawn.

Each rod drive is subjected to scram and performance testing. The initial setting of the Intermediate Range Monitors (IRMs) is at maximum gain or at the value of gain used during the preoperational test.

14.2.10.5 Initial Heatup to Rated Temperature and Pressure

Nuclear heat up follows the satisfactory completion of the fuel loading and zero power level tests. Further checks are made of coolant chemistry together with radiation surveys at the selected plant locations.

Four control rods are scram-timed with normal accumulator pressure for continuous monitoring at intermediate and rated reactor pressures. Control rod sequences are further investigated in order to obtain rod pattern versus temperature relationships. The process computer checkout continues as more process variables become available for input. The Reactor Core Isolation Cooling (RCIC) System will undergo controlled starts at low reactor pressure and at rated conditions, with testing in the quick-start mode at 1000 psig. Correlations are obtained between reactor vessel temperatures at several locations and the values of other process variables as heatup continues. The movements of NSSS piping, mainly as a function of thermal expansion, are recorded for comparison with design data. An intermediate calibration of the IRM and APRM is made using coolant temperature rise data during nuclear heatup.

14.2.10.6 Power Testing From 25 Percent to 100 Percent of Rated Output

The power testing phase comprises the following tests, many of which are repeated several times at different test levels. Reference should be made to Table 14.2-4 for the probable order of execution for the full series. The power-flow map shown in Figure 14.2-6 describes the startup test conditions. While a certain basis order of testing is maintained relative to power ascension, there is, nevertheless, considerable flexibility in the test sequence at a particular power level which may be used whenever it becomes operationally expedient. In no instance, however, is nuclear safety compromised.

1. Coolant chemistry test and radiation surveys are made at each specified test level in order to assure a safe and efficient power increase.

2. Selected CRDs are scram-time tested at various power levels to provide correlation with the initial data.

3. Deleted (in Rev 0)

4. Following the first reasonably accurate heat balance (25 percent power) the IRMs are reset.

5. At each power plateau (refer to Subsection 14.2.4), the LPRMs are calibrated.

6. The APRMs are calibrated initially at each new power level and following LPRM calibration.

7. Completion of the process computer checkout is made for all variables, and the various options are compared with alternate calculational methods as soon as significant power levels are available.

8. Further tests of the RCIC System are made with and without injection into the reactor pressure vessel.

9. Collection of data from the system expansion tests is completed for those piping systems which had not previously reached full operating temperatures.

10. Core performance evaluations are made at all test points above the ten percent power level and for selected flow transient conditions; the work involves the determination of core thermal power, maximum linear heat generation rate (MLHGR), maximum average planar linear heat generation rate (MAPLHGR), and the Minimum Critical Power Ratio (MCPR).

11. Overall plant stability in relation to minor perturbations is shown by the following group of tests which are made at all test points:

    a. Pressure regulator setpoint change

    b. Water level setpoint change

    c. Turbine valve surveillance

    d. Recirculation flow step change

    The first two tests require that the changes made should approximate as closely as possible a step change in demand, while for the next test individual main turbine control, stop and bypass valves are manually cycled. The remaining test is performed to properly adjust the control loop of the recirculation system. For all of these tests the plant performance is monitored by recording the transient behavior of numerous process variables, the one of principal interest being neutron flux. Other imposed transients are produced by step changes in demand core flow, simulating loss of a feedwater heater and simulating failure of the operating pressure regulator to permit takeover by the backup regulator. Table 14.2-4 indicates the power and flow levels at which all these stability tests are performed.

12. The category of major plant transients includes full closure of all the main steam isolation valves, turbine trip and generator load rejection, loss of offsite power, tripping a feedwater pump and several trips of the recirculation pumps. The plant transient behavior is recorded for each test and the results shall be compared with the acceptance criteria and the predicted design performance. Table 14.2-4 shows the operating test conditions for the major plant transients.

13. A test is made of the relief valves in which leaktightness and general operability are demonstrated.

14. At specified power levels the jet pump flow instrumentation is calibrated.

15. The as-built characteristics of the recirculation system are investigated as soon as operating conditions permit full core flow.

16. The local control loop performance, based on the drive pump, jet pumps and control equipment, is checked.

17. Individual CRD scram times are determined in conjunction with the performance of a planned reactor scram. Scram times for control rods not fully withdrawn during the planned reactor scram (up to a maximum of 32 control rods) are either exempted based on analysis or tested individually before reaching 40% power.

14.2.11 Test Program Schedule

Figure 14.2-4 represents the tentative Startup Schedule for Clinton Power Station, Unit 1. The Startup Schedule depicts testing to be performed from the time a system is turned over to IP by Baldwin Associates to completion of the test program. As the test program proceeds the

Startup Schedule will be optimized to take into account actual progress that is inconsistent with the schedule. Updated schedules will be distributed as needed. Approved preoperational test procedures will be available for examination by the NRC approximately 60 days prior to the scheduled performance of the test. Procedures relating to fuel loading, startup phase testing, and supporting activities will be available for examination by the NRC not less than 60 days prior to the scheduled fuel load date.

14.2.12 Individual Test Description

14.2.12.1 Preoperational Test Procedures

The following test descriptions are provided for each individual preoperational test that will be conducted. During the final construction phase, it may be necessary to modify preoperational test methods as operating and preoperational test procedures are developed. Consequently, methods described in the following descriptions are general, not specific. Actual test procedures will, of course, be more detailed and will not be limited in scope to what is contained in these descriptions.

When phrases such as "per design, design specifications, consistent with design intent, as designed, etc." are used in the acceptance criteria, that information is taken from the following sources:

General Electric Design Specifications
General Electric Design Specifications Data Sheets
General Electric Test Specifications
General Electric Instrument Setpoint Data Sheets
Sargent & Lundy Design Criteria
Sargent & Lundy System Descriptions
Sargent & Lundy Electrical Schematics
Sargent & Lundy Instrument Data Sheets
Sargent & Lundy P&ID's
Vendor Manuals Supplied by General Electric or Sargent & Lundy
CPS-FSAR
Technical Specifications

The specific documents used in the preparation of each test are listed in the reference section of that test procedure. The tests will demonstrate that the installed equipment and systems perform within the limits of these specifications.

Table 14.2-2 provides a listing of the preoperational tests.

Testing of safety-related instrumentation and control systems begins with the calibration of instruments at the component level soon after turnover from the contractor. Safety-related setpoints are set for the first time during this activity.

Soon after the calibration of all instruments on the instrument loop is complete, a loop calibration is performed. During this activity, the setpoints are again verified. Any substantial drift in the safety-related setpoint will be identified during this loop test.

Prior to the performance of the Preoperational Test (PTP), installed instrumentation from which quantitative data is to be taken during the performance of the PTP, will be recalibrated as required by the Startup Group. The preoperational test will demonstrate proper operation of the system. Any substantial drift in safety-related setpoints should, therefore, be identified during the performance of the PTP.

Following successful completion of the PTP, the system is normally turned over to the Operations Department. Surveillance testing and preventative maintenance will be performed by the Operations Department on safety-related instrumentation to the extent necessary and at the frequency necessary to insure that safety-related setpoint drift is minimized.

In summary, safety-related setpoints will be verified directly or indirectly several times during the test program as described above. The results of these tests may be used to identify safety-related setpoint drift trends. These trends may then be used to modify the frequency of future setpoint verification tests (Q&R 640.7).

IPC will expand test program (Chapter 14) to verify the voltage levels at the safety-related buses are optimized (for the full load and minimum load conditions that are expected throughout the anticipated range of voltage variations of the offsite power source) by appropriate adjustment of the voltage tap settings of the intervening transformers (Q&R 640.10).

Testing method will be as follows:

1. With intervening transformer's tap setting at taps specified by engineering design and all station distribution buses, including all Class 1E buses down to the 120/208 level, loaded to at least 30% of full load.

2. Record the existing grid and Class 1E bus voltage and bus loading, down to 120/208 level at steady state conditions and during the starting of a large Class 1E and non-Class 1E motor (not concurrently).

Note: The bus voltages and loading need only be recorded on that string of buses which previously showed lowest by engineering design.

3. The acceptance criteria will be that the test voltages shall not be lower than 3% of the values specified by engineering design and never less than Class 1E equipment rated voltage.

Containment recirculation fans are not used at CPS for post-accident containment heat removal. Accident conditions result in the containment being isolated with no fans running. Fans (supply and exhaust) are physically located outside containment. No forced recirculation of air exists with accident conditions (Q&R 640.11).

14.2.12.1.1 FEEDWATER SYSTEM

Test Objectives

1. To demonstrate operation of the controls, support systems, safety devices, alarms and annunciators for the steam driven and motor driven reactor feed pumps.

2. To verify pump and system hydraulic characteristics.

3. To verify operation and response of the feedwater control system.

Prerequisites and Initial Conditions

1. C&IO testing is complete.
2. The condensate and condensate booster systems are available.
3. Turbine building closed cooling water is available.
4. Circulating water is available.
5. A steam supply for feedpump operation and shaft sealing is available.
6. Pump, motor and turbine auxiliaries are available.
7. Instrument air is available.

Test Procedure

1. The feedwater control system will be tested to verify operational capability using simulated signals. System alignment will be accomplished by:
    a. Verifying system response to abnormal signal inputs by alarms, interlocks and signal outputs.
    b. Verifying response to turbine driven reactor feed pump speed regulators and control to varying steam, feed, and level signals.
    c. Verifying response of the motor driven reactor feed pump regulating valve to varying steam, feed, and level signals.
    d. Verifying response in 3-element, single element mode and manual control.
2. Feedpump turbines, motor and auxiliaries will be operationally tested.
3. Feedwater flow performance will be verified to the maximum extent possible.
4. Pump minimum flow rates and valve operation will be verified.
5. Operability of alarms, trips and interlocks will be verified.
6. Valve operation and timing will be verified.

Acceptance Criteria

1. Feedwater controls function as designed.
2. Pump, motor, turbine and auxiliary equipment perform as designed.
3. Hydraulic performance falls within design limits.
4. Alarms, trips, and interlocks function as designed.

5. Valve operation and timing (including isolation) falls within design tolerances.

14.2.12.1.2 REACTOR WATER CLEANUP SYSTEM

Test Objectives

1. To demonstrate the integrated operation of the reactor water cleanup system.
2. To operationally check the pumps, control stations, cleanup filter demineralizers, interlocks, and alarms.

Prerequisites and Initial Conditions

1. C&IO testing is complete.
2. Component cooling water is available.
3. Resin and filter aid is available.
4. A sufficient quantity of chemically acceptable water is available.
5. The Reactor Pressure Vessel, main condenser and liquid radwaste system are available to receive water.

Test Procedure

1. System performance will be checked at ambient reactor pressure and temperature.
2. Blowdown to radwaste and the main condenser will be demonstrated.
3. The backwash and precoat operations of the filter-demineralizers will be demonstrated.
4. Operability of interlocks, isolations, controls and alarms will be verified.
5. Leak detection circuitry associated with the reactor water cleanup system will be checked.
6. Valve operation will be verified.

Acceptance Criteria

1. Pump and system performance will indicate that the reactor water cleanup system should perform as designed at rated temperature and pressure.
2. Interlocks, isolations, controls and alarms will perform as designed.
3. Leak detection circuitry will function as designed.
4. Valve operation and timing will be within design limits.

14.2.12.1.3 STANDBY LIQUID CONTROL SYSTEM

Test Objectives

1. To verify the operability of the system.

2. To demonstrate system test modes.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.

2. A sufficient quantity of chemically acceptable water is available to conduct the test.

3. The reactor vessel is capable of accepting demineralized water during the test.

4. The inboard and outboard isolation valves for the reactor water cleanup system are available for testing.

5. Service air is available.

6. The setpoints of the standby liquid control pumps' discharge relief valves have been verified.

Test Procedure

1. The standby liquid control storage tank will be filled with demineralized water and the following checks performed:

    a. The tank level and temperature alarms will be verified.

    b. The tank temperature controls and air sparger will be checked.

    c. The standby Liquid control pumps will be operated.

2. The test tank will be filled with demineralized water and the following accomplished.

    a. The standby liquid control pumps will be operated in the test mode.

    b. Pump packing will be adjusted to minimize leakage.

3. Each loop will be started using the keylock switch. Flow rates to the reactor will be measured. Isolation of the reactor water cleanup system will be verified during this test.

4. Prior to fuel loading the standby liquid control tank will be filled with the required boron solution, mixed and sampled.

Acceptance Criteria

1. All alarms will actuate at points within tolerances set forth in the station instrument data sheets.

2. Temperature will be maintained in the standby liquid control storage tank.

3. The air sparger will function as designed.

4. The system functions per design in the test mode.

5. All design actions and interlocks will take place when the keylock switch is placed in run and in stop.

6. Flow rates to the reactor are within limits set by design.

7. Pump packing leakage is within design limits.

8. The solution in the standby liquid control tank will be verified by normal sampling means to meet the chemistry requirements specified by design.

14.2.12.1.4 NUCLEAR BOILER SYSTEM

Test Objectives

1. To verify nuclear boiler instrumentation functions.

2. To verify operation of the logics, interlocks, and alarms associated with the Automatic Depressurization System (ADS).

3. To verify operation of logics, interlocks, and alarms associated with the Nuclear Steam Supply Shutoff System (NSSSS).

4. To verify functional operation of the main steam isolation valves, main steam relief valves and auto-depressurization.

5. To verify integrated operation of the containment isolation valves associated with the NSSS.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. Instrument air is available.

3. The reactor and main steam lines can accept water.

Test Procedure

1. Reactor vessel water level will be varied and nuclear boiler level instrumentation verified.

2. Automatic depressurization system logic will be verified, including interlocks and alarms.

3. Nuclear steam supply shutoff system logic will be verified, including interlocks and alarms.

4. Nuclear boiler valves will be functionally tested:

a. Main steam containment isolation valve operation will be checked.

b. Main steam relief valves will be functionally tested.

c. Main steam isolation valve cold operating time will be checked.

d. Safety-relief and MSIV accumulators will be capacity checked.

5. Verify integrated operation of the NSSS valves in response to a manual isolation command.

Acceptance Criteria

1. Actual reactor water level will agree with installed vessel level instrumentation within design requirements.

2. ADS logic will function within design requirements.

3. NSSS logic will function within design requirements.

4. MSIV operation and timing will be within design tolerances for ambient conditions.

5. Safety/relief valves and MSIV accumulator capacities will be sufficient to perform design functions.

6. Controls, alarms, and interlocks will operate within design limits.

7. Containment isolation functions will occur per design.

14.2.12.1.5 RESIDUAL HEAT REMOVAL SYSTEM

Test Objectives

1. To verify proper operation of controls, interlocks, and alarms associated with each mode of operation.

2. To verify the capability of the residual heat removal system to deliver sufficient flow during various modes of operation.

3. Demonstrate actions upon receipt of isolation signals.

Prerequisites and Initial Conditions

1. Checkout and initial operation phase testing has been completed.

2. A sufficient supply of chemically acceptable water is available in the suppression pool and the reactor vessel.

3. The reactor vessel is available to receive water during the LPCI, and the shutdown cooling modes of operation.

4. Shutdown service water is available.

5. The RCIC system is available for testing.

Test Procedure

1. Logic and interlock tests will be performed for all modes of operation. With the pumps locked out, each mode will be actuated from each possible source and all associated events will be monitored. Valve timing will be checked. The modes to be checked are low pressure coolant injection, suppression pool cooling, shutdown cooling, containment spray, and test.

2. The RHR pumps will be performance tested.

3. Using a simulated LPCI automatic initiation signal, establish flow. Monitor system characteristics with flow to the reactor vessel.

4. Align the system for the suppression pool cooling mode. Head versus flow curves will be obtained for each pump.

5. Deleted.

6. The system will be aligned in the shutdown cooling mode. System flow parameters will be checked.

7. Establish a flow of gas through the containment spray nozzles. Flow through individual nozzles will be verified by the use of smoke bombs, flags or some other means. Verify the path between the containment spray isolation valve and the air test connection by either pressurizing the line with water from the flushing water header upstream of the containment spray isolation valves and obtaining flow at the air test connection or by pressurizing the line with air and obtaining air flow at a vent or test connection upstream of the containment spray isolation valves.

8. The system will be placed in the test mode. Flow curves will be obtained to use as a basis for evaluating performance during future testing.

9. Verify the system standby mode including water leg pump operation.

10. Verify that paths for the air-flow test of containment spray nozzles overlap the water-flow paths of the pumps to demonstrate that there is no blockage in the flow path.

Acceptance Criteria

1. Logic and interlocks will perform per design specifications.

2. Valves will operate within time limits specified by design.

3. Pump performance results will indicate performance of design functions.

4. Flow and pressures during each mode will be consistent with design intent. Flow orifice size will be verified to be in accordance with design.

5. The system standby mode and water leg pump are demonstrated to operate as designed.

14.2.12.1.6 REACTOR CORE ISOLATION COOLING SYSTEM

Test Objectives

1. To verify the operation of the controls, alarms, interlocks, and valves associated with the RCIC system.

2. To verify automatic and manual system activation.

3. To verify automatic and manual system isolation.

4. RCIC turbine operation and pump flow parameters will be determined to the extent possible with an auxiliary steam supply.

Prerequisites and Initial Conditions

1. Checkout and initial operation phase testing has been completed.

2. A source of steam is available for RCIC turbine operation.

3. The suppression pool is available to receive the RCIC turbine exhaust.

4. Chemically acceptable water is available in the RCIC storage tank and suppression pool in sufficient quantity to perform the test.

5. The reactor vessel is available to receive water.

Test Procedure

1. Alarms, controls, and interlocks will be checked.

2. Automatic valves will be cycled and timing checked.

3. The system will be activated manually and by introduction of the automatic initiation signal.

4. The standby mode will be tested.

5. With auxiliary steam, RCIC turbine operation will be checked and pump operation will be verified with suction from the RCIC storage tank and with suction from the suppression pool.

Acceptance Criteria

1. All alarms, controls, and interlocks will perform their design function.

2. Automatic valves will operate as designed and within time limits specified by design.

3. Valve actuations will take place as designed when each system activation or isolation signal is introduced.

4. Turbine parameters will be consistent with the vendors instruction manual.

5. The standby mode including RCIC water leg pump performance will be verified to be in accordance with design.

6. Pump operation will be verified to the extent possible, using auxiliary steam to drive the pump turbine. Flow paths to the reactor vessel and the suppression pool will be verified.

14.2.12.1.7 REACTOR RECIRCULATION SYSTEM

Test Objectives

1. To demonstrate the functional capability of the recirculation system controls, motors, MG sets, pumps and valves to work as a system to deliver recirculation flow.

2. To the extent possible, under cold conditions with no fuel in the reactor vessel, preliminary performance data of the recirculation pumps, jet pumps, and recirculation system will be obtained.

Prerequisites and Initial Conditions

1. Checkout and initial operation phase testing has been completed.

2. Component cooling water is available.

3. Seal water is available from the control rod drive system.

4. The support systems for pumps and motors are operable.

5. The reactor vessel is available for testing.

6. A sufficient quantity of chemically acceptable water is available.

Test Procedure

1. Valves will be tested for proper operation including timing, interlocks, and indication.

2. With the recirculation pumps operating within the limits dictated by the system conditions.

    a. Instrumentation, controls, and interlocks will be checked.

    b. Recirculation and jet pump performance characteristics will be tested to the extent practicable.

    c. Flow control valve operation will be demonstrated.

3. Recirculation pump vibration will be monitored.

Acceptance Criteria

1. Jet pump characteristics will be within manufacturers' specifications.

2. System valves will operate per design specifications.

3. Interlocks, controls, and instrumentation function in accordance with design specifications.

4. Measured pump and system performance will be analyzed for possible indications of design performance deficiencies under expected system operating conditions.

5. Recirculation pump vibration will be within design specified limits for speeds at which it is monitored.

14.2.12.1.8 ROD CONTROL AND INFORMATION SYSTEM

Test Objectives

To verify operation of the rod control and information system including relays, control circuitry, switches and indicating lights, and control valves.

Prerequisites and Initial Conditions

1. Checkout and initial operation phase testing has been completed.

2. The CRD system is operational.

Test Procedure

1. Rod blocks, interlocks, and alarms will be verified.

2. The rod control and information system capability will be demonstrated by individual and integrated tests of the following:

    a. rod pattern controller

    b. rod interface system

    c. rod activity control system

    d. rod gang drive system

    e. rod position information system

Acceptance Criteria

1. Rod blocks, interlocks, and alarms function as designed.

2. The rod control and information system functions as designed.

3. Valve timing, rod inhibit logic, rod pattern control, and valve drive commands will function as designed.

14.2.12.1.9 CONTROL ROD DRIVE SYSTEM

Test Objectives

1. To verify the performance characteristics of the control rod drive water pumps.
2. To demonstrate that the CRD system is fully operational.
3. To insure that flow control valves are adjusted for correct drive speeds.

Prerequisites and Initial Conditions

1. Checkout and initial operation phase testing has been completed.
2. Chemically acceptable water is available in sufficient quantity to perform the test.
3. The reactor vessel is available to receive water use for the test.
4. The rod control and information system is functional and available.
5. The reactor protection system is available.
6. Instrument air is available.
7. Nitrogen is available.

Test Procedure

1. The control rod drive water pumps will be checked for flow, pressure, and vibration.
2. Proper hydraulic functions will be verified for charging accumulators, drive water, cooling water, and discharge water headers during single and ganged rod modes of operation.
3. Pressure differentials across filters and strainers and their associated alarm functions will be verified.
4. Proper seal flow to drive water and reactor recirculation pumps will be verified.
5. CRD notch control including latching and position indication will be verified.
6. Withdrawal and insertion speeds of each rod will be verified and flow control valves will be adjusted as necessary.
7. Scram testing of control rods, with the reactor at atmospheric pressure, will be accomplished.
8. Transient response data for the total system will be compiled during insertion, withdrawal and scram functions.

Acceptance Criteria

1. Pump performance and vibration shall fall within the manufacturer's specification limits.

2. Hydraulic flows and pressures shall fall within design specification limits.

3. Pressure differentials across filters and the strainer will be within design specified limits and alarms will function as designed.

4. Seal water flow will be within the range necessary to perform as specified by design.

5. Scram time, rod insert and withdrawal times will be within the limits set by the control rod design specifications.

6. Transient response will be analyzed to insure that performance is within design specified limits.

7. Scram discharge volume capacity is adequate to perform its designed function.

8. Scram discharge volume instrumentation alarm, rod block and scram functions operate as designed.

14.2.12.1.10 FUEL HANDLING AND VESSEL SERVICING EQUIPMENT

Test Objectives

1. To demonstrate operation of the fuel handling vessel servicing equipment.

2. To demonstrate operation of the fuel transfer system and equipment.

Prerequisites and Initial Conditions

1. Checkout and initial operation phase testing has been completed.

2. The service air system is available.

3. The fuel pool and containment pools are available for testing.

4. The reactor protection system is available for testing.

5. The rod control and information system is available.

6. Slings and lifting devices are certified at design loads.

Test Procedure

1. Demonstrate operation of the refueling bridge and auxiliary platform including interlocks and logic.

2. Demonstrate operation of equipment used to transfer fuel between the containment and fuel buildings.

3. Demonstrate operation of the transfer tube valves.

4. Demonstrate operation of the fuel handling platform including interlocks and logic.

5. Verify operability of the following equipment:

   a. cell disassembly tools

   b. channel replacement tools

   c. instrument handling tools

   d. vacuum cleaning equipment

Acceptance Criteria

1. Interlocks and logic associated with the refueling platform auxiliary platform, and refueling bridge perform as designed.

2. The refueling platform, auxiliary platform, refueling bridge transfer equipment perform functionally as designed.

3. Transfer tube valves operate as designed.

4. Vessel servicing tools perform as designed.

14.2.12.1.11 LOW PRESSURE CORE SPRAY SYSTEM

Test Objectives

1. To demonstrate operability of the low pressure core spray system.

2. To verify the core spray pattern.

3. To verify proper operation of controls, interlocks, and alarms associated with system operation.

4. To verify operation in the test mode.

Prerequisites and Initial Condition

1. Checkout and initial operation phase testing has been completed.

2. A sufficient supply of chemically acceptable water is available in the suppression pool.

3. The reactor vessel is available to receive water.

4. The RHR system is available for testing.

Test Procedure

1. Logic and interlock checks including manual and automatic actuations will be performed.

2. The LPCS pump will be performance tested.

3. The system will be placed in the core spray mode for flow and spray pattern verification. The spray pattern will be photographed for analysis of core coverage.

4. The system will be placed in the test mode. Pump and system parameters will be recorded.

5. Remote valve operation will be verified.

6. The standby lineup and water leg pump operation will be demonstrated.

Acceptance Criteria

1. Logic, interlocks, and alarms will operate per design specifications.

2. Pump and system flow performance will be per design specifications.

3. Valve operating times will be within design limits.

4. Core spray photographs have been reviewed by GE to determine that the spray pattern gives total core coverage.

14.2.12.1.12 HIGH PRESSURE CORE SPRAY SYSTEM

An injection into the reactor vessel at normal operating reactor pressure is an unnecessary hazard during the preoperational test because of the inability to achieve rated reactor vessel conditions and maintain adequate pressure control during the injection test. However, the ability of the High Pressure Core Spray System to inject design flow into the reactor vessel at rated conditions is verified during the preoperational test. Subsection 14.2.12.1.12 verifies and plots the pump head curve from minimum flow to pump runout and it determines the system friction losses with injection into the reactor vessel at atmospheric pressure. By comparing the pump head curve and system friction loss curves the flow into the reactor vessel at rated pressure will be calculated and verified to be greater than or equal to the design flow.

This test method for the High Pressure Core Spray System is similar to that used at Grand Gulf and La Salle. Neither Grand Gulf nor LaSalle plan to perform injection tests of this system at normal operating pressure (Q&R 640.1).

Test Objectives

1. To demonstrate the operability of the high pressure core spray system.

2. To verify the core spray pattern and flow rate.

3. To verify proper operation of controls, interlocks, and alarms associated with system operation.

4. To verify operation in the test mode.

Prerequisites and Initial Conditions

1. Checkout and initial operation phase testing has been completed.

2. A sufficient supply of chemically acceptable water is available in the suppression pool and the RCIC storage tank.

3. The reactor vessel is available to receive water.

Test Procedure

1. Logic and interlock checks including manual and automatic actuations will be performed.

2. The HPCS pump will be performance tested.

3. The system will be placed in the core spray mode for flow and spray patter verifications. The spray pattern will be photographed for analysis of core coverage.

4. The system will be placed in the test mode. Pump and system parameters will be recorded.

5. Remote valve operation will be verified.

6. The standby lineup and water leg pump operation will be demonstrated.

7. Pump and motor tests with normal power supplies will be performed.

Acceptance Criteria

1. Logic, interlocks, and alarms will operate per design specifications.

2. Pump and system flow performance will be per design specifications.

3. Valve operating times will be within design limits.

4. Core spray photographs have been reviewed by GE to determine that the spray pattern gives total core coverage.

14.2.12.1.13 FUEL POOL COOLING AND CLEANUP SYSTEM

Test Objectives

1. To demonstrate the capability of the fuel pool cooling and cleanup system to maintain and alter pool levels as required.

2. To demonstrate the operability of pool instrumentation.

3. To demonstrate functional operation of the system equipment.

4. To demonstrate operation of interlocks within the system and with other systems.

5. To demonstrate functional operation of the suppression pool makeup system.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. A sufficient quantity of chemically acceptable water is available for the test.

3. Component cooling water is available.

4. The portion of the RHR system required for the test is available.

Test Procedure

1. Pool instrumentation, alarms, and interlocks will be demonstrated.

2. The fuel pool cooling and cleanup system will be demonstrated in all operational modes.

3. System interlocks will be tested.

4. The RHR fuel pool cooling mode will be verified.

5. The suppression pool makeup system valve operation and logic will be tested.

6. The leak detection circuit will be tested.

Acceptance Criteria

1. Pool instrumentation performs as designed.

2. The fuel pool cooling and cleanup system will maintain and alter pool levels in accordance with the design.

3. Interlocks operate as designed.

4. Flow through the RHR interconnection is within design.

5. The suppression pool makeup system valve operation and logic perform as designed.

6. Leak detection circuitry performs per design.

14.2.12.1.14 LIQUID RADWASTE

Test Objectives

1. To demonstrate the operation of the liquid radwaste system.

2. To verify design flow rates within the liquid radwaste system.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. Component cooling water is available.

3. Auxiliary steam is available.

4. The cycled condensate system is operable.

5. A supply of water is available.

6. The process sampling system is available.

7. The solid radwaste reprocessing and disposal system is available to receive effluent.

8. Process monitoring units interlocked with the liquid radwaste system are available for testing.

Test Procedure

1. The system will be operated to demonstrate flows, control and interlock operation, and overall system operation using water.

2. Demonstrate filter and demineralizer regeneration cycles.

3. Demonstrate evaporator operation to the extent possible.

4. Demonstrate sample technique and discharge flow control.

Acceptance Criteria

1. Process flow rates fall within design tolerances.

2. Interlocks and automatic operations function per design.

3. System and component functions are demonstrated to operate as designed.

14.2.12.1.15 SOLID RADWASTE

Test Objectives

To demonstrate the capabilities of the solid radwaste system.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. The liquid radwaste system is available.

Test Procedure

1. Trash compacting and handling equipment will be demonstrated.

2. Remote operation of equipment will be demonstrated.

Acceptance Criteria

1. Alarms, interlocks, and automatic operations perform as designed.

2. Remote operations will be demonstrated to operate as designed.

3. System operation from receipt of waste to completion of the handling process will be demonstrated to perform in accordance with design.

14.2.12.1.16 REACTOR PROTECTION SYSTEM

Test Objectives

1. To demonstrate the capability of the reactor protection system to provide reactor scrams as designed.

2. To obtain applicable scram response times.

3. To verify RPS operation with normal and alternate power supplies.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. A-C and D-C power is available.

Test Procedure

1. RPS Logic, inclusive of all applicable bypasses, interlocks, seal-ins, reset permissive and Mode Switch to shutdown time delays, alarms, indicators and permissives will be tested.

2. Input instruments will be loop calibrated and/or functionally tested to demonstrate proper trip action into RPS logic.

3. Reactor Recirculation Circuit Breaker Trips will be tested.

4. Pilot Scram Valve and Scram Valve operation will be tested.

5. Backup Scram Valve operation will be tested.

6. Scram Discharge Volume isolation valve operation will be tested.

7. Main Condenser Vacuum Pump trips for Main Steam Line Radiation trip inputs will be tested.

8. Manual Scram inputs to the RPS logic and Pilot Scram Valve Solenoid load drivers will be tested.

9. Logic power supplies will be tested for proper operation.

10. The proper system operation with normal and alternate power supplies will be tested.

11. Fail Safe operation will be tested.

12. Response times for applicable logic channels from the process variable (with the exception of neutron sensors) to the de-energization of the Pilot Scram Valve Solenoids will be verified.

Acceptance Criteria

1. RPS logic, inclusive of all applicable bypasses, interlocks, seal-ins, time delays, alarms, indicators and permissives will perform per design specifications.

2. Input instrumentation setpoints and trip action will be consistent with design specifications.

3. Equipment activated by the RPS logic will perform per the design specifications.

4. Manual Scrams will perform per the design specifications.

5. Power supplies and power distribution equipment will be within tolerances specified by design for proper operation of the instrumentation.

6. The RPS "Fail Safe" feature will perform per the design specification.

7. Response times will be consistent with the design response times used in the safety analysis.

14.2.12.1.17 NEUTRON MONITORING SYSTEM

Test Objectives

To demonstrate the capability of the neutron monitoring system to function in accordance with design specifications. The source range monitor, intermediate range monitor, local power range monitor and average power range monitor subsystems are included.

Prerequisites and Initial Conditions

1. Checkout and initial operation phase testing has been completed.

2. Calibrations of instruments within the scope of this test are current.

Test Procedure

1. The traversing mechanisms for the SRM and IRM detectors will be functionally demonstrated.

2. SRM, IRM, and APRM channels including indication, recorders, trips, bypasses, interlocks, and alarms will be tested by the introduction of simulated signals.

3. The recirculation flow bias subsystem will be demonstrated using simulated inputs.

Acceptance Criteria

1. The detector traversing mechanisms and associated interlocks operate within design tolerances.

2. Each neutron monitoring channel functions within design tolerances.

3. The recirculation flow bias circuitry functions within design limits.

14.2.12.1.18 TRAVERSING INCORE PROBE SYSTEM

Test Objectives

1. To demonstrate operation of the traversing incore probe system.
2. To verify positioning mechanism operation and interlock operation.

Prerequisites and Initial Conditions

1. C&IO testing is complete.
2. Instrument air is available.

Test Procedure

1. Operation of the drive control units will be verified.
2. Control, interlock, and indication functions will be verified.
3. Purge operation will be verified.

Acceptance Criteria

1. All modes of operation will be demonstrated to perform as designed.
2. Interlocks and indications perform per design criteria.
3. The purge system performs per design.

14.2.12.1.19 PROCESS RADIATION MONITORING SYSTEM

Test Objectives

1. To demonstrate the operability of the following radiation monitoring subsystems:
    a. main steam line
    b. containment vent exhaust plenum
    c. off-gas pretreatment
    d. radwaste effluent
    e. component cooling water effluent
    f. carbon bed vault
    g. RHR loop A service water
    h. RHR loop B service water

i. service water effluent

j. fuel pool heat exchanger IA shutdown service water

k. fuel pool heat exchanger IB shutdown service water

1. off-gas post treatment

m. common station, HVAC vent stack

n. fixed continuous air monitors

o. containment fuel transfer plenum

p. fuel building vent exhaust

q. control building air intake

r. standby gas treatment exhaust

2. To verify interlocks, alarms and controls.

3. To verify operation of heat tracing.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. Check sources are in place.

Test Procedure

1. Radiation monitor detector performance will be tested using check sources.

2. Functional tests will be performed to demonstrate operability of pumps, valves, controls, and instrumentation.

3. Alarm, trip, and interlock functions will be tested.

4. Verify heat tracing will maintain the system within temperature range.

Acceptance Criteria

1. Radiation monitor detector performance with check sources will fall within design tolerances.

2. Alarms, trips and interlocks perform per design specifications.

3. System temperature is maintained with range.

14.2.12.1.20 AREA RADIATION MONITORING SYSTEM

Test Objectives

1. To verify operation of the area radiation monitoring equipment.

Prerequisites and Initial Conditions

Checkout and initial operation phase testing has been completed.

Test Procedure

1. Each area monitor will be tested for indicating and alarm functions.
2. Interlocks will be checked.

Acceptance Criteria

1. Channel accuracy shall be within design tolerances.
2. Alarm and interlock functions will take place at design specified points.

14.2.12.1.21 OFF-GAS SYSTEM

Test Objectives

1. To functionally demonstrate operation of the off-gas system equipment.
2. To demonstrate the operability of the off-gas hydrogen analyzers.

Prerequisites and Initial Conditions

1. C&IO testing is complete.
2. The instrument air system is available.
3. The plant chilled water system is available.

Test Procedure

1. Operation of the refrigeration units will be demonstrated.
2. Operation of the dryers will be demonstrated.
3. Interlocks, controls, and alarms will be checked.
4. Integrated operation of the off-gas system equipment will be demonstrated to the extent possible.
5. The hydrogen analyzers will be tested.
6. Operation of remotely operated valves will be tested.

7. Filter efficiency will be tested.

Acceptance Criteria

1. Alarms, controls, and interlocks function within design limits.
2. The refrigeration units and dryers perform the intended design functions.
3. Off-gas system parameters are within design limits.
4. The hydrogen analyzers perform as designed.
5. Valve operation from remote stations will be verified to be in accordance with design.
6. Filter efficiency will fall within design limits.

14.2.12.1.22 MSIV LEAKAGE CONTROL SYSTEM

Test Objectives

1. To verify MSIV leakage control logic.
2. To verify operation of interlocks and alarms associated with the MSIV leakage control system.
3. To functionally demonstrate MSIV leakage control equipment.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

Test Procedure

1. Controls, interlocks, and alarms will be tested.
2. Valves, heaters, and blowers will be tested for proper operation.

Acceptance Criteria

1. Controls, interlocks, and alarms will function as designed.
2. Valves, heaters, and blowers will operate per design.
3. Valve operating times will fall within design specified limits.

14.2.12.1.23 SUPPRESSION POOL MAKEUP SYSTEM

Test Objectives

1. To verify suppression pool makeup system logic.

2. To observe the transfer of water from the upper containment pool to the suppression pool.

Prerequisites and Initial Conditions

1. C&IO testing is complete.
2. The fuel pool cooling and cleanup system is available.
3. Required portions of the containment monitoring system are available.

Test Procedure

1. Initiation logic will be checked for operation alarms, controls, and interlocks.
2. A timed dump of water from the upper pool to the suppression pool will be observed.

Acceptance Criteria

1. Logic performs within design tolerances.
2. The dumping of the upper pool to the suppression pool occurs within design time limits.

14.2.12.1.24 CONTAINMENT COMBUSTIBLE GAS CONTROL SYSTEM

Test Objectives

1. To demonstrate the operation of the hydrogen recombiners.
2. To demonstrate the operation of the hydrogen mixing system.
3. To demonstrate the operation of the drywell/containment vacuum breakers.

Prerequisites and Initial Conditions

1. C&IO testing is complete.
2. Shutdown service water is available.
3. The suppression pool contains a sufficient quantity of water.

Test Procedure

1. Control, alarms, and interlocks will be checked for operation.
2. Valve operation will be demonstrated.
3. The hydrogen mixing compressor and valves will be operationally demonstrated.
4. The operation of the hydrogen recombiner units will be demonstrated in the test mode.

5. The setpoint and operability of the drywell/containment vacuum breakers will be demonstrated.

Acceptance Criteria

1. Controls, alarms, and interlocks will operate within design tolerances.

2. Valve operation will conform to design specifications.

3. The hydrogen mixing compressor and valves perform within design specifications.

4. Hydrogen recombiner performance is within design tolerances.

5. The drywell/containment vacuum breakers will operate within design specifications.

14.2.12.1.25 COMPONENT COOLING WATER SYSTEM

Test Objectives

1. To demonstrate the capability of the component cooling water system to provide flow to components.

2. To demonstrate automatic transfer of cooling functions to the shutdown service water system.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. Plant service water is available.

3. Shutdown service water is available.

Test Procedure

1. Pump and system flow characteristics will be verified.

2. Controls, interlocks and alarms will be verified.

3. Automatic transfer of cooling loads to the shutdown service water system under dynamic conditions will be demonstrated.

4. Valve operation will be demonstrated.

Acceptance Criteria

1. Pump and system flow characteristics are within design limits.

2. Controls, interlocks, and alarms perform as designed.

3. The transfer of heat loads to the shutdown service water system is demonstrated to operate in accordance with design.

4. Valve operation and timing is within design limits.

14.2.12.1.26 SHUTDOWN SERVICE WATER

Test Objectives

1. To demonstrate the ability of the shutdown service water system to supply water to the various components it serves.

2. To demonstrate proper operation of the automatic actuations and interlocks associated with the system.

3. To demonstrate that the shutdown service water pumps will not be subjected to vortexing at either normal lake level or design minimum ultimate heat sink (UHS) levels.

4. To demonstrate that the shutdown service water pumps have adequate NPSH at both normal lake level and design minimum UHS levels.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.

2. The heat exchangers served by shutdown service water will be available for the test.

Test Procedure

1. The pumps will be performance tested.

2. Auto start and interlock features will be tested.

3. Flow paths will be verified.

4. Pumps will be operated at normal lake level and design minimum UHS level to verify sufficient NPSH and the absence of vortexing.

Acceptance Criteria

1. Pump performance shall meet design specifications.

2. All auto start and interlock features shall perform per design specifications.

3. Flow rates will be verified in accordance with design to all equipment served by the shutdown service water system.

4. Valve operation and timing is within design tolerances.

5. Pumps operate per design with no signs of vortexing at normal lake level and design minimum UHS level.

14.2.12.1.27 SHUTDOWN SERVICE WATER VENTILATION SYSTEM

Test Objectives

To demonstrate the capability of the shutdown service water ventilation system.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. The shutdown service water system is available for operation.

Test Procedure

1. Auto-start, alarm, and interlock features will be checked.

2. The system will be operationally tested.

3. Control from the remote shutdown panel will be verified.

Acceptance Criteria

1. Auto-start, alarm, and interlock functions perform as designed.

2. The ability of the system to cool the shutdown service water pump rooms will be demonstrated to perform in accordance with design.

3. Air and water flow will be within design tolerances.

14.2.12.1.28 ESSENTIAL SWITCHGEAR HEAT REMOVAL SYSTEM

Test Objectives

To verify the operational capability of the switchgear heat removal system during normal and abnormal conditions.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. Plant chilled water is available.

3. Shutdown service water and plant service water is available.

4. The auxiliary building HVAC system is available.

Test Procedure

1. Verify fan, filter and damper controls, interlocks, and alarms.

2. Verify refrigeration equipment operation.

3. Demonstrate system capability to maintain switchgear and battery room atmospheres.

4. Verify battery room exhaust air flow rate.

Acceptance Criteria

1. Fan, filter and damper controls, interlocks and alarms will perform per design specifications.

2. The refrigeration system will perform as designed.

3. Temperature and humidity will be consistent with design expectations.

4. Air flow will be within design tolerances.

14.2.12.1.29 CONTROL ROOM HVAC SYSTEM

Test Objectives

1. Demonstrate the operation of the control room HVAC equipment during normal and abnormal plant operating conditions.

2. Confirm the proper operation of system interlocks, controls, and alarms.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. Flow and 1eak tightness tests are complete.

3. Shutdown service water is available.

4. Demineralized water is available.

5. Radiation monitors, chlorine monitors, and smoke detectors interlocked with the control room HVAC are operational and available for testing.

Test Procedure

1. Verify fan, damper, heater, humidifier, and air conditioner controls, interlocks, permissives, trips, and alarms.

2. Verify isolation damper operation.

3. Verify actuations from radiation monitors, chlorine monitors, and smoke detectors.

4. Verify control room atmospheric pressure differential with surrounding area.

5. Demonstrate operation in all modes.

Acceptance Criteria

1. Fans, dampers, heaters, humidifiers, and air conditioning units function as designed.

2. Dampers operate as designed and within designed specified time limits.

3. Actuations from radiation monitors, chlorine detectors, and smoke detectors are correct as designed.

4. Control room atmospheric pressure is greater than the surrounding areas.

5. The control room HVAC will operate as designed in all modes.

14.2.12.1.30 ECCS EQUIPMENT COOLING HVAC SYSTEM

Test Objectives

1. Demonstrate operation of the various ECCS equipment room cooling units.

2. To demonstrate the heat removal adequacy of the ESF cooler during post-accident conditions.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. Shutdown service water is available.

3. The ECCS equipment required for performance of this test is available.

Test Procedure

1. Verify fan and valve controls, interlocks and alarms.

2. Evaluate the ability of each cooler to maintain area temperatures.

Acceptance Criteria

1. Fan and valve controls, including auto-starts function as designed.

2. The coolers maintain respective area temperatures within design requirements.

3. The ESF cooler is capable of removing the postulated post-accident design heat loads.

14.2.12.1.31 DIESEL GENERATOR ROOM HVAC

Test Objectives

1. To demonstrate operation of fans and dampers.

2. To demonstrate operation of the heater and cooler.

3. To demonstrate controls, interlocks, and alarms.

Prerequisites and Initial Conditions

1. C&IO phase testing is complete.

2. The plant chilled water system is available.

Test Procedure

1. Functionally test the fans and dampers including controls and alarms.

2. Demonstrate operation of the heater and cooler and controls.

3. Test system interlocks with the fire protection system and diesels.

Acceptance Criteria

1. The fans and dampers operate in accordance with design.

2. The heater and cooler perform per design intent.

3. Extra- and intra-system interlocks operate in accordance with the design.

14.2.12.1.32 DRYWELL PURGE VENTILATION SYSTEM

Test Objectives

1. To demonstrate operation of the drywell purge system.

2. To demonstrate system logic on interlocks.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.

Test Procedure

1. Controls, interlocks, and alarms will be functionally tested.

2. Manual and automatic signals will be used to activate the system. Fan, damper, instrument, alarm, and interlock action will be checked.

3. Valve timing will be verified.

4. Airflow will be verified.

Acceptance Criteria

1. Controls, interlocks, and alarms will function as designed.

2. The system will function as designed.

3. Valves will operate within design specified times.

4. Airflow will be within design limits.

14.2.12.1.33 DRYWELL COOLING SYSTEM

Test Objectives

1. To demonstrate operation of the drywell cooling system.

2. To demonstrate system logic and interlocks.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. Plant service water is available.

Test Procedure

1. Controls, interlocks, and alarms will be functionally tested.

2. Airflows will be verified.

Acceptance Criteria

1. Controls, interlocks and alarms will function as designed.

2. Airflow will be within design tolerances.

14.2.12.1.34 CONTAINMENT BUILDING HVAC SYSTEM

Test Objectives

1. To demonstrate operation of the containment building HVAC system.

2. To demonstrate system logic and interlocks.

3. To demonstrate system ability to maintain containment pressure negative with respect to the outside atmosphere.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. The plant chilled water system is available.

3. The drywell purge system is available for testing.

Test Procedure

1. Controls, interlocks, trips, and alarms will be functionally tested.

2. Isolation valves will be functionally tested.

3. Fan capacities will be verified.

4. Airflows to various areas will be checked.

5. Normal and purge configurations will be demonstrated.

Acceptance Criteria

1. Controls, interlocks, trips, and alarms will function as designed.

2. Isolation valve operation and timing will be within design limits.

3. Fan capacities and area air flows will be within design requirements.

4. The system will perform design functions in each configuration.

5. The system will maintain containment pressure within design limits.

14.2.12.1.35 STANDBY GAS TREATMENT SYSTEM

Test Objectives

1. To demonstrate operation of the standby gas treatment system trains.

2. To demonstrate system logic and interlocks.

3. To demonstrate system ability to maintain a negative pressure in the secondary containment.

Prerequisites and Initial Conditions

1. Checkout and initial operation phase testing has been completed.

2. The areas served by SGTS are completed and intact.

Test Procedure

1. Controls, interlocks, and alarms will be functionally tested.

2. Manual and automatic signals will be used to activate the system. Fan, damper, instrument, alarm, and interlock action will be checked.

3. Each train will be tested for the capability of maintaining the secondary containment at a specified negative pressure.

4. Damper operations will be timed.

5. Airflow through each train will be checked.

6. Fan capacities will be verified.

Acceptance Criteria

1. Controls, interlocks, and alarms will function as designed.

2. The system will operate as designed during manual and automatic start conditions.

3. Each train will maintain secondary containment pressure per design specification.

4. Dampers will operate within time limits specified by design.

5. Airflows and fan capacities will be within design limits.

14.2.12.1.36 DIESEL GENERATOR SYSTEM

Test Objectives

1. To demonstrate the ability of each diesel to start and acquire emergency loads during simulated accident conditions. This will include a demonstration for each diesel that the ECCS system(s) reach design flow within the design time.

2. To demonstrate the operability of the diesel-generator auxiliary systems, i.e., fuel oil transfer, lube oil, cooling system, starting air supply system.

Prerequisites and Initial Conditions

1. Checkout and initial operation phase testing has been completed.

2. The makeup water system is available.

3. Shutdown service water is available.

4. The portion of the fire protection system covering the diesel-generator rooms is operable.

5. Diesel generator room HVAC is available.

6. The ECCS system(s) are available for operation, as applicable to the diesel under test.

Test Procedure

1. All diesel starting and trip sequences will be tested to assure proper operation.

2. All auxiliary systems will be functionally demonstrated.

3. Demonstrate the manual and automatic operation of the diesel-generator, including measurement of time to rated voltage and frequency and load test at full load for a specified time period.

4. All emergency mode interlocks, controls, indications, and alarms will be verified to operate in accordance with design specifications.

5. Load rejection tests shall be conducted to assure diesel operation in accordance with design specifications.

6. Demonstrate starting ability with design minimum starting air available.

7. Conduct a consecutive start reliability test.

8. Demonstrate synchronization and load transfer capabilities.

9. Demonstrate separately for each division, that the ECCS system(s) reach design flow within the design times including diesel-generator start time.

Acceptance Criteria

1. The automatic sequence test loads the generators in the proper design sequence and time interval and the applicable ECCS system(s) reach the required flow to the reactor vessel within the required time as specified in the Technical Specifications.

2. All auxiliary systems perform intended design functions.

3. Rated load and frequency can be attained and maintained for a design specified time period.

4. Load rejection does not result in exceeding design specified speeds and nominal voltage and frequency are restored within design specified times.

5. Emergency mode controls, alarms and interlocks operate as designed.

6. The diesels will start with design minimum starting air capacity available.

7. The diesels will perform the required number of consecutive starts as recommended in Regulatory Guide 1.108 without failure.

8. Synchronization and load transfers will be demonstrated to perform in accordance with Regulatory Guide 1.108.

14.2.12.1.37 REACTOR VESSEL FLOW INDUCED VIBRATION

Test Objectives

To verify that structural integrity of the reactor internals remains intact during and after flow induced vibrations.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. The recirculation system testing is completed sufficiently to allow safe operation of the recirculation pumps at rated volumetric flow for an extended period of time.

3. The capability exists to maintain reactor water temperature equal to or greater than 150°F during the test.

4. Capability to maintain the reactor pressure vessel 100 psi greater than saturation is provided.

Test Procedure

1. A preflow vessel internal inspection will be conducted. This will include visual inspection of selected internal structures and component parts.

2. A flow test will be completed. The extent of the test and monitoring will be consistent with NRC Regulatory Guide 1.20 recommendations.

3. A postflow vessel internal inspection will be conducted and a visual inspection will be performed subsequent to vessel draining. This will include visual inspection of the same selected internal structures and component parts as were examined in the preflow inspection.

Acceptance Criteria

1. Evidence of defects, loose parts, or excessive wear will be evaluated for effect on plant operation.

2. No extraneous material shall be permitted in the jet pump annulus or the plenum region as a result of specified flow testing.

14.2.12.1.38 125 VDC SYSTEMS

Test Objectives

To demonstrate that the batteries and battery chargers will supply direct current power as required.

Note: An engineering evaluation has been performed to verify that the emergency DC loads will remain operable at the minimum voltage level established in the discharge test. This evaluation included calculation of voltage at the device terminal , including the worst-case voltage drop, which was determined for the longest cable in the system. The calculated available voltages were then compared with vendor-supplied operating data for each device. In all but one case the calculated voltages were well within the operating voltage range of the devices. The one exception (RCIC Gland Seal Air Compressor 1E51-C002F) has been field-tested in Preoperational Test PTP-RI-01. This test has verified proper compressor operation at the minimum voltage available at the device terminals, considering voltage drop due to the cable, and the minimum allowable bus voltage of 105 volts (Q&R 640.16).

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. A load is available for the performance of battery capacity checks.

3. Adequate ventilation is available for the battery rooms.

Test Procedure

1. The capability of each battery charger to individually maintain a float charge on the battery and to provide an equalizing charge while maintaining a normal load on the associated D-C bus will be tested.

2. The ability of each battery to accept load will be demonstrated by de-energizing the battery charger while design D-C load is being carried on the bus.

3. A test discharge will be carried out on each battery to verify capacity.

4. The emergency D-C loads will be verified to remain operable at the minimum voltage level established in the discharge test either by field or vendor testing of a typical device. (See Response to Question 640.16(5).)

5. The batteries will be recharged after the test discharge.

Acceptance Criteria

1. The battery chargers will provide battery float and equalizing charges while maintaining normal bus loads.

2. Each battery will maintain normal bus loads upon loss of battery chargers per design specifications.

3. Each battery will contain sufficient capacity to perform its emergency function specified by design, while individual cell limits are not exceeded.

4. The emergency D-C loads remain in operation at the minimum voltage level established in the discharge test.

5. After the discharge test, the batteries will be restored to normal charge within the rated recovery time specified by design.

14.2.12.1.39 CONTAINMENT MONITORING SYSTEM

Test Objectives

1. Demonstrate the operability of the containment monitoring system equipment.

2. Verify operation of heat tracing.

Prerequisites and Initial Conditions

Checkout and initial operation phase testing has been completed.

Test Procedure

1. Suppression pool level instrumentation will be tested.

2. Suppression pool temperature monitors and associated instrumentation will be tested.

3. Suppression pool excess flow instrument line check valves, and drywell pressure excess flow check valves including all instrumentation will be tested.

4. Humidity monitors in the drywell and associated instruments will be tested.

5. Containment pressure monitors and associated instruments will be tested.

6. Containment hydrogen concentration monitors and associated instrumentation will be tested.

7. Containment radiation monitors and associated instrumentation will be tested.

8. Verify heat tracing will maintain the system within temperature range.

Acceptance Criteria

1. Valve, instruments, recorders, interlocks, and alarms function in accordance with design specifications.

2. System temperature is maintained within range.

14.2.12.1.40 LOSS OF OFF-SITE POWER/INTEGRATED ECCS

Test Objectives

1. Demonstrate integrated A-C system performance to simulated partial (one source) and full (both sources) loss of off-site power.

2. Demonstrate independence among redundant on-site A-C and D-C power sources.

3. Verify voltage drop on system IE buses down to the 120/208 level.

4. Demonstrate the ability of RHR/LPCI, LPCS and HPCS systems to realign, start and provide rated flow on integrated response to a simulated LOCA signal. The ECCS system flow may be to the reactor vessel, or to the test return line.

5. Demonstrate the ability of the diesel generators to maintain ECCS loads while they provide rated flow on integrated response to a simulated LOCA signal in conjunction with a loss of off-site power. ECCS flow may be to the reactor vessel or to the test return line.

Prerequisities and Initial Conditions

1. C&IO testing is complete on main power, 6900 VAC, 4160 VAC, 480 VAC, 120 VAC and 125 VDC distribution systems.

2. The emergency diesels have been preoperationally tested and are available.

3. 345 kV and 138 kV off-site power is available.

4. Reliable communications exist between control points for the test.

5. Permission for loss of power testing has been obtained from the IP system dispatcher.
6. All station 480 volt distribution buses and class 1E buses down to the 120/208 level are loaded to 30% minimum.
7. Preoperational test flow data for RHR, HPCS and LPCS have been reviewed and the systems are operable.

Test Procedure

1. Simulated partial and full loss of off-site power tests will be performed.
2. Independence between redundant class 1E power sources and load groups will be demonstrated by performing the loss of off-site power coincident with a LOCA signal three times, each time having one load group at a time disconnected and allowing the remaining diesel generators to start.
3. Load shedding will be demonstrated.
4. Re-energization sequencing and timing of ECCS loads will be verified.
5. Grid and Class 1E bus voltages down to the 120/208 volt level will be recorded at steady state, and during the starting of a large class 1E and non-class 1E load.

Acceptance Criteria

1. The A-C distribution system will perform as designed during loss of off-site power tests.
2. Independence between redundant Class 1E power sources and load groups will exist.
3. Load shedding, source transfer, and re-energization operations will perform per design specifications.
4. Test voltage shall not be lower than 3% of the values specified by engineering analysis and never less than Class 1E equipment design voltage.
5. Integrated ECCS response must show the ability of RHR/LPCI, LPCS and HPCS to realign in the injection mode and reach rated flow following a LOCA signal.
6. The diesel generators will maintain ECCS loads while the ECCS systems provide rated flow during integrated ECCS response in conjunction with a simulated LOCA and loss of off-site power.

14.2.12.1.41 AUXILIARY BUILDING HVAC

Test Objectives

To demonstrate the capabilities of the auxiliary building HVAC system.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. Plant chilled water is available.

Test Procedure

1. Verify fan, filter, and damper controls, interlocks, and alarm operation.

2. Measure the pressure of various areas within the auxiliary building with respect to outside ambient.

3. Measure the differential pressure between selected areas within the auxiliary building.

4. Demonstrate the system's ability to supply airflow to the various areas.

Acceptance Criteria

1. Fans, filters, and damper controls, interlocks, and alarms perform per design specifications.

2. Differential pressures will be consistent with design requirements.

3. Proper airflows to various areas will be verified to be in accordance with design.

14.2.12.1.42 RADWASTE BUILDING HVAC

Test Objectives

To demonstrate the capability of the radwaste building HVAC system.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. Plant chilled water is available.

Test Procedure

1. Verify fans, filters, and damper controls, interlocks, and alarm operation.

2. Demonstrate system capability to supply airflow to the various areas.

3. Verify that airflow is from relatively clean areas to areas with a potential for higher radioactive contamination.

4. Measure the pressure in the radwaste building with respect to the outside ambient.

Acceptance Criteria

1. Fans, filters, and damper controls, interlocks, and alarms will perform per design specifications.

2. Airflows will be consistent with design.

3. Radwaste building pressure will be negative with respect to the outside ambient and consistent with design limits.

14.2.12.1.43 FUEL BUILDING HVAC SYSTEM

Test Objectives

1. Demonstrate operation of the fuel building HVAC equipment.

2. To confirm proper operation of system interlocks, controls, and alarms.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. The plant chilled water system is available.

Test Procedure

1. Verify fan and damper controls, interlocks, permissives and alarms.

2. Verify fan and damper operation.

3. Verify trips from radiation monitors, reactor water level and drywell pressure.

4. Measure the differential pressure between various areas maintained by the fuel building HVAC and the outside atmosphere.

Acceptance Criteria

1. Fan and damper controls, interlocks, and alarms function as designed.

2. Dampers operate as designed.

3. All radiation, reactor water level, and drywell pressure trips operate as designed.

4. Fuel building, containment gas control boundary, RWCU room, and ECCS pump rooms pressure is negative with respect to the outside atmosphere.

14.2.12.1.44 OFF-GAS VAULT HVAC SYSTEM

Test Objectives

1. To demonstrate operation of the off-gas vault HVAC equipment.

2. To confirm proper operation of system controls, interlocks, and alarms.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. The plant chilled water system is available.

Test Procedure

1. Verify fan and damper controls, operation, interlocks, and alarms.

2. Verify the off-gas vault refrigeration equipment controls, operation, interlocks, and alarms.

3. Demonstrate that the system can maintain the required temperature in the charcoal absorber vault and the fan coil unit room.

4. Demonstrate the system ability to elevate temperatures in the charcoal absorber vault to the maximum requirement.

5. Measure the differential pressure between the interior of the charcoal absorber vault and the adjacent areas.

Acceptance Criteria

1. Fans and dampers function as designed.

2. Refrigeration equipment operates as designed.

3. Temperatures can be achieved and maintained per system design.

4. The charcoal absorber vault can be maintained at a negative pressure with respect to the adjacent areas.

14.2.12.1.45 FIRE PROTECTION SYSTEM

Test Objectives

To demonstrate operation of the fire protection systems and components.

Prerequisites and Initial Conditions

C&IO testing is complete.

Test Procedure

1. All controls, alarms, interlocks, and logic are checked for proper operation.

2. Remote operated valve operation will be tested.

3. The diesels and pumps will be functionally tested.

4. Deluge valve operation and associated alarms will be tested.

5. Smoke detectors and heat detectors will be tested.

6. CO_2 system functions will be tested.

7. PCGG Halon system fucntions will be tested.

Acceptance Criteria

1. Controls, alarms, and logic operate as designed.

2. Valves will operate as designed.

3. Diesels and pumps will perform per design.

4. Deluge valves will operate as designed.

5. Detection devices will perform all functions as designed.

6. The CO_2 system will function as designed.

7. The Halon system will function as designed.

14.2.12.1.46 INSTRUMENT AND SERVICE AIR SYSTEM

Test Objectives

1. To demonstrate the operation of air compressors, dryers, and filters.

2. To demonstrate that air of sufficient quantity and quality can be supplied to the instrument air system.

3. To demonstrate the effects that loss of instrument air pressure has on branch lines which serve safety related equipment.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. Valves, in other systems, that are required for the loss of instrument air pressure tests are available.

3. Component cooling water is available.

Test Procedure

1. Functionally demonstrate compressor, filter, and dryer operation.

2. Test capacity and quality of air supplied to the instrument air system.

3. Check interlocks, controls, and alarms for the air compressors, filters, dryers, and balance of system.

4. Loss of instrument air testing will be performed on lines which serve safety related equipment.

Acceptance Criteria

1. Air compressors, filters, and dryers will perform as designed.

2. The quantity and quality of the air supplied to the instrument air system will be within design limits.
3. Interlocks, controls, and alarms will perform as designed.
4. The instrument air system will perform per design specifications during loss of air testing.

14.2.12.1.47 CONDENSATE

Test Objectives

To demonstrate operation of the condensate and condensate booster systems.

Prerequisites and Initial Conditions

1. C&IO testing is complete.
2. The condensate polishing system is available.
3. The reactor feedwater system is available.
4. Turbine building closed cooling water is available.

Test Procedure

1. The condensate and condensate booster pumps will be performance tested.
2. Controls, interlocks, trips, and alarms will be verified.
3. Hotwell level control will be tested.
4. Minimum flow rates and valve operation will be verified.
5. Heater controls will be tested.

Acceptance Criteria

1. Pump performances will be within design.
2. Controls, interlocks, trips, and alarms will perform as designed.
3. Minimum flow rates and valve performance will fall within design limits.

14.2.12.1.48 ENVIRONS MONITORING SYSTEM

Test Objectives

To demonstrate proper operability of the Environs Monitoring System (EM).

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. AC electrical power is available.

Test Procedure

1. Using actual and simulated inputs, the indication, and recording equipment of Meteorology Monitoring System will be demonstrated.

2. Using simulated inputs, the indication, alarm and recording equipment of Seismic Monitoring System will be demonstrated.

Acceptance Criteria

1. The Meteorological Monitoring System indication and recording equipment will function satisfactorily per design requirements.

2. The Seismic Monitoring system alarm, indication and recording equipment will function satisfactorily per design requirements.

14.2.12.1.49 CONDENSER CIRCULATING WATER SYSTEM

Test Objectives

1. To demonstrate circulating water system capability for providing flow to the condenser.

2. To demonstrate integrated operation of the circulating water, traveling screens, screen wash, and chlorination systems.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. Vacuum priming is available.

3. The chlorination system is available.

4. Plant service water is available.

5. Filtered water is available.

6. The traveling screens are operational.

Test Procedure

1. Controls, interlocks, and alarms will be verified.

2. System flow characteristics will be demonstrated for various pump combinations.

3. Circulating water system valve operation will be demonstrated.

4. A demonstration of the integrated operation of the circulating water, traveling screens, screen wash, and chlorination systems will be performed.

Acceptance Criteria

1. Controls, interlocks and alarms will perform per design specifications.

2. Flow characteristics will be within design limits. Adequate NPSH is available, i.e. the circulating water pumps exhibit no signs of cavitation.

3. Circulating water system valves perform per design specifications.

4. The circulating water, traveling screens, screen wash, and chlorination systems perform as an integrated unit.

14.2.12.1.50 COMMUNICATIONS SYSTEMS

Test Objectives

1. To demonstrate the capabilities of the various inplant and off-site communication systems to be used for normal and abnormal operating conditions.

2. To demonstrate plant emergency alarms.

Prerequisites and Initial Conditions

1. Vendor installation and testing is complete.

2. C&IO testing is complete.

Test Procedure

1. Operation of the Intra-Plant Radio Systems and the Emergency Radio System will be demonstrated.

2. Operation of the Public Address System including the plant emergency alarms will be demonstrated.

3. Operation of the Sound Power System will be demonstrated.

4. Operation of the Special Emergency Telephone Systems will be demonstrated.

Acceptance Criteria

1. The Intra-Plant Radio System and the Emergency Radio System will perform as required by design specifications.

2. The Public Address System including the plant emergency alarms will perform as required by design specifications.

3. The Sound Power System will perform as required by design specifications.

4. The Special Emergency Telephone System will perform as required by design specifications.

14.2.12.1.51 CRANES

Test Objectives

1. To demonstrate the operation of the containment building polar crane.

2. To demonstrate the operation of the fuel handling cranes.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

Test Procedure

1. Test controls, interlocks, and travel limits on the cranes.

2. Perform load test.

Acceptance Criteria

Controls, interlocks and travel limits perform per design specifications.

14.2.12.1.52 DRYWELL LEAKAGE

Test Objectives

1. To determine that the leak rate is within design limits for high pressure (30 psig) and low pressure (3.0 psig) leak rate tests.

2. To obtain base line data for subsequent drywell leakage tests.

Prerequisites and Initial Conditions

1. The drywell structural integrity test is performed in conjunction with the 30 psig leak rate test and is completed prior to the 3.0 psig leak rate test.

2. The suppression pool is full.

3. All closures are in place.

4. Pressurizing and test equipment is checked out and ready for the test.

Test Procedure

1. The drywell will be pressurized to approximately 30 psig and the leak rate determined.

2. The drywell will be pressurized to approximately 3.0 psig and the leak rate determined.

Acceptance Criteria

The leak rate will be within design limits as specified in Section 6.2.6.

14.2.12.1.53 PRIMARY CONTAINMENT LEAK RATE

Test Objectives

1. To verify that the integrated leakage rate does not exceed the containment design basis accident leakage rate.

2. To obtain base line data for use during subsequent leak rate tests.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. Isolation valves are operable.

3. All hatches and closures are in place.

4. Containment ventilation is available.

5. Pressurizing and test equipment is checked out and ready for the test.

6. Containment isolation valves will be closed by normal means and without preliminary exercising or adjustment.

7. Type “B” and “C” tests as defined by 10 CFR 50, Appendix J have been performed.

Test Procedure

A type “A” test as defined by 10 CFR 50, Appendix J will be performed.

Acceptance Criteria

Containment leakage does not exceed design limits.

14.2.12.1.54 TURBINE BUILDING HVAC SYSTEM

Test Objectives

1. To demonstrate operation of the turbine building HVAC equipment.

2. To confirm proper operation of system interlocks, controls, and alarms.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. The plant chilled water system is available.

Test Procedure

1. Verify fan and damper controls, interlocks, and alarms.

2. Verify fan and damper operation.

3. Verify air flow.

4. Measure the differential pressure between the turbine building and outside atmosphere.

Acceptance Criteria

1. Fan and damper controls, interlocks, and alarms function as designed.

2. Dampers operate as designed.

3. Air flows are within design limits.

4. Differential pressure between the turbine building and outside atmosphere is maintained within design limits.

14.2.12.1.55 LOOSE PARTS MONITORING SYSTEM

This subsection is historical information. The Loose Parts Monitoring System requirements were removed as a result of NRC SER contained within NEDC-32975P-A February 2001.

Test Objectives

To demonstrate proper operation of the Loose Parts Monitoring Equipment.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

Test Procedure

1. Using simulated inputs, the Vibration alarms channels will be demonstrated.

2. Using actual inputs, the loose parts alarms channels will be demonstrated.

3. The operation of the Auto Turn-On feature, Loose Parts Locator and the Auto Monitor will be demonstrated.

Acceptance Criteria

1. The Vibration alarm function will perform within design requirements.

2. The Loose Parts alarm function will perform within design requirements.

3. The Automatic Turn-on and Record feature, Loose Parts Locator and Audio Monitor function will perform satisfactorily.

14.2.12.1.56 DRAIN SYSTEMS

Test Objectives

To demonstrate the operation of the Containment, Auxiliary, Fuel, Turbine, Radwaste, Off Gas, and Control Building equipment and floor drains systems and the Diesel Generator Building floor drain system.

Prerequisites and Initial Conditions

1. C&IO testing is complete.
2. Cycled Condensate water is available.
3. Instrument air is available.

Test Procedure

1. All system pumps will be performance tested.
2. Controls, interlocks, trips and alarms will be verified.
3. Valve operation will be verified.

Acceptance Criteria

1. Pump performance will be within design criteria.
2. Controls, interlocks, trips and alarms will perform as designed.
3. Valve performance will fall within design limits.

14.2.12.1.57 EMERGENCY LIGHTING SYSTEM

Test Objectives

1. Demonstrate battery pack lighting system performance to simulated loss of A-C battery charging/control power.
2. Demonstrate 125V D-C emergency lighting system to simulated loss of A-C control power.

Prerequisites and Initial Conditions

1. C&IO testing is complete on battery powered and 125VDC emergency lighting systems.
2. 125VDC power to emergency lighting cabinets is available.
3. 120VAC power to regular and standby lighting cabinets is available.

Test Procedure

1. Battery pack emergency lighting system will be tested by simulating loss of A-C battery charging/control power.

2. 125VDC emergcncy lighting system will be tested by simulating loss of A-C control power to emergency lighting cabinets.

Acceptance Criteria

1. The battery pack emergency lighting system will operate as designed during loss of A-C control power.

2. The 125VDC lighting system will operate as designed during loss of A-C control power to emergency lighting cabinets.

14.2.12.1.58 INTEGRATED AUX POWER LOGIC TEST

Test Objectives

1. Demonstrate proper operation of protective devices, relaying and logic, transfer and trip devices, interlocks and alarms for the Aux Power system in integrated fashion.

Prerequisites and Initial Conditions

1. C&IO testing is complete on switchyard, RAT, ERAT, Non-Seg Bus Ducts IRT4, IRT6, IET4, 4160V Buses IA, IB, IAI, IBI, ICI, 6900V Buses IA and IB.

2. Equipment listed above is available for operation at the extent required to support this test.

3. The annunciator system is available to the extent required to support this test.

4. The BOP computer processor is available to the extent required to support this test.

5. Permission to conduct test has been obtained from IP system dispatcher.

6. Diesel generator feed breakers C&IO testing is complete to the extent that they are available for operation in the test position.

Test Procedure

1. Proper Kirk Key interlocking of Non-Seg Bus ducts will be demonstrated.

2. Proper integrated system response to the following relay schemes will be demonstrated:

   Breaker Failure CS 4538
   RAT System F
   RAT System S
   ERAT System F
   ERAT System S

3. Proper integrated operation of interlocks, trips, transfers and indications will be demonstrated for 4160V Buses IAI, IBI and ICI.

Acceptance Criteria

The Aux Power system will operate as designed during logic test.

14.2.12.1.59 480VAC AUX POWER TEST

Test Objectives

To demonstrate that the 480VAC Auxiliary Power System operates within design limits and that the system is operational and can meet its performance specifications.

Prerequisites and Initial Conditions

1. C&IO testing is complete.
2. 125VDC power is available.
3. 6900V and 4160V power is available.
4. Communications are established as deemed necessary.
5. Annunciator and computer are available as necessary.

Test Procedure

1. Demonstrate the satisfactory installation and operation of the applicable circuit breakers and tie breakers.
2. Perform an inspection of the 6900/480V or 4160/480V transformer. Verify the correct tap settings and demonstrate the satisfactory installation and operation of the transformer cooling fans as applicable.
3. Demonstrate the satisfactory installation and operation of all 480V Auxiliary Power System annunciator alarms and computer points.
4. Energize the 480V Bus and verify phase sequence and Bus voltage.
5. Energize the 480V MCC's and 480V Risers fed from the applicable 480V Bus and verify phase sequence and Bus voltage.
6. Verify applicable 480V MCC distribution panel voltages.

Acceptance Criteria

The 480VAC Auxiliary Power System operates within design limits and performs per design specifications.

14.2.12.1.60 REMOTE SHUTDOWN SYSTEM

Test Objectives

1. Demonstrate that all remote shutdown controls for valves, pumps, and governors function as designed in both the "normal" and "emergency" modes.

2. Verify that all remote shutdown indicators and annunciators function as designed in both the "normal" and "emergency" modes.

3. Demonstrate that remote shutdown transfer switches function as designed.

Prerequisites and Initial Conditions

1. 125VDC power is available.

2. 120VAC power is available.

3. C&IO testing of the Topaz inverter is complete.

4. Applicable portions of the following systems have been verified as ready for testing from the remote shutdown panel:

Reactor Core Isolation Cooling	(RI)
Residual Heat Removal	(RH)
Shutdown Service Water	(SX)
Nuclear Boiler	(NB)

Test Procedure

1. Verify that correct indication is displayed on remote shutdown panel level, temperature, flow, pressure and speed instruments in the "emergency" mode.

2. Verify that control room annunciation is received when any transfer switch is placed in the "emergency" mode.

3. Verify that all remote shutdown panel annunciators function as designed.

4. With the applicable transfer switch in the "normal" mode, verify that each remote shutdown valve can be operated only from the main control room.

5. With the applicable transfer switch in the "emergency" mode, verify that each remote shutdown valve can be operated only from the shutdown panel.

6. Verify that all correct valve position indication is displayed at the correct control panel for all valve tests, i.e., valve in "emergency" mode, indication displayed at remote shutdown panel.

7. Demonstrate that RHR "A" and SX "A" pumps can be started from the remote shutdown panel.

8. Verify the operability of the RCIC turbine controls from the remote shutdown panel.

Acceptance Criteria

1. All remote shutdown transfer switches (RSTS'S) function as designed.

2. All instruments associated with the remote shutdown system function as designed.

3. All RHR valves, status indicators, interlocks and instruments associated with the remote shutdown system function as designed.

4. The RHR loop associated with the remote shutdown system is operable from the remote shutdown panel.

5. The Shutdown Service water pump, valves, indicators and instruments associated with the remote shutdown panel function as designed.

6. The RCIC turbine, valves, indicators controllers and instruments associated with the remote shutdown panel function as designed.

7. The SRV's and indicators associated with the remote shutdown panel function as designed.

8. The HVAC start signals and operating permissives associated with the remote shutdown panel function as designed.

14.2.12.1.61 HYDROGEN IGNITION SYSTEM

Test Objective

To demonstrate proper operation of the hydrogen ignitors.

Prerequisites and Initial Conditions

C&IO testing is complete.

Test Procedure

1. System interlocks, trips, and alarms will be checked for proper operation.

2. Proper operation of the hydrogen ignitors will be verified.

Acceptance Criteria

1. System interlocks, trips, and alarms will operate within design specifications.

2. All hydrogen ignitors will operate in conformance with design specifications.

14.2.12.1.62 NUCLEAR SYSTEMS PROTECTION SYSTEM (NSPS) SELF TEST AND ANALOG TRIP SUB-SYSTEMS

Test Objectives

1. To demonstrate the functions of the Analog Trip System (ATS).
2. To demonstrate the ability of the SElf Test System (STS) to isolate faults in NSPS.

Prerequisites and Initial Conditions

1. C&IO testing is complete.
2. Power is available to the NSPS cabinets.
3. The logic associated with those systems resident in the NSPS cabinets is operable.
4. Annunciators associated with NSPS are operable.
5. The Process Computer and Diagnostic Terminal are available.

Test Purpose

1. Verify the ability of the STS to isolate a simulated fault within prescribed time limits in the "On-Line" mode.
2. Verify the ability of the STS to run a cycle of testing within the prescribed time period.
3. Verify that detected failures are properly annunciated.
4. Verify proper operation of the diagnostic terminal and its ability to report failures.
5. Verify the ability of the ATS to correctly display analog information.
6. Verify the ability of the ATS to find analog trip module trip setpoints and gross fail trip setpoints.
7. Verify proper annunciator action while operating the ATS.
8. Verify that the STS does not interfere with the proper operation of functional logic.

Acceptance Criteria

1. The functions of the Self Test System meet design specifications.
2. The functions of the Analog Trip System meet design specifications.

14.2.12.1.63 LEAK DETECTION

Test Objectives

1. To verify the operability of the Leak Detection system is in accordance with design specifications.

2. To confirm the proper operation of system interlocks and alarms.

Prerequisites and Initial Conditions

1. Checkout and initial operation phase testing has been completed.

2. Calibration of instruments within the scope of this test are current.

Test Procedure

1. Leak detection logic including interlocks, seal-ins, bypasses, and alarms will be tested.

2. Area and differential temperatures sensors will be tested to the indicating devices.

3. Drywell Fission Product monitors will be tested.

4. The Valve Stem Leak Off and other miscellaneous leak detection systems will be tested.

Acceptance Criteria

1. Logics and interlocks will perform per design specifications.

2. Temperature sensors will operate as designed.

3. Drywell Fission Product monitors will operate as designed.

4. The Valve Stem Leak Off and other miscellaneous leak detection systems will operate as designed.

14.2.12.1.64 SAFETY/RELIEF VALVE MONITORING SYSTEM

Test Objectives

To demonstrate the proper operation of the Safety/Relief Valve Monitoring System (SV).

Prerequisites and Initial Condition

1. C&IO testing is complete.

2. The Safety/Relief Valve Monitoring panel is energized.

Test Purpose

Using simulated or actual inputs, the indication and alarm function will be demonstrated.

Acceptance Criteria

1. The loss of power will function within design requirements.

2. The test switch indication and alarm function perform in accordance with design.

3. The Safety/Relief Valve indication and alarm will function satisfactorily within design requirements.

14.2.12.2 Startup Test Procedures

The tests comprising the Startup Test Phase are described in this subsection. For each test a description of the test purpose, test prerequisites, test description and statement of test acceptance criteria, where applicable, is provided. Additions, deletions, and changes to these descriptions are expected to occur as the test program progresses.

In describing the purpose of a test, an attempt is made to identify those operating and safety-oriented characteristics of the plant which are being explored.

Where applicable, a definition of the relevant acceptance criteria for the test is given and is designed either Level 1 or Level 2. A Level 1 criterion normally relates to the value of a process variable assigned in the design of the plant, components systems or associated equipment. If a Level 1 criterion is not satisfied, the plant will be placed in a suitable hold condition until resolution is obtained. Tests compatible with this hold condition may be continued. Following resolution, applicable tests must be repeated to verify that the requirements of the Level 1 criterion are not satisfied.

A Level 2 criterion is associated with expectations relating to the performance of systems. If a Level 2 criterion is not satisfied, operating and testing plans would not necessarily be altered. An engineering evaluation and investigation of the measurements and of the analytical techniques used for the predictions would be started. If a certain Level 2 criterion is not satisfied after a reasonable effort, then engineering may choose to document the results with a full explanation of their recommendations. Thus, all Level 2 requirements may not be satisfied provided that the overall system performance is evaluated to be acceptable based on engineering's recommendations.

For transients involving oscillatory response, the criteria are specified in terms of decay ratio (defined as the ratio of successive maximum amplitudes of the same polarity). The decay ratio must be less than unity to meet a Level 1 criterion and less than 0.25 to meet Level 2.

When phrases such as “per design, design specifications, consistent with design intent, as designed, etc” are used in the acceptance criteria, that information is taken from the following sources:

General Electric Design Specifications and Reports
General Electric Design Specifications Data Sheets
General Electric Test Specifications
General Electric Instrument Setpoint Data Sheets
Sargent & Lundy Design Criteria
Sargent & Lundy System Descriptions
Sargent & Lundy Electrical Schematics

Sargent & Lundy Instrument Data Sheets
Sargent & Lundy P&ID's
Vendor Manual Supplied by General Electric or Sargent & Lundy
CPS-FSAR
Technical Specifications

The specific documents used in the preparation of each tests are listed in the reference section of that test procedure. The tests will demonstrate that the installed equipment and systems perform within the limits of these specifications.

Table 14.2-3 provides a listing of the startup tests.

14.2.12.2.1 CHEMICAL AND RADIOCHEMICAL

14.2.12.2.1.1 Purpose

The principal objectives of this test are a) to secure information on the chemistry and radiochemistry of the reactor coolant, and b) to determine that the sampling equipment, procedures and analytic techniques are adequate to supply the data required to demonstrate that the chemistry of all parts of the entire reactor system meet specifications and process requirements.

Specific objectives of the test program include evaluation of fuel performance, evaluations of demineralizer operations by direct and indirect methods, measurements of filter performance, confirmation of condenser integrity, demonstration of proper steam separator-dryer operation, measurement and calibration of the off-gas system, and calibration of certain process instrumentation. Data for these purposes is secured from a variety of sources: plant operating records, regular routine coolant analysis, radiochemical measurements of specific nuclides, and special chemical tests.

14.2.12.2.1.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Plant Manager has approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.1.3 Description

Prior to fuel loading a complete set of chemical and radiochemical samples will be taken to ensure that all sample stations are functioning properly and to determine initial concentrations. Subsequent to fuel loading during reactor heatup and at each major power level change, samples will be taken and measurements will be made to determine the chemical and radiochemical quality of reactor water and reactor feedwater, amount of radiolytic gas in the steam, gaseous activities leaving the air ejectors, decay times in the offgas lines, and performance of filters and demineralizers. Calibrations will be made of monitors in the stack, liquid waste system and liquid process lines.

14.2.12.2.1.4 Acceptance Criteria

Level 1

Chemical factors defined in the Technical Specifications must be maintained within the limits specified.

The activity of gaseous liquid effluents must conform to license limitations.

Water quality must remain within the guidelines of the water quality specifications.

Level 2 - NA

14.2.12.2.2 RADIATION MEASUREMENTS

14.2.12.2.2.1 Purpose

The purposes of this test are a) to determine the background radiation levels in the plant environs prior to operation for base data on activity buildup and b) to monitor radiation at selected power levels to assure the protection of personnel during plant operation.

14.2.12.2.2.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.2.3 Description

A survey of natural background radiation throughout the plant site will be made prior to fuel loading. Subsequent to fuel loading, during reactor heatup and at power plateaus (refer to Table 14.2.4), gamma radiation level measurements and where appropriate, thermal and fast neutron dose rate measurements will be made at significant locations throughout the plant. All potentially high radiation areas will be surveyed.

14.2.12.2.2.4 Acceptance Criteria

Level 1

The radiation doses of plant origin and the occupancy times of personnel in radiation zones shall be controlled consistent with the guidelines of the Standards for Protection Against Radiation outlined in 10 CFR 20.

Level 2 - NA

14.2.12.2.3 FUEL LOADING

14.2.12.2.3.1 Purpose

The purpose of this test is to load fuel safely and efficiently to the full core size.

14.2.12.2.3.2 Prerequisites

Prerequisites to fuel loading are described in 14.2.10 and the tests require thereby are implied in those prerequisites. Also, the following prerequisites will be met prior to commencing fuel loading to assure that this operation is performed in a safe manner:

1. The status of all systems required to be operable for fuel loading will be specified and will be in the status required.

2. Fuel and control rod inspections will be complete. All control rods are fully inserted and have been functionally and scram tested.

3. The operability of the SRM's has been source checked prior to loading or resumption if significant delays are incurred.

4. Nuclear instrumentation (SRMs and IRMs) has been installed and activated with 1) a minimum count rate of 0.7 counts per second and a signal to noise ratio greater than twenty on the SRMs or a minimum count rate of 3.0 counts per second and a signal to noise ratio greater than two on the SRMs, and 2) the SRMs and IRMs are in the non-coincident trip mode. High-flux scrams and rod block trips are set conservatively low on the SRMs.

5. Reactor vessel status will be specified relative to internal component placement and this placement will be established to make the vessel ready to receive fuel.

6. Reactor vessel water level will be established and minimum level prescribed.

14.2.12.2.3.3 Description

Prior to fuel loading, control rods, neutron sources and SRM detectors will be installed and tested. Fuel loading will begin by placing the first four bundles between an SRM detector and an alternate neutron source location to yield the maximum SRM count rate and proceeding radially outwards. This loading pattern will continue until the outside face of the loading block will have first reached the core periphery. Subsequent loading increments will be performed in a spiral pattern around the initial SRM until the core is fully loaded. The SRM located in the quadrant of initial fuel loading will be used to maintain continuous visual indication in the control room until other SRMs are on scale. A portable source will be used to periodically demonstrate operability of the SRMs located in areas with no fuel. The neutron count rate will be monitored in this fashion as the core loading progresses to ensure continuous subcriticality. A partial core shutdown margin demonstration will also be performed.

Control rod functional test, subcriticality checks, and shutdown margin demonstrations will be performed periodically during the loading.

14.2.12.2.3.4 Acceptance Criteria

Level 1

The partially-loaded core must be subcritical by at least 0.38 percent $\Delta k/k$ with the analytically determined highest worth rod fully withdrawn.

Level 2 - NA

14.2.12.2.4 FULL CORE SHUTDOWN MARGIN

14.2.12.2.4.1 Purpose

The purpose of this test is to demonstrate that the reactor will be subcritical throughout the first fuel cycle with any single control rod fully withdrawn.

14.2.12.2.4.2 Prerequisites

Prerequisites to full core shutdown margin testing are established in 14.2.10 and the tests required thereby are implied in those prerequisites. Also, the following prerequisites will be complete prior to performing the full core shutdown margin tests:

1. The predicted critical rod position is available.

2. Nuclear instrumentation is available with minimum count rate of 0.7 counts per second and signal to noise ratio greater than twenty on SRMs or a minimum count rate of 3.0 counts per second and a signal to noise ratio greater than two on the SRMs and the SRMs and IRMs are in the non-coincident trip mode.

3. High-flux scram and rod block setpoints are set conservatively low.

14.2.12.2.4.3 Description

This test will be performed in the fully loaded core in the xenon-free condition. The shutdown margin test will be performed by withdrawing the control rods from the all-rods-in configuration until criticality is reached. If the highest worth rod will not be withdrawn in sequence, other rods may be withdrawn providing that the reactivity worth is equivalent. The difference between the measured Keff and the calculated Keff for the in-sequence critical will be applied to the calculated value to obtain the true shutdown margin.

14.2.12.2.4.4 Acceptance Criteria

Level 1

The shutdown margin of the fully loaded, cold (68°F or 20°C), xenon-free core occurring at the most reactive time during the cycle must be at least 0.38% $\Delta k/k$ with the analytically strongest rod (or its reactivity equivalent) withdrawn. If the shutdown margin is measured at some time during the cycle other than the most reactive time, compliance with the above criterion is shown demonstrating that the shutdown margin is 0.38% $\Delta k/k$ plus an exposure dependent correction factor which corrects the shutdown margin at that time to the minimum shutdown margin.

Level 2

Criticality should occur within plus or minus 1.0 percent $\Delta k/k$ of the predicted critical.

14.2.12.2.5 CONTROL ROD DRIVE SYSTEM

14.2.12.2.5.1 Purpose

The purposes of the control rod drive system test are a) to demonstrate that the control rod drive (CRD) system operates properly over the full range of primary coolant temperatures and pressures from ambient to operating, and b) to determine the initial operating characteristics of the entire CRD system.

14.2.12.2.5.2 Prerequisites

Required preoperational tests have been completed. The appropriate parties have reviewed and the Plant Manager has approved the test procedure and initiation of testing. The reactor vessel, turbine building closed cooling water system, condensate system and instrument air system must be operational to the extent required to conduct the test.

14.2.12.2.5.3 Description

The CRD tests performed during the startup test program are designed as an extension of the tests performed during the preoperational CRD system tests. Thus, after it is verified that all control rod drives operate properly as installed, they are tested periodically during heatup to assure that there is not significant binding caused by thermal expansion of the core components. A list of all control rod drive tests to be performed during startup testing is provided on the following page.

CONTROL ROD DRIVE SYSTEM TESTS

	Test Conditions			
	Reactor Pressure with Core Loaded			
Action	0	600	(psig) 800	Rated
Position Indication	all			
Insert/withdraw Single CRD Notch & continuous modes	all			
Coupling	all			
Friction	all			4*
Cooling water flow rates				Total
Individual CRD scram	all	4*	4*	all*
Individual CRD scram				4***

NOTE: Single CRD scrams should be performed with the charging valve closed. (Do not ride the charging pump head.)

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* Refers to four fully withdrawn CRDs selected for continuous monitoring based on slow normal accumulator pressure scram times as determined from open vessel testing, or

unusual operating characteristics. The "four selected CRDs" must be compatible with the requirements of both the withdrawal sequence and the installed rod movement limitation systems.

** Individual CRD scram times will be determined from scram data taken during TC-1 or TC-2. Scram time data for control rods not fully withdrawn during the performance of the test described in FSAR 14.2.12.2.5, up to the maximum of 32 control rods not occupying adjacent locations in any direction, including diagonal, are exempted under hot, pressurized conditions, provided they meet all other surveillance test requirements, and that all scram reactivity requirements of the plant safety analysis are met with no scram contribution from these rods. Any remaining rods neither exempted nor fully withdrawn in FSAR Sect. 14.2.12.2.5 will be individually scram tested, before exceeding 40% power.

*** Scram times of the four selected fully withdrawn CRDs will be determined at test condition heatup and at test condition 6 in conjunction with the performance of planned reactor scrams (See tests 25B and 27).

14.2.12.2.5.4 Acceptance Criteria

Level 1

Each CRD must have a normal withdraw speed less than or equal to 3.6 inches per second (9.14 cm/sec), indicated by a full 12-foot stroke in greater than or equal to 40 seconds.

The maximum scram times, measured with vessel pressures between 950 to 1050 psig, of individual CRDs shall comply with line 1 of the following table:

NOTE: For near rated vessel pressure, the scram time shall be measured with charging header pressure at greater than or equal to 1750 psig. Also, individual scram time can be determined in conjunction with the performance of a planned reactor scram (See Test per subsection 14.2.12.2.25). Scram time data for control rods not fully withdrawn during the performance of Test per subsection 14.2.12.2.25, up to the maximum of 32 control rods not occupying adjacent locations in any direction, including the diagonal, are exempted under hot, pressurized conditions, provided they meet all other surveillance test requirements, and that all scram reactivity requirements of the plant safety analysis are met with no scram contribution from these rods. Any remaining rods neither exempted nor fully withdrawn in Test per subsection 14.2.12.2.25 will be individually scram tested, before exceeding 40% power.

		Maximum Scram Time (seconds) from solenoid de-energization to Position:		
Line	Pressure	43	29	13
1	950-1050	.31-.32	.81-.86	1.44-1.57
2	950-1050	.38-.39	1.09-1.14	2.09-2.22
3	950-1050	.30-.31	.78-.84	1.40-1.53

NOTE: For intermediate dome pressures, the scram time criteria are determined by linear interpolation at each notch position.

In the event that any CRD scram time exceeds the criteria listed on line 1 of the above table:

1. The maximum scram times of all CRDs which exceeded the times of line 1 shall be reevaluated and shall meet the criteria in line 2.

2. The total number of slow CRDs (i.e., failed criteria in line 1 but passed criteria in line 2) shall not exceed 5.

3. The average scram times of the remaining CRDs (those that met criteria in line 1) shall not exceed the criteria in line 3.

4. A drive failing criteria of line 1 but meeting criteria under line 2 shall not occupy adjacent drive locations in any direction, including the diagonal with another slow or inoperative drive. Note: A CRD which fails the criteria in line 2 is considered an inoperable CRD.

Level 2

Each CRD must have a normal insert or withdraw speed of 3.0 plus or minus 0.6 inches per second, indicated by a full 12-foot stroke in 40 to 60 seconds.

With respect to the control rod drive friction tests, if the differential pressure variation exceeds 15 psid for a continuous drive-in, a settling test must be performed, in which case, the differential settling pressure should not be less than 30 psid nor should it vary by more than 10 psid over a full stroke.

The CRD's total cooling water flow rate shall be between 0.28 and 0.34 gpm times the total number of drives.

NOTE: The differential settling pressure should be nominally 5 psid higher at the 00 position than at any other position along the CR due to the proper functioning of the spring actuated buffer piston located at the top of the drive.

For vessel pressures below 950 psig the maximum scram time of individual fully withdrawn CRDs shall comply with the criteria given in Figure 14.2-8. This is the time from the opening of the main scram contactor to notch 11.

Buffer time (defined as the pickup of position indicator probe switch “52” to dropout of “52”) shall not be less than 10 milliseconds when scram testing at nominal accumulator conditions with the reactor open to the atmosphere. If the buffer time with the reactor open to atmosphere is less than 12.7 milliseconds, then the buffer time at normal accumulator conditions with the reactor at rated pressure shall not be less than 15 miliseconds.

14.2.12.2.6 SRM PERFORMANCE AND CONTROL ROD SEQUENCE

14.2.12.2.6.1 Purpose

The purpose of this test is to demonstrate that the operational sources, source range monitor (SRM) instrumentation, and rod withdrawal sequencer provide adequate information to achieve criticality and increase power in a safe and efficient manner.

14.2.12.2.6.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and the initiation of testing. The control rod drive system must be operational.

14.2.12.2.6.3 Description

The operational neutron sources will be installed and source range monitor count rate data will be taken during rod withdrawals to critical and compared with stated criteria on signal and signal count to noise count ratio.

A withdrawal sequence has been calculated which completely specifies control rod withdrawals from the all rods in condition to the rated power configuration. Critical rod patterns will be recorded periodically as the reactor is heated to rated temperature.

Movements of rods in a prescribed sequence is monitored by the Rod Control and Information System, which will prevent out of sequence withdrawal. Also, not more than two rods may be inserted out of sequence.

14.2.12.2.6.4 Acceptance Criteria

Level 1

There must be a neutron signal count-to-noise count ratio of at least 20:1 on the required operable SRMs with a minimum count rate of 0.7 counts/second on the required operable SRMs.

Otherwise, there must be a neutron signal count-to-noise count ratio of an least 2:1 on the required operable SRMs with a minimum count rate of 3.0 counts/second on the required operable SRMs.

Level 2 - NA

14.2.12.2.7

DELETED

14.2.12.2.7.4

DELETED

14.2.12.2.8

DELETED

14.2.12.2.9 IRM PERFORMANCE

14.2.12.2.9.1 Purpose

The purpose of this test is to adjust the intermediate range monitor system to obtain an optimum overlap with the SRM and APRM systems.

14.2.12.2.9.2 Prerequisites

Required preoperational tests have been complete, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. All source range monitors and pulse preamplifiers, intermediate range monitors and voltage preamplifiers, and average power range monitors have been calibrated in accordance with vendor instructions.

14.2.12.2.9.3 Description

Initially the IRM system is set to maximum gain or at the value of gain used during the preoperational test. After the APRM calibration, the IRM gains will be adjusted to optimize the IRM overlap with the SRMs and APRMs.

14.2.12.2.9.4 Acceptance Criteria

Level 1

Each required operable IRM channel must be on scale before the SRM's exceed their rod block setpoint. Each APRM must be on scale before the IRM's exceed their rod block setpoint, at the highest range.

Level 2

Each required operable IRM channel must be adjusted so that a half decade overlap with the SRM's and one decade overlap with the APRM's are assured.

14.2.12.2.10 LPRM CALIBRATION

14.2.12.2.10.1 Purpose

The purpose of this test is to calibrate the Local Power Range Monitoring (LPRM) System.

14.2.12.2.10.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and the initiation of testing. Instrumentation for calibration has been checked and installed.

14.2.12.2.10.3 Description

The LPRM channels will be calibrated to make the LPRM readings proportional to the neutron flux in the LPRM water gap at the chamber elevation. Calibration factors will be obtained through the use of either an off-line or a process computer calculation that relates the LPRM reading to average fuel assembly power at the chamber height.

14.2.12.2.10.4 Acceptance Criteria

Level 1 - NA

Level 2

Each LPRM reading will be within 10 percent of its calculated value.

14.2.12.2.11 APRM CALIBRATION

14.2.12.2.11.1 Purpose

The purpose of this test is to calibrate the average power range monitor system.

14.2.12.2.11.2 Prerequisites

Required preoperational tests have been completed and the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and the initiation of testing. Instrumentation for calibration has been checked and installed.

14.2.12.2.11.3 Description

A heat balance will generally be made each shift and after each major power level change. Each APRM channel reading will be adjusted to be consistent with the core thermal power as determined from the heat balance. During heatup a preliminary calibration will be made by adjusting the APRM amplifier gains so that the APRM readings agree with the results of a constant heatup rate heat balance. The APRMs should be recalibrated in the power range by a heat balance as soon as adequate feedwater indication is available.

Recalibration of the APRM system will not be necessary from safety considerations if at least three of the four APRM have readings greater than or equal to core power.

14.2.12.2.11.4 Acceptance Criteria

Level 1

The APRM channels must be calibrated to read equal to or greater than the actual core thermal power.

Technical Specification and Fuel Warranty Limits on APRM gain and APRM scram and rod withdrawal block shall not be exceeded.

In the startup mode, all APRM channels must produce a scram at less than or equal to 15% of rated thermal power.

Level 2

If the above criteria are satisfied then the APRM channels will be considered to be reading accurately if they agree with the heat balance or the minimum value required based on peaking factor, MFLPD, and fraction of rated power to within ±2% of rated power.

The indicated APRM power will at no time exceed 100% of rated power.

14.2.12.2.12 PROCESS COMPUTER

14.2.12.2.12.1 Purpose

The purpose of this test is to verify the performance of the process computer under plant operating conditions.

14.2.12.2.12.2 Prerequisites

Required preoperational tests have been completed and the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. Computer diagnostic tests have been completed. Construction and construction testing on each input instrument and its cabling shall be completed.

14.2.12.2.12.3 Description

Computer system program verifications and calculational program validations at static and at simulated dynamic input conditions will be preoperationally tested at the computer supplier's site and following delivery to the plant site. Following fuel loading, during plant heatup and ascension to rated power, the nuclear steam supply system and the balance of plant system process variables sensed by the computer as digital or analog signals will become available. Verify that the computer is receiving correct values of sensed process variables and that the results of performance calculations of the nuclear steam supply system are correct. At steady state power conditions the Dynamic System Test Case will be performed.

14.2.12.2.12.4 Acceptance Criteria

Level 1 - NA

Level 2

Process computer programs for Reactor Core Power Distribution will be considered operational when:

1. The MCPR calculated by the process computer and the backup method either:

    a. are in the same fuel assembly and do not differ in value by more than 2%; or

    b. for the case in which the MCPR calculated by the process computer is in a different assembly than that calculated by the backup method, then for each assembly the MCPR and CPR calculated by the two methods shall agree within 2%.

2. The maximum LHGR calculated by the process computer and the backup method either:

    a. Are in the same fuel assembly and do not differ in value by more than 2%, or

    b. For the case in which the maximum LHGR calculated by the process computer is in a different assembly than that caluclated by the backup method, then for each assembly the maximum LHGR and LHGR calculated by the two methods shall agree within 2%.

3. The MAPLHGR calculated by the process computer and the backup method either:

   a. Are in the same fuel assembly and do not differ in value by more than 2%, or

   b. For the case in which the MAPLHGR calculated by the process computer is in a different assembly than that calculated by the backup method, then for each assembly the MAPLHGR and APLHGR calculated by the two methods shall agree within 2%.

4. The LPRM calibration factors calculated by the process computer and the backup method agree to within 2%.

5. The remaining programs will be considered operational upon successful completion of the static and dynamic testing.

14.2.12.2.13 <u>RCIC SYSTEM</u>

14.2.12.2.13.1 <u>Purpose</u>

The purpose of this test is to verify the proper operation of the reactor core isolation cooling (RCIC) system over its expected operating pressure and flow ranges, and to demonstrate reliability in automatic starting from cold standby when the reactor is at power.

14.2.12.2.13.2 <u>Prerequisites</u>

Required preoperational tests have been completed, the appropriate parties have reviewed and the Plant Manager has approved the test procedures and initiation of testing. Initial RCIC turbine operation (uncoupled) must be performed to verify satisfactory operation and over-speed trip.

14.2.12.2.13.3 <u>Description</u>

The RCIC system test consists of two parts: Injection to the RCIC storage tank (RST) and injection to the reactor vessel. The RST injections consist of controlled and quick starts at reactor pressures ranging from 150 psig to rated, with corresponding pump discharge pressures throttled to be 100 psi above the reactor pressure. During this part of the testing, proper operation of the system will be verified. Immediately after the operability demonstration the RCIC turbine speed loop controller adjustment will be performed at near rated reactor pressure condition.

Reactor vessel injection tests at near rated reactor pressure condition follow to complete the pump flow loop controller adjustments and to demonstrate automatic starting from a hot standby condition. Then, automatic mode start at 150 psig reactor pressure follows to demonstrate the system performance with the set of optimized controller settings from either "hot" or "cold" standby condition. "Cold" is defined as a minimum 72 hours without any kind of RCIC operation.

These injections are followed by two more reactor injections, beginning with cold RCIC hardware. These vessel injections verify the adequacy of the startup transients and steady-state controller adjustments.

Following these injections, two RST injections are done with cold RCIC equipment. These runs provide a benchmark for future surveillance testing.

The differential pressure trip modules for the RCIC steam supply line high flow isolation trip will be calibrated by using the data obtained from the several auto-start tests at near-rated pressure conditions.

A demonstration of extended operation of RST injection for up to two hours (or until pump and turbine oil temperature is stabilized) of continuous running at rated flow and near rated reactor pressure conditions is scheduled at a convenient time during the test program.

14.2.12.2.13.4 Acceptance Criteria

Level 1

The average pump discharge flow must be equal to or greater than 600 gpm after 30 seconds have alapsed from automatic initiation at any reactor pressure between 150 psig and rated pressure.

The RCIC turbine shall not trip or isolate during automatic or manual start test.

If any Level 1 criteria are not met, the reactor will only be allowed to operate up to a restricted power level defined by Figure 14.2-5.

Level 2

The turbine gland seal system shall be capable of preventing significant steam leakage to the atmosphere.

The differential pressure trip modules for the RCIC steam supply line high flow isolation trip shall be calibrated to actuate at the value specified in Technical Specifications.

The speed and flow control loop shall be adjusted so that the decay ratio of any RCIC system related variable is not greater than 0.25.

In order to provide an overspeed and isolation trip avoidance margin, the first and subsequent speed peaks associated with the transient quick start shall not exceed the rated RCIC turbine speed by more than 5%.

14.2.12.2.14 SELECTED PROCESS TEMPERATURES AND WATER LEVEL REFERENCE LEG TEMPERATURE

14.2.12.2.14.1A Purpose

The purpose of this test are (1) to assure that the measured bottom head drain temperature corresponds to bottom head coolant temperature during normal operations, (2) to identify any reactor operating modes that cause temperature stratification, (3) to determine the proper setting of the low flow control limiter for the recirculation pumps to avoid coolant temperature stratification in the reactor pressure vessel bottom head region, (4) to familiarize the plant personnel with the temperature differential limitations of the reactor system.

14.2.12.2.14.1B Purpose

The purpose of this test is to measure the reference leg temperature and recalibrate the instruments if the measured temperature is different than the value assumed during the initial calibration.

14.2.12.2.14.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. System and test instrumentation has been calibrated.

14.2.12.2.14.3A Description

The adequacy of bottom drain line temperature sensors will be determined by comparing it with recirculation loop coolant temperature when core flow is 100% of rated.

During initial heatup while at hot standby conditions, the bottom drain line temperature, recirculation loop suction temperature and applicable reactor parameters are monitored as the recirculation flow is slowly lowered to either minimum stable flow or the low recirculation pump speed minimum valve position whichever is the greater. Utilizing this data it can be determined whether coolant temperature stratification occurs when the recirculation pumps are on and if so, what minimum recirculation flow will prevent it.

Monitoring the preceeding information during planned pump trips will determine if temperature stratification occurs in the idle recirculation loops or in the lower plenum when one or more loops are inactive.

All data will be analyzed to determine if changes in operating procedures are required.

14.2.12.2.14.3B Description

To monitor the reactor vessel water level, five level instrument systems are provided. These are:

1. Shutdown Range
2. Narrow Range
3. Wide Range
4. Fuel Range
5. Upset Range

These systems are used respectively as follows:

1. Water level measurement in cold, shutdown conditions

2. Feedwater flow and water level control functions

3. Safety functions

4. Post-Accident indication

5. Water level measurements during transient conditions

The test will be done at rated temperature and pressure and under steady-state conditions and will verify that the reference leg temperature of the instrument is the value assumed during initial calibration. If not, the instruments will be recalibrated using the measured value.

14.2.12.2.14.4A Acceptance Criteria

Level 1

The reactor recirculation pumps shall not be started nor flow increased unless the coolant temperatures between the steam dome and bottom head drain are within 100°F of each other.

The recirculation pump in an idle loop must not be started, active loop flow must not be raised and power must not be increased unless the loop suction temperature is within 50°F of the active loop suction temperature. If two pumps are idle, the loop suction temperature must be within 50°F of the steam dome temperature before pump startup.

Level 2

During two pump operation at rated core flow, the bottom head temperature as measured by the bottom drain line thermocouple should be within 30°F of the recirculation loop temperatures.

14.2.12.2.14.4B Acceptance Criteria

Level 1

N/A

Level 2

The difference between the actual reference leg temperature(s) and the value(s) assumed during intial calibration shall be less than that amount which will result in a scale end point error of 1% of the instrument span for each range.

14.2.12.2.15 SYSTEM EXPANSION

14.2.12.2.15.1 Purpose

The purpose of the thermal expansion test is to confirm that the suspension pipe suspension system is working as designed and that the pipe is free of obstructions that could constrain free pipe movement caused by thermal expansion.

14.2.12.2.15.2 Prerequisites

The required preoperational tests are complete; the appropriate parties have reviewed and approved the test procedure and initiation of testing. Instrumentation has been installed and calibrated.

14.2.12.2.15.3 Description

The thermal expansion tests consist of measuring displacements and temperatures of piping during various operating modes. The first power level used to verify expansion shall be as low as practicable. Thermal movement and temperature measurements shall be recorded at the following test points:

1. Reactor pressure vessel heatup and hold, at least, one intermediate temperature before reaching normal operating temperature; at this time the drywell piping and suspension shall be inspected for obstruction or inoperable supports.

2. Reactor pressure vessel heatup and hold at normal operating temperature.

3. Main steam and recirculation piping heatup and hold at normal operating temperature.

4. On three subsequent heatup cooldown cycles, measurements will be recorded at the operating and shutdown temperatures to measure possible shakedown effects.

The piping considered to be within the boundary of this test is listed below:

1. Main steam: Steam lines, including the RCIC piping on Line A, shall be tested. Those portions within the scope of the test are bounded by the reactor pressure vessel nozzles and the penetration head fittings.

2. Relief valve discharge piping: The piping attached to the main steam lines and bounded by the relief valve discharge flange and the first downstream anchor shall be within the scope of the test.

3. Recirculation piping: The recirculation piping, bounded by the reactor pressure vessel nozzle, is within the scope of the test.

4. Small attached piping: All small branch piping attached to those portions of piping within the scope of the test is bounded by the large pipe branch connection and the first downstream guide or anchor. Small brance pipes that cannot be monitored because of limited access are excluded from the scope of this test.

14.2.12.2.15.4 Acceptance Criteria

The thermal expansion acceptance criteria are based upon the actual movements being within a prescribed tolerance of the movements predicted by analysis. Measured movements are not expected to correspond precisely with those mathematically predicted. Therefore, a tolerance is specified for differences between measured and predicted movement. The tolerances are based on consideration of measurement accuracy, suspension free play, and vary from the predictions by more than the specified tolerance, the piping is expanding in a manner consistent with predictions and is therefore acceptable. Tolerances shall be the same for all operating test conditions. For the locations to be monitored, predicted displacements and actual measurements will be compared.

Level 1

The Level 1 movement tolerances are intended to set bounds on thermal movement which, if exceeded, require that the test be placed on hold.

Pipe will not necessarily converge smoothly to predicted movements with increase in operating temperature. During the first part of the test, vessel movements will often move the pipe in a direction opposite of stress report predictions; the pipe may also advance in a stepwise fashion due to friction constraint. Level 1 criteria discount spurious movement measurements that could result in unnecessary test holds but still maintain safe limits on movement.

To assure that the criteria are applied at relevant test conditions, the criteria cannot be applied before the vessel and piping temperatures are at meaningful values. In addition, a voting logic is used to discount spurious movements due to instrument malfunction. If the free thermal expansion of the piping is obstructed, movement discrepancies would occur at multiple locations because of coupling effects; therefore, in specified cases, if only one instrument out of several indicateds movements are not within Level 1 criteria, that measurement will be discounted as spurious.

Main Steam

Prerequisites for criteria application:

1. Reactor must be at normal operating temperature.

2. Thermal transducers must indicate that piping is at normal operating temperature.

3.* Thermal transducer must indicate that the RCIC line is at normal operating temperature.

Requirements for test hold or termination:

1. If both of the pair of movement transducers on the same main steam pipe indicate that movements along a non-vertical X-axis of the plant coordinate system are not within the Level 1 movement tolerances, the test shall be placed on hold.

2. If both of the vertical movement transducers (one on the steam line A and other on RCIC piping off of main steam line A) indicate that movements are not within the Level 1 movement tolerances, the test shall be placed on hold.

* Applicable to steam line A only.

3. If any one of the other main steam line movement transducers indicate that movements are not with Level 1 tolerances, the test shall be placed on hold.

Recirculation Piping

Prerequisites for criteria application:

1. Reactor must be at normal operating temperature.

2. A thermal transducer must indicate that pipe is at normal operating temperature.

Requirements for test hold or termination:

1. If both of the pair of non-vertical movement transducers on the same recirculation discharge pipe indicate that movements along the same axes of the plant coordinate system are not within the Level 1 movement tolerances, the test shall be placed on hold.

2. If any one of the other movement transducers indicate that the movements are not within the Level 1 movement tolerances, the test shall be placed on hold.

Level 2

Transducer alignment Level 2 tolerances, and predicted movements for the various system operating modes are contained in the applicable piping stress reports.

Correlation of Test Data and Analysis

The predicted movements are based on mathematical calculations that are dependent on assumed nozzle movements and temperature distributions. The measured temperatures and nozzle movements must be compared with those assumed in the analysis to determine which analysis condition corresponds to the test condition. Only corresponding conditions can be used to evaluate test results. If the test conditions do not correspond to any of those assumed in the analysis, the evaluating GE Piping Design Engineer may find it necessary to calculate movements based on measurements, and compare the predicted movements with the measured moments to establish acceptability.

14.2.12.2.16

DELETED

14.2.12.2.17 CORE PERFORMANCE

14.2.12.2.17.1 Purpose

The purposes of this test are a) to evaluate the core thermal power and flow and b) to evaluate the following core performance parameters: 1) maximum linear heat generation rate (MLHGR), 2) minimum critical power ratio (MCPR) and 3) maximum average planar linear heat generation rate (MAPLHGR).

14.2.12.2.17.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Plant Manager has approved the test procedure and initiation of testing. System instrumentation is installed and calibrated and test instrumentation is calibrated.

14.2.12.2.17.3 Description

The core performance evaluation is employed to determine the principal thermal and hydraulic parameters associated with core behavior. These parameters are:

Core flow rate
Core thermal power level
MLHGR
MAPLHGR
MCPR

The core performance parameters listed above will be evaluated by a backup method or may be obtained from the process computer.

If the process computer is used as a primary means to obtain these parameters, it must be proved that it agrees with the backup method (BUCLE) within 2 percent on all thermal parameters or the results must be corrected to do so. If both the backup method (BUCLE) and the process computer are not available, the manual calculation techniques available at the site can be used for the core performance evaluation.

BUCLE refers to GE's "Back-Up Core Limits Evaluation" computer program. This is not the only automated backup method available for core performance calculations. Appropriate means of validating process computer results will be determined as needed.

14.2.12.2.17.4 Acceptance Criteria

Level 1

The Maximum Linear Heat Generation Rate (MLHGR) of any rod during steady-state conditions shall not exceed the limit specified by the Plant Technical Specifications.

The steady-state Minimum Critical Power Ratio (MCPR) shall not exceed the limits specified by the Plant Technical Specifications.

The Maximum Average Linear Heat Generation Rate (MAPLHGR) shall not exceed the limits specified by the Plant Technical Specifications.

Steady-state reactor power shall be limited to the rated value (2894 MWT) and values on or below the minimum of either rated thermal power or the 105% steam flow design flow control line. Core flow shall not exceed its rated value (84.5×10^6 lb/hr).

Level 2

N/A

14.2.12.2.18

DELETED

14.2.12.2.19 PRESSURE REGULATOR

14.2.12.2.19.1 Purpose

The purposes of this test are a) to determine the optimum settings for the pressure control loop by analysis of the transients induced in the pressure control system by means of the pressure regulators, b) to demonstrate the takeover capability of the backup pressure regulator upon failure of the controlling pressure regulator, c) to demonstrate that other affected parameters are within acceptable limits during pressure regulator induced transient maneuvers, and d) to demonstrate smooth pressure control transition between the turbine control valves and bypass valves when the reactor steam generation exceeds the steam flow used by the turbine.

14.2.12.2.19.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been checked and calibrated as appropriate.

14.2.12.2.19.3 Description

The pressure set point will be decreased rapidly and then increased rapidly by about 10 psi and the response of the system will be measured in each case. It is desirable to accomplish the set point change in less than 1 second. At specified test conditions the load limit setpoint will be set so that the transient is handled first by control valves, then by bypass valves or both. The backup regulator will be tested by simulating a failure of the operating pressure regulator so that the backup regulator takes over control. The response of the system will be measured and evaluated and regulator settings will be optimized.

14.2.12.2.19.4 Acceptance Criteria

Level 1

The transient response of any pressure control system related variable to any test input must not diverge.

Level 2

In all tests the decay ratio is to be less than or equal to 0.25 for each process variable that exhibits oscillatory response to pressure regulator changes.

Pressure control deadband, delay, etc., shall be small enough that steady-state limit cycles, if any, shall produce reactor steam flow variations no larger than plus or minus 0.5% of rated steam flow.

The peak neutron flux and/or peak vessel pressure remain below the scram settings by 7.5% and 10 psi, respectively, during pressure regulatory transients. Peak heat flux must remain at least 5.0% below its scram trip point.

The pressure response time from initiation of pressure setpoint change to the pressure regulator sensed pressure peak shall be less than or equal to 10 seconds.

The variation in incremental regulation (ratio of the maximum to the minimum value of the quantity: "incremental change in pressure control signal/incremental change in steam flow", for each flow range) shall meet the following:

% of Steam Flow Obtained With Valves Wide Open	Variation
0 to 85	≤4:1
85 to 97	≤2:1
85 to 99	≤5:1

14.2.12.2.20 FEEDWATER SYSTEM

14.2.12.2.20.1A Purpose

The purpose of this test is to adjust the feedwater control system for acceptable reactor water level control.

14.2.12.2.20.1B Purpose

The purpose of this test is to demonstrate adequate response to a feedwater temperature loss.

14.2.12.2.20.1C Purpose

The purpose of this test is to demonstrate the capability of the automatic core flow runback feature to prevent a low water level scram following the trip of one feedwater pump.

14.2.12.2.20.1D Purpose

The purpose of this test is to demonstrate the capacities of the turbine-driven feed pumps.

14.2.12.2.20.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed them and the Power Plant Manager has approved the test procedure and the initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.20.3A Description

Reactor water level set point changes of approximately 3 to 6 inches will be used to evaluate and adjust the feedwater control system settings for all power and feedwater pump modes. The level set point changes will also demonstrate core stability to subcooling changes.

Under normal operation with one feedwater loop in automatic and the loop to be tested in manual, a manual flow step will be initiated and each loop's flow response will be determined.

14.2.12.2.20.3B Description

A loss of feedwater heating event will be initiated to subject the system to transient equivalent to that caused by the worst case single failure. This event will then be performed at 80% to 90% power with the recirculation flow near its rated value.

14.2.12.2.20.3C Description

One of the operating feedwater pumps will be tripped and the automatic flow runback circuit will act to drop power to within the remaining capacity of the system.

14.2.12.2.20.3D Description

Turbine-driven feedpump capacities will be verified to ensure that they are less than the maximum capacities assumed in the FSAR.

14.2.12.2.20.4A Acceptance Criteria

Level 1

The decay ratio must be less than 1.0 for each process variable that exhibits oscillatory response to any test input changes.

Level 2

The decay ratio is to be less than or equal to 0.25 for each process variable that exhibits oscillatory response to any test input changes.

The open loop dynamic flow response of each feedwater actuator (turbine or valve) to small <10%) step disturbances shall be:

(1)	Maximum time to 10% of a step disturbance	≤1.1 sec
(2)	Maximum time from 10% to 90% of a step disturbance	≤1.9 sec
(3)	Peak overshoot (% of step disturbance)	≤15%
(4)	Settling time, 100% ± 5% of step disturbance	≤14 sec

The average rate of response of the feedwater actuator to large >20% of pump flow) step disturbances shall be between 10% and 25% rated feedwater pump flow/second. Rated pump flow is equivalent to the capacity of a single feedwater pump. This average response rate will be assessed by determining the time required to pass linearly through the 10% and 90% response points.

14.2.12.2.20.4B Acceptance Criteria

Level 1

The maximum feedwater temperature decrease for the feedwater heater loss test must be less than or equal to 100°F. The resultant MCPR must be greater than the fuel thermal safety limit. The increase in simulated heat flux cannot exceed the predicted level 2 value by more than 2%.

The predicted value will be based on the actual test values of feedwater temperature change and power level.

Level 2

The increase in simulated heat flux cannot exceed the predicted value referenced to the actual feedwater temperature change and power level.

14.2.12.2.20.4C Acceptance Criteria

Level 1

None

Level 2

The reactor shall avoid low water level scram by three inches margin from an initial water level halfway between the high and low level alarm setpoints.

14.2.12.2.20.4D Acceptance Criteria

Level 1

Maximum speed attained shall not exceed the speeds which will give the following flows with the normal complement of pumps operating.

a) 139% flow at 1080 psia

b) 144% flow at rated pressure of 1040 psia

Level 2

The maximum feedwater pump speed must be greater than the calculated speeds required to supply:

a) With rated complement of pumps - 115% NBR at 1080 psia

b) One feedwater pump tripped condition - 80% NBR at 1024 psia

14.2.12.2.21 TURBINE VALVE SURVEILLANCE

14.2.12.2.21.1 Purpose

The purpose of this test is to demonstrate the acceptable procedures for testing of the main turbine control, stop and bypass valves.

14.2.12.2.21.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been checked and calibrated as appropriate.

14.2.12.2.21.3 Description

Individual main turbine control, stop and bypass valves are tested routinely during plant operation as required for turbine surveillance testing. At a power level between 45% and 65% power, each turbine control, stop and bypass valve will be cycled and the response of the reactor will be observed. Note proximity to APRM flow bias scram point. Each valve test will be manually initiated and reset. Rate of valve stroking and timing of the close-open sequence will be such that the minimum practical disturbance is introduced and that PCIOMR limits are not exceeded.

14.2.12.2.21.4 Acceptance Criteria

Level 1 - NA

Level 2

Peak neutron flux must be at least 7.5% below the scram trip setting. Peak vessel pressure must remain at least 10 psi below the high pressure scram setting. Peak heat flux must remain at least 5.0% below its scram trip point.

Peak steam flow in each line must remain 10% below the high flow isolation trip setting.

14.2.12.2.22 MAIN STEAM ISOLATION VALVES

14.2.12.2.22.1A Purpose

The purposes of this test are a) to functionally check the main steam line isolation valves (MSIVs) for proper operation at selected power levels and b) to determine isolation valve closure time at rated conditions.

14.2.12.2.22.1B Purpose

The purpose of this test is to determine reactor transient behavior during and following simultaneous full closure of all MSIVs

14.2.12.2.22.1C Purpose

The purpose of this test is to verify the correct calibration of the steam line flow elements.

14.2.12.2.22.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.22.3A Description

At 5% and greater reactor power levels, individual fast closure of each MSIV will be performed to verify their functional performance and to determine closure times. The times to be determined are a) the valve stroke time and b) total effective closure time. The MSIV stroke time equals the interval from when the valve starts to move until it is 100% closed. Total effective closure time equals the interval from de-energizing the solenoids until the valve is 100% closed plus the maximum instrumentation delay time.

14.2.12.2.22.3B Description

A test of the simultaneous full closure of all MSIV's will be performed at greater than or equal to 95% of rated thermal power. Correct performance of the RCIC system and the relief valves during the subsequent pressure transient will be shown. Reactor process variables will be monitored to determine the transient behavior of the system during and following the Main Steam Line isolation.

The operation of the safety grade low-low pressure relief logic system will be monitored. A comparison between the reactor pressure behavior and SRV actuations will be made to confirm open/close setpoints and containment load mitigation through the prevention of subsequent simultaneous actuations.

14.2.12.2.22.3C Description

The calibration constants of both sets of main steam line flow elements (elbows and venturis) will be verified to match predicted values. Heat and mass balances will be performed on the reactor system at several power levels and the information obtained will be used to construct calibration curves for each flow element. If the accurancies of the steam line flow elements are not within ±5% of rated flow (relative to the feedwater flow elements) then new calibration curves will be constructed.

14.2.12.2.22.4A Acceptance Criteria

Level 1

MSIV stroke time, for any individual valve, shall be no faster than 3.0 seconds and no slower than 5.0 seconds. Total effective MSIV closure time shall be less than or equal to 5.5 seconds.

Level 2

During full closure of individual valves, peak vessel pressure must be 10 psi below scram, peak neutron flux must be at least 7.5% below scram, and steam flow in individual lines must be 10% below the isolation trip setting. The peak heat flux must be at least 5% below its trip setting.

The reactor shall not scram or isolate.

14.2.12.2.22.4B Acceptance Criteria

Level 1

The positive change in vessel dome pressure occurring within the first 30 seconds after a closure of all MSIV valves must not exceed the Level 2 criteria by more than 25 psi. The positive change in simulated heat flux must not exceed the Level 2 criteria by more than 2% of the rated value.

The MSIV stroke times shall be no faster than 3.0 seconds and no slower than 5.0 seconds.

The reactor shall scram on receipt of a full isolation signal.

The feedwater control system will prevent flooding of the main steam lines.

If any SRV's open, no more than one shall reopen after the first blowdown.

Level 2

For the full MSIV closure from full power, predicted analytical results based on beginning of cycle design basis analysis, assuming no equipment failures and applying appropriate parametric corrections, will be used as the basis to which the actual transient is compared. The following table specifies the upper limits of these criteria during the first 30 seconds following initiation of the indicated conditions.

Initial Conditions		Criteria	
Power	Dome Pressure	Increase In Heat Flux	Increase In Dome Pressure
(%)	(psia)	(%)	(psi)
100	1040	*	*

*   Defined in the Transient Safety Analysis Design Report issued by GE.

A recirculation pump trip shall be initiated if low water level (Level 2) is reached. Pumps will transfer to low speed if low water level (Level 3) is reached.

The total number of SRV opening cycles of the "low low" set valve, after initial blowdown, shall not exceed three times during the initial five minutes after the full isolation.

If the low low pressure relief logic functions, the open/close actions of the SRV's shall occur within ±15 psi and ±20 psi of their design setpoints, respectively.

RCIC and HPCS shall automatically initiate if low water level Level 2 is reached. If they initiate their performance shall match Technical Specification requirements.

The temperature measured by thermocouples on the discharge side of the valves shall return to within 10°F of the temperature recorded before the valve was opened.

14.2.12.2.22.4C   Acceptance Criteria

Level 1

None

Level 2

The accuracies of the elbow taps and meters shall be within ±5% of rated flow relative to the feedwater flow elements whenever flow is between 20% and 120% of rated. The repeatability/noise shall be within ±5% of rated flow. The flow venturi DP shall be equal to or greater than 79.71 psi at rated steam flow.

14.2.12.2.23 RELIEF VALVES

14.2.12.2.23.1 Purpose

The purpose of this test is (a) to verify that the relief valves function properly (can be opened and closed manually), (b) to verify that the relief valves reseat properly after operation, (c) to verify that there are no major blockages in the relief valve discharge piping.

14.2.12.2.23.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.23.3 Description

A functional and flow demonstration test of each safety relief valve (SRV) shall be made prior to reaching test condition 2 with a reactor pressure greater than 950 psig. During the flow demonstration test of each SRV, the electrical output response is monitored during the rated pressure test. The test duration will be about 10 seconds to allow turbine bypass valves and tailpipe temperature sensors to reach a steady state.

The tailpipe temperature sensor responses will be used to detect the opening and subsequent closure of each SRV. The MWe responses will be analyzed for anomolies indicating a restriction in an SRV tailpipe.

Valve capacity will be based on certification by ASME code stamp with the applicable documentation being available in the on-site records. Note that the nameplate capacity/pressure rating assumes that the flow is sonic. This will be true if the back pressure is not excessive. A major blockage of the line would not necessarily be offset and it should be determined that none exists through the MWe response signatures.

Vendor bench test data of the SRV opening responses will be available on-site for comparison with design specifications.

This test will also be used to calibrate the SRV flow monitor system using actual SRV lift data. After calibration, alarm setpoints will be established based on existing background noise levels and the guidelines provided by the flow monitor vendor.

14.2.12.2.23.4 Acceptance Criteria

Level 1

There should be a positive indication of steam discharge during the manual actuation of each valve.

Level 2

Pressure control system - related variables may contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response must be less than or equal to 0.25.

The temperature measured by thermocouples on the discharge side of the valves shall return to within 10°F of the temperature recorded before the valve was opened.

During the rated pressure test the steam flow through each relief valve, as measured by electrical output shall not differ by more than 0.5 percent of rated MWe from the average of all the valve responses.

14.2.12.2.24 TURBINE TRIP AND GENERATOR LOAD REJECTION

14.2.12.2.24.1 Purpose

The purpose of this test is to demonstrate the response of the reactor and its control systems to protective trips in the turbine and generator.

14.2.12.2.24.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Plant Manager has approved the test procedure and initiation of testing. All controls and interlocks are checked and instrumentation calibrated.

14.2.12.2.24.3 Description

The turbine stop valves will be tripped at a low reactor power level within bypass valve capacity and the main generator breaker will be tripped at a higher power in such a way that a load imbalance trip occurs. For the protective trips occurring at intermediate and higher power levels, the reactor will scram by de-energizing the reactor protection system (RPS) solenoids, actuated by stop/control valve motion. Several reactor and turbine operating parameters will be monitored to evaluate the response of the bypass valves, relief valves, and reactor protection system. Additionally, the peak values of reactor steam pressure and heat flux will be determined. The ability to ride through a turbine trip within bypass capacity without a scram will also be demonstrated at a low power level. The method chosen for inducing a 100% load rejection will maximize the expected turbine overspeed.

The operation of the safety grade low-low set pressure relief logic system will be monitored. A comparison between the reactor pressure behavior and SRV actuations will be made to confirm open/close setpoints and containment load mitigation through the prevention of subsequent simultaneous SRV actuations.

14.2.12.2.24.4 Acceptance Criteria

Level 1

For Generator trip from greater than 50% power, bypass valve quick opening should begin by 0.1 second after start of stop valve closure, and bypass flow should be greater than or equal to 80% of bypass valve capacity within another 0.2 second (i.e., within 0.3 second of start of stop or control valve closure).

Feedwater system settings must prevent flooding of the steam lines following these transients.

The two pump drive flow coastdown transient during the first three seconds must be bounded by the criteria specified for the test in Subsection 14.2.12.2.27.

The positive change in vessel dome pressure occurring within 30 seconds after either generator or turbine trip must not exceed the Level 2 criteria by more than 25 psi.

The positive change in simulated heat flux shall not exceed the Level 2 criteria by more than 2% of rated value.

If any safety/relief valves open, no more than one valve shall reopen after the first blowdown.

Level 2

There shall be no MSIV closure during the first three minutes of the transient and operator action shall not be required during that period to avoid the MSIV trip. (The operator may take action as he desires after the first three minutes, including switching out of run mode. The operator may also switch out of run mode in the first three minutes if he confirms from measured data that this action did not prevent MSIV closure caused by the reactor water level transient.)

The positive changes in vessel dome pressure and simulated heat flux which occur within the first 30 seconds after the initiation of either generator or turbine trip must not exceed the predicted values.

(Predicted values as defined in the Transient Safety Analysis Design Report issued by G.E. will be referenced to actual test conditions of initial power level and dome pressure and will use BOL (Beginning of Life) nuclear data. Worst case design of technical specifications values of all hardware performance shall be used in the prediction, with the exception of control rod insertion time and the delay from beginning of turbine control valve or stop valve motion to the generation of the scram signal. The predicted pressure and heat flux will be corrected for the actual measured values of these two parameters.)

For the turbine trip within the bypass valves capacity, the reactor shall not scram for initial thermal power values within that bypass valve capacity.

The measured bypass capacity shall be equal to or greater than that used for the FSAR analysis.

Recirculation LFMG sets shall take over after the initial recirculation pump trips and adequate vessel temperature difference shall be maintained.

Feedwater level control shall avoid loss of feedwater due to possible high level (Level 8) trip during the event.

Low water level total recirculation pump trip, HPCS and RCIC shall not be initiated.

If the low-low set pressure relief logic functions, the open/close actions of the SRV's shall occur within ±15 psi and ±20 psi of their design setpoints, respectively.

The temperature measured by thermocouples on the discharge side of the safety/relief valves must return to within 10°F of the temperature recorded before the valve was opened.

14.2.12.2.25 SHUTDOWN FROM OUTSIDE THE MAIN CONTROL ROOM

14.2.12.2.25.1 Purpose

The purpose of this test is to demonstrate that the reactor can be brought from a normal initial steady-state power level to the point where normal low pressure shutdown cooling is initiated and under control with reactor vessel pressure and water level controlled from outside the control room.

14.2.12.2.25.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. All controls and interlocks are checked and instrumentation calibrated.

14.2.12.2.25.3 Description

The test will initiate from a power level of approximately 10-25% with the turbine generator on-line. The reactor will be scrammed and isolated by separate actions from outside the control room after a simulated control room evacuation. Reactor pressure and water level will be controlled using SRV's, RCIC, and RHR from outside the control room during the subsequent hot standby and cooldown. The cooldown will continue at least until the RHR shutdown cooling mode is placed in service from outside the main control room. The portion of demonstrating cold shutdown capability may be performed in conjuction with another startup test when sufficient decay heat is available and reactor cooldown is required. The operating crew will be equal to the minimum shift operating requirements. All other operator actions not directly related to vessel water level and pressure will be performed in the main control room.

14.2.12.2.25.4 Acceptance Criteria

Level 1 - NA

Level 2

During a simulated control room evacuation, the reactor must be maintained in hot standby conditions for at least 30 minutes.

The test must demonstrate the reduction of reactor coolant pressure and temperature sufficient to put RHR shutdown cooling system in operation and cooldown of at least 50°F using this decay heat removal system.

14.2.12.2.26 RECIRCULATION FLOW CONTROL

14.2.12.2.26.1A Purpose

The purpose of this test is to demonstrate the recirculation flow control system's capability while in the valve position (POS) mode.

14.2.12.2.26.1B Purpose *

The purposes of this test are a) to demonstrate the recirculation flow control system's capability over the entire flow control range, including valve position, core flow, and neutron flux modes of operation, and b) to determine that all electrical compensators and controllers are set for desired system performance and stability.

14.2.12.2.26.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. All controls are checked and instrumentation calibrated.

14.2.12.2.26.3A Description

The testing of the recirculation flow control system follows a "building block" approach while the plant is ascending from low to high power levels. Components and inner control loops are tested first, followed by drive flow control and plant power maneuvers to adjust and then demonstrate the outer loop controller performance.

14.2.12.2.26.3B Description

By far the most extensive testing will be performed along the mid power load line where most of the final adjustments are determined. The core power distribution will be adjusted by control rods to permit broader range of maneuverability with respect to preconditioning interim operating management recommendations (PCIOMR). In general, the controller dials and gains will be raised to meet the maneuvering performance objectives. Thus the system will be set to be the slowest that will perform satisfactorily, in order to maximize stability margins and to minimize equipment wear by avoiding controller overactivity.

Because of PCIOMR power maneuvering rate restrictions, the fast flow maneuvering adjustments are performed along a mid power rod line, and an extrapolation made to the expected results along the 100 percent rod line as illustrated in[1] Figure 14.2-6.

Illinois Power Company has the option to decide to:

1. Perform the faster power changes on the 100 percent rod line that are greater than what the PCIOMR allow, or

2. To accept the mid power load line demonstrations as acceptable proof of maneuverability.

For immediate commercial operating, the flux loop will be set slower, and the operators will limit their actions in the Manual mode. If PCI0MR's are ever withdrawn the tested (faster) Auto settings can be inserted onto the controller with only a brief dynamic test, rather than a full startup test.

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* Master (Auto/Manual) and Flux (Auto/Manual) control modes have been deleted.

14.2.12.2.26.4A Acceptance Criteria

Level 1

The transient response of any Recirculation system-related variables to any test input must not diverge.

Level 2

Recirculation system related variables may contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response must be less than or equal to 0.25.

Maximum rate of change of valve position shall be 10 ± 1% per sec.

During TC-3 and TC-6 while operating on the high speed (60HZ) source, gains and limiters shall be set to obtain the following response.

Delay time for position demand step shall be:

For step inputs of 5% ≤ 0.15 sec.

Response time for position demand step shall be:

For step inputs of 5% ≤ .45 sec.

Overshoot after a small position demand input (5%) step shall be <10% of magnitude of input.

14.2.12.2.26.4B Acceptance Criteria

Flow Loop Criteria

Level 1

The transient response of any recirculation system-related variable to any test input must not diverge.

Level 2

The decay ratio of the flow loop response to any test inputs shall be less than or equal to 0.25.

The flow loops provide equal flows in the two loops during steady state operation. Flow loop gains should be set to correct a flow imbalance in less than 25 sec.

The delay time for flow demand step (≤5%) shall be 0.4 seconds or less.

The response time for flow demand step (≤5%) shall be 1.1 seconds or less.

The maximum allowable flow overshoot for step demand of ≤5% of rated shall be 6% of the demand step.

The flow demand step settling time shall be ≤6 sec.

Flux Loop Criteria

Level 1

The flux loop response to test inputs shall not diverge.

Level 2

Flux overshoot to a flux demand step shall not exceed 2% of rated for a step demand of ≤ 20% or rated.

The delay time for flux response to a flux demand step shall be ≤ 0.8 sec.

The response time for flux demand step shall be ≤ 2.5 sec.

The flux setting time shall be ≤ 15 sec. for a flux demand step ≤ 20% of rated.

Scram Avoidance and General Criteria

Level 1

NA

Level 2

For any one of the above loops' test maneuvers, the trip avoidance margins must be at least the following:

For APRM ≥ 7.5%.

For simulated heat flux ≥ 5.0%.

Flux Estimator Test Criteria

Level 1

Not Applicable

Level 2

Switching between estimated and sensed flux should not exceed 5 times/5 minutes at a steady state.

During flux step transient there should not be switching to sensed flux or if switching does occur, it should switch back to estimated flux within 20 seconds of the start of the transient.

Flow Control Valve Duty Test Criteria

Level 1

Not Applicable

Level 2

The flow conrrol valve duty cycle in any operating mode shall not exceed 0.2% - Hz. Flow control valve duty cycle is defined as:

$$\frac{\text{Integrated valve movement in percent (\% hz)}}{\text{2 x time span in seconds}}$$

14.2.12.2.27 RECIRCULATION SYSTEM

14.2.12.2.27.1A Purpose

The purposes of this test are a) to determine transient responses and steady-state conditions following single recirculation pump trips at selected reactor power levels and b) to verify that the feedwater control system can satisfactorily control water level without a resulting turbine trip scram following a single recirculation pump trip.

14.2.12.2.27.1B Purpose

The purpose of this test is to record and verify acceptable performance of the RPT circuitry.

14.2.12.2.27.1C Purpose

The purpose of this test is to obtain recirculation system performance data during the startup test program.

14.2.12.2.27.1D DELETED

14.2.12.2.27.1E Purpose

The purpose of this test is to verify that no recirculation system cavitation occurs on the operable region of the power/flow map.

14.2.12.2.27.2 Prerequisites

Required preoperational tests have been completed and the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.27.3A Description

A potential threat to plant availability is the high water level turbine trip scram caused by the level upswell that results after an unexpected recirculation one pump trip. The change in core flow and the resultant power decrease causes void formation which the level sensing system senses as a rise in water level. The one pump trip tests are to prove that the water level will not rise enough to threaten a high level trip of the main turbine or the feedwater pump.

14.2.12.2.27.3B Description

In case of higher power turbine or generator trips, there is an automatic opening of circuit breakers in the pump power supply. The result is a fast core flow coastdown that helps reduce peak neutron and heat flow in such events. This two pump trip test verified that this flow coastdown is satisfactory prior to the high power turbine/ generator trip tests and subsequent operation.

14.2.12.2.27.3C Description

Recirculation system parameters will be recorded at several power-flow conditions during power ascension and in conjunction with single pump trip recoveries.

14.2.12.2.27.3D DELETED

14.2.12.2.27.3E Description

The jet pumps, the FCV's and the recirculation pumps will cavitate at conditions of high flow and low power where NPSH demands are high and little feedwater subcooling occurs. However, the recirculation flow will automatically runback upon sensing a decrease in subcooling (as measured by the difference between the steam and recirculation loop temperature), to lower the reactor power. The maximum recirculation flow is limited by appropriate stops which will runback the recirculation flow from the possible cavitation region. It will be verified that these limits are sufficient to prevent operation where recirculation pump or jet pump cavitation is predicted to occur.

The recirculation system flow control valves will cavitate at conditions of high differential pressure and low power (low subcooling). The recirculation flow will automatically run back upon sensing a decrease in subcooling (as measured by low feedwater flow). This limit will be verified to ensure that operation is prevented where flow control valve cavitation may occur.

In both the above cases, flow runback is caused by a shift in the power supply to the recirculation pump motors from normal power to the low frequency motor generators. However, actual transfer to low pump speed may not be required during the performance of this testing as long as no sign of recirculation pump, jet pump or recirculation flow control valve cavitation is evident and closely monitored before cavitation interlock setpoints are exceeded.

14.2.12.2.27.4A Acceptance Criteria

Level 1

The reactor shall not scram during a one pump trip recovery.

Level 2

The reactor water level margin to avoid a high level trip shall be 3.0 inches during the one pump trip.

NOTE

Margin to trip is defined as:
Margin = (Hi Level Trip L8 Setpoint) - (Maximum water level reached during test) - (Hi Level Alarm L7 setpoint - Initial water level)

The simulated heat flux margin to avoid a scram shall be ≥ 5.0 percent during the one pump trip recovery.

The APRM margin to avoid a scram shall be ≥ 7.5% during the one pump trip recovery.

The time from zero pump speed to full pump speed shall be greater than 3 seconds.

14.2.12.2.27.4B Acceptance Criteria

Level 1

The two pump drive flow coastdown transient during the first 3 seconds must be bounded by the limiting curves. The two pump drive flow coastdown limiting curves are defined in the Transient Safety Analysis Design Report issued by G.E. and will be used as the basis to which the actual transient is compared. The limiting curves as applicable to this test will be determined based on the measurements of the recirculation flow delta P using the elbow flowmeters, transmitter time constants, and applicable electronic time constants. It should be noted that the coastdown limiting curves are not safety criteria but indications of plant performance. Violation of the coastdown requirements does not indicate an unsafe condition but rather that the impact should be evaluated on an individual basis. Therefore, evaluation and acceptance of actual test data by the appropriate design engineering organization may be utilized to satisfy this criteria.

Level 2

NA

14.2.12.2.27.4C Acceptance Criteria

Level 1

NA

Level 2

The core flow shortfall shall not exceed 5% at rated power. *

The measured core ΔP shall be be 0.6 psi above prediction using beginning of life values at rated power and rated flow. *

The calculated jet pump M ratio shall not be 0.2 points below prediction using beginning of life values at rated power and rated flow. *

The drive flow shortfall shall not exceed 5% at rated power. *

The measured recirculation pump efficiency shall not be 8% points below the vendor tested efficiency at rated power and rated flow.

The nozzle and riser plugging criteria given below shall not be exceeded.

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* The GE Steam Generation System Design Unit will provide predictions for the comparisons for these criteria.

Riser Criterion:

$$\left|\frac{0.5\left(\Delta P_j + \Delta P_k\right) - 0.1\ \Sigma_i \Delta P_i}{0.1\ \Sigma_i \Delta P_i}\right| \leq 0.1,$$

i = 1, 10 for loop A
i = 11, 10 for loop B

Nozzle Criterion:

$$\left|\frac{\Delta P_j + \Delta P_k}{0.5\left(\Delta P_j + \Delta P_k\right)}\right| \leq 0.12$$

Where:

ΔP_j and ΔP_k = Pressure drop in the jet pumps on the same riser.

ΔP_i = Pressure drop in the jet pumps "i" on the same loop as jet pumps "j" and "k".

14.2.12.2.27.4D DELETED

14.2.12.2.27.4E Acceptance Criteria

Level 1

NA

Level 2

The runback logic shall have settings which are adequate to prevent operation in areas of potential cavitation.

14.2.12.2.28 LOSS OF TURBINE GENERATOR AND OFF-SITE POWER

14.2.12.2.28.1 PURPOSE

The purpose of this test is to demonstrate acceptable performance of the AC power supply system during the simultaneous loss of turbine-generator and off-site power.

14.2.12.2.28.2 PREREQUISITES

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.28.3 DESCRIPTION

The loss of off-site power test will be performed between 10 and 20 percent of rated power coincident with a turbine generator trip, and the loss of power condition will be maintained for at least thirty (30) minutes. The proper response of reactor plant equipment, automatic switching equipment, and the proper sequencing of the diesel generator loads will be checked. No exception to Appendix A, Paragraph 5jj is needed (formerly Exception 4). (Q&R 640.1)

14.2.12.2.28.4 ACCEPTANCE CRITERIA

Level 1

Reactor protection system actions shall prevent violation of fuel thermal limits.

All safety systems such as the Reactor Protection System, the diesel-generators, and HPCS must function properly without manual assistance, and HPCS and/or RCIC system action, if necessary, shall keep the reactor water level above the initiation level of Low Pressure Core Spray, LPCI and Automatic Depressurization systems and MSIV closure. Diesel generators shall start automatically.

The turbine steam bypass valves shall open after turbine generator trips and remain operable until the MSIV's are closed or until the low condenser vacuum signal closes the bypass valves or for at least 5 seconds.

Level 2

Proper instrument display to the reactor operator shall be demonstrated, including power monitors, pressure, water level, suppression pool temperature and reactor cooling system status. Displays shall not be dependent on specially installed instrumentation. Temporary interruption of instrument display is acceptable provided that the operator has sufficient information available for long term operation to properly assess the plant state.

The turbine steam bypass valves shall remain operable after turbine-generator trips for at least 35 seconds or until the MSIV's are closed or until the low condenser vacuum signal closes the bypass valves.

14.2.12.2.29 PIPING VIBRATION

14.2.12.2.29.1 Purpose

The purpose of this test is to verify that the main steam, recirculation, and RCIC steam piping vibration is within acceptable limits and to verify that, during operating transient loads, pipe stresses are within code limits.

14.2.12.2.29.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.29.3 Description

This test is an extension of the System Expansion Test (subsection 14.2.12.2.15), and the preoperational vibration tests. Consult Subsection 14.2.12.2.15 for piping considered to be within the scope of testing.

Because of limited access due to high-radiation levels, very little visual observation will be required during the startup phase of the testing. Remote measurements of piping vibrations shall be made during the following steady-state conditions:

1. Main steam flow at 25 percent of rated.
2. Main steam flow at 50 percent of rated.
3. Main steam flow at 75 percent of rated.
4. Main steam flow and recirculation flow at 100 percent of rated.
5. RCIC turbine steam line at 100 percent of rated.
6. RHR suction piping at 100 percent of rated flow in shutdown cooling mode.
7. Recirculation at minimum flow and coincident temperature.
8. Recirculation flow at 50% ±5% of rated on 100% rod line and at operating temperature.
9. Recirculation flow at 75% ±5% of rated on 100% rod line and at operating temperature.

During the operating transient load testing, the amplitude of displacement and number of cycles per transient of the main steam and recirculation piping will be measured, and the displacements compared with acceptance criteria. Remote vibration and deflection measurements shall be taken during the following transients:

1. Recirculation pump start.
2. Recirculation pump trip at 100 percent of rated flow.
3. Main steam and recirculation piping during a turbine trip or generator trip at 100 percent power.
4. Main steam piping during a generator load reject without scram.
5. Manual discharge of each SRV valve at 1,000 psig and at selected planned transient tests that result in SRV discharge.
6. RCIC steam and water piping during RCIC starts.
7. Feedwater lines during a feedpump trip at TC-6.

For the locations to be monitored, predicted displacements and actual measurements will be compared. The locations to be monitored and predicted displacements for the monitored locations will be provided by the piping test specification (23A1861) and data sheet (23A1861AA).

14.2.12.2.29.4 Acceptance Criteria

Level 1

Operating Transients: Level 1 limits on piping displacements are prescribed. These limits are based on keeping the loads on piping and suspension components within safe limits. If any one of the transducers indicates that these movements have been exceeded, the test shall be placed on hold.

Operating Vibration: Level 1 limits on piping displacement are prescribed. These limits are based upon keeping piping stresses and pipe-mounted equipment accelerations within safe limits. If any one of the transducers indicates that the prescribed limits are exceeded, the test shall be placed on hold.

Level 2

Operating Transients: Transducers have been placed near points of maximum anticipated movement. Where movement values have been predicted, tolerances are prescribed for differences between measurements and predictions. Tolerances are based on instrument accuracy and suspension free play. Where no movements have been predicted, limits on displacement have been prescribed for each transducer.

Operating Vibration: Acceptable levels of operating vibration are prescribed. The limits have been set, based on consideration of analysis, operating experience, and protection of pipe-mounted components.

14.2.12.2.30 RECIRCULATION SYSTEM FLOW CALIBRATION

14.2.12.2.30.1 Purpose

The purpose of this test is to perform complete calibration of the installed recirculation system flow instrumentation.

14.2.12.2.30.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.30.3 Description

During the testing program at operating conditions which allow the recirculation system to be operated at rated flow at rated power, the jet pump flow instrumentation will be adjusted to provide correct flow indication based on the jet pump flow. After the relationship between drive flow and core flow is established, the APRM flow-bias instrumentation will be adjusted to function properly at rated conditions.

14.2.12.2.30.4 Acceptance Criteria

Level 1

None

Level 2

Jet pump flow instrumentation shall be adjusted such that the jet pump total flow recorder will provide correct core flow indication at rated conditions.

After the relationship between drive flow and core flow is established, the APRM flow-bias instrumentation will be adjusted to match this relationship.

The flow control system shall be adjusted to limit maximum core flow to not more than 102.5% of rated by limiting the flow control valve opening position.

14.2.12.2.31 REACTOR WATER CLEANUP SYSTEM

14.2.12.2.31.1 Purpose

The purpose of this test is to demonstrate specific aspects of the mechanical operability of the reactor water cleanup system. (This test, performed at rated reactor pressure and temperature, is actually the completion of the preoperational testing that could not be done with nuclear heating).

14.2.12.2.31.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.31.3 Description

With the reactor at rated temperature and pressure, process variables will be recorded during steady-state operation in three modes as defined by the System Process Diagram: Hot Shutdown with loss of RPV recirculation pumps, Normal, and Blowdown. A comparison of the bottom head flow indicator and the RWCU inlet flow indicator will be made.

14.2.12.2.31.4 Acceptance Criteria

Level 1

NA

Level 2

The temperature at the tube side outlet of the non-regenerative heat exchangers shall not exceed 130°F in the blowdown mode or 120°F in the normal mode.

The pump available NPSH will be 13 feet or greater during the hot shutdown with loss of recirculation pumps mode defined in the process diagram.

The cooling water supplied to the non-regenerative heat exchangers shall be less than 6% above the flow corresponding to the heat exchanger capacity (as determined from the process diagram) and the existing temperature differential across the heat exchangers. The outlet temperature shall not exceed 180°F.

Pump and motor vibration shall be less than or equal to 2 mils peak-to-peak (in any direction) as measured on the bearing housing.

The bottom head flow indicator shall be recalibrated to the RWCU flow indicator if the deviation between them is greater than 25 gpm, for normal system flow between 60 to 160 gpm.

14.2.12.2.32 RESIDUAL HEAT REMOVAL SYSTEM

14.2.12.2.32.1 Purpose

The purpose of this test is to demonstrate the ability of the residual heat removal (RHR) system to: remove heat from the reactor system so that the refueling and nuclear system servicing can be performed.

14.2.12.2.32.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.32.3 Description

During a suitable reactor cooldown following a planned or unplanned reactor scram or shutdown event, the shutdown cooling mode of the RHR system will be demonstrated. Unfortunately the decay heat load is insignificant during the startup test period. Use of this mode with low core exposure could result in exceeding the 100°F/hr cooldown rate of the vessel if both RHR heat exchangers are used simultaneously. Late in the test program after accumulating significant core exposure, this demonstration will more adequately demonstrate the heat exchanger capacity. The RHR heat exchangers will also be tested in the suppression pool cooling mode.

14.2.12.2.32.4 Acceptance Criteria

Level 1

Not Applicable

Level 2

The RHR system shall be capable of operating in the suppression pool cooling and shutdown cooling modes (with both one and two heat exchangers) at the heat exchanger capacity determined by the flow rates and temperature differentials indicated on the process diagrams.

14.2.12.2.33 DRYWELL ATMOSPHERE COOLING SYSTEM

14.2.12.2.33.1 Purpose

The purpose of this test is to verify the ability of the drywell cooling system to maintain design conditions in the drywell during operation and post scram conditions.

14.2.12.2.33.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.33.3 Description

During heatup and power operation, data will be taken to ascertain that the drywell atmospheric conditions are within design limits.

14.2.12.2.33.4 Acceptance Criteria

Level 1 - NA

Level 2

The drywell cooling system shall maintain drywell air temperatures at or below the design calues as specified for the NSSS equipment.

The drywell cooling system maintains temperatures in the drywell within limits acceptable for proper operation of electrical equipment, controls and instrumentation in the drywell.

14.2.12.2.34 MSIV LEAKAGE CONTROL SYSTEM

14.2.12.2.34.1 Purpose

The purpose of this test is to demonstrate the ability of the MSIV leakage control system (MSIV-LCS) to depressurize the piping between the MSIVs and outboard motor-operated isolation valve, maintain this piping at a slight subatmospheric pressure, and direct allowable MSIV leakage into the standby gas treatment system.

14.2.12.2.34.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and the initiation of testing. All system instrumentation is installed and calibrated. All system controls and interlocks have been checked.

14.2.12.2.34.3 Description

The reactor will be scrammed or shut down from any temperature with pressure, above 20 psig and the MSIVs will be subsequently closed. It will be demonstrated that after being manually placed in service, the MSIV-LCS inboard and outboard subsystems can be initiated provided reactor and main steam line pressure are below 20 psig permissive. The piping between the MSIVs will be depressurized, and the inboard and outboard blowers will take suction there maintaining slightly subatmospheric pressure while discharging to standby gas treatment system in the long term leakage control mode.

14.2.12.2.34.4 Acceptance Criteria

Level 1

NA

Level 2

1. Upon being manually placed in service, the inboard and outboard MSIV-LCS subsystems initiate automatically.

2. The inboard and outboard MSIV-LCS subsystems depressurize the piping within time limits specified by design.

3. The inboard and outboard MSIV-LCS blowers maintain the piping between the MSIVs slightly subatmospheric by removing the existing MSIV leakage.

14.2.12.2.35 OFFGAS SYSTEM

14.2.12.2.35.1 Purpose

The purpose of this test is to verify the proper operation of the offgas system over its expected operating parameters and to determine the performance of the activated carbon adsorbers.

14.2.12.2.35.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have revised and the Power Plant Manager has approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.35.3 Description

At startup flow and again at normal flow, the pressure at selected locations will be recorded and checked to see that they are within design specifications. The hydrogen analyzer, relative humidity, temperature, recombiner performance, dilution steam flow, radionuclide residence times, dessicant dryer, radiolytic gas production and HEPA filters will be checked periodically throughout the plant startup while at steady-state conditions.

14.2.12.2.35.4 Acceptance Criteria

Level 1

The release of radioactive gaseous and particulate effluents must not exceed the limits specified in the technical specifications.

Flow of dilution steam to the noncondensing stage must not fall below 75% of the specified normal value when the steam jet air ejectors are pumping.

Level 2

The system flow, pressure, temperature, and dewpoint shall comply with the design specifications. The catalytic recombiner, the hydrogen analyzer, the dessicant dryer, the activated carbon beds, and the filters shall be working properly during operation i.e., there shall be no gross malfunctioning of these components.

14.2.12.2.36 PENETRATION COOLING

14.2.12.2.36.1 Purpose

The purpose of this test is to demonstrate the ability of the penetration coolers to cool the concrete surrounding selected high temperature penetrations in the containment wall.

14.2.12.2.36.2 Prerequisites

The required preoperational tests have been completed, the appropriate parties have reviewed and the Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been installed and calibrated.

14.2.12.2.36.3 Description

The penetration cooling tests consist of measuring concrete temperatures surrounding selected main steam and RWCU discharge piping penetrations in the containment and auxiliary buildings. Measurements from a series of temperature sensors, located on the concrete, will be taken at various steady-state operating power levels. The measurements will be compared to the analytically predicted temperatures and will be shown to be acceptable in relation to the results of the analysis and the design criteria. Readings will be taken during the initial reactor heatup and at each major power level during the power ascension test phase.

14.2.12.2.36.4 Acceptance Criteria

Level 1

The temperature of the concrete adjacent to the selected containment penetrations shall not exceed 200°F.

Level 2

The temperature of the concrete surrounding the selected containment penetrations shall not exceed the values predicted by design specifications.

14.2.12.2.37 STEAM PRODUCTION

14.2.12.2.37.1 Purpose

The purpose of this test is to demonstrate that the reator steam production rate satisfies all appropriate warranties in the NSSS contract.

14.2.12.2.37.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.37.3 Description

Compliance with the steam output warranty is demonstrated by a steam output performance test of 100 hours' continuous duration. At two separate times during the test, when it is determined that all plant conditions are stabilized, the steam production rate will be measured during a 2-hour period at conditions prescribed in the nuclear steam generating system warranty. These measurements will include the temperature, pressure and flow rate of feedwater entering the reactor, the energy added by the reactor water by the recirculation pumps, the flow rate through and temperature entering and leaving the reactor cleanup system, the flow rate and temperature of the control rod drive cooling water, the carryover of reactor water into the steam lines and the steam pressure outside the drywell near the MSIV.

Thermodynamic parameters are consistent with the 1967 ASME Steam Tables. Correction techniques for conditions that differ from the contracted conditions will be mutually agreed to prior to the performance of this test.

14.2.12.2.37.4 Acceptance Criteria

The NSSSS parameters as determined by using normal operating procedures shall be within the appropriate license restrictions.

The NSSS will be capable of supplying steam in an amount and quality corresponding to the final feedwater temperature and other conditions shown on the Rated Steam Output Curve in the NSSS technical description. The Rated Steam Output Curve provides the warrantable reactor vessel steam output as a function of feedwater temperature, as well as warrantable steam conditions at the outboard main steam isolation valves.

Level 2

None

14.2.12.2.38 NEUTRON FLUX NOISE SURVEILLANCE

14.2.12.2.38.1 Purpose

The purpose of this test is to monitor the neutron flux noise levels in the reactor and to verify that the behavior is within expected limits.

14.2.12.2.38.2 Prerequisites

Required preoperational tests have been completed, the appropriate parties have reviewed and the Power Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.2.38.3 Description

BWR cores typically operate with the presence of global neutron flux noise in a stable mode which is due to random boiling and flow noise. Neutron flux limit cycle oscillations, that result from a combination of the neutron kinetics and core thermal hydraulic dynamics, are most likely near the natural circulation end of the power/flow domain at high powers. Tests have demonstrated that the occurrence of neutron flux limit cycle oscillations (decay ratio = 1.0) are readily observable on the APRM and LPRM instrumentation and result in noticeable increases in the neutron flux response. Both local flux and total core response will be evaluated by monitoring selected LPRM's and APRM's during steady state conditions. A minimum of nine

LPRM strings will be monitored (detector levels A and C) to adequately represent each octant of the core and the core center.

14.2.12.2.38.4 Acceptance Criteria

Level 1 - Not Applicable

Level 2

Global neutron flux variations as measured by the APRM's shall be no larger than ±2.5% of scale during steady state operation.

Local neutron flux variations as measured by the LPRM's shall be no larger than ±5.0% of scale during steady state operation.

14.2.12.2.39 PROCESS SAMPLING COOLING

14.2.12.2.39.1 Purpose

The purpose of this test is to demonstrate the ability of the process sampling coolers to cool the hot samples.

14.2.12.2.39.2 Prerequisites

The required preoperational test have been completed, the appropriate parties have reviewed, and the Plant Manager has approved the test procedure and initiation of testing. Instrumentation has been installed and calibrated.

14.2.12.2.39.3 Description

The process sampling cooler testing consists of causing the process fluid to flow through the system and observing that the sample is cooled per the acceptance criteria.

14.2.12.2.39.4 Acceptance Criteria

Level 1

Not Applicable

Level 2

Sample panels shall condition samples per design requirements.

14.2.12.3 Acceptance Test Procedures

The following test descriptions are provided for selected individual acceptance test. For each test a description of the test objectives, prerequisites and initial conditions, test procedure, and acceptance criteria is provided. Additions, deletions, and changes to these descriptions are expected to occur as the test program progresses. Consequently, methods described in the following descriptions are general, not specific. Actual test procedures will, of course, be more detailed and will not be limited in scope to what is contained in these descriptions.

In describing the purpose of a test, an attempt is made to identify those operating characteristics of the plant which are being explored.

Specific acceptance criteria for each preoperational test are gathered from various sources. Typically, these sources include, but are not limited to the following:

General Electric Test Specifications
General Electric Instrument Setpoint Data Sheets
Sargent & Lundy System Descriptions
Sargent & Lundy Electrical Schematics
Sargent & Lundy Instrument Data Sheets
Sargent Lundy P&ID's
Vendor Manuals Supplied by General Electric or Sargent & Lundy
CPS FSAR
Technical Specifications

The specific documents used in the preparation of each test are listed in the reference section of that test procedure. The tests will demonstrate that the installed equipment and systems perform within the limits of these specifications.

Table 14.2-5 provides a listing of the acceptance tests.

14.2.12.3.1 EXTRACTION STEAM

Test Objectives

To demonstrate the ability of the extraction steam system to respond to process signals and interlocks.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.

2. Instrument air is available.

3. Electrical power is available to extraction steam system components and controls.

4. Main turbine electrohydraulic control system shall be in the “tripped” condition.

Test Procedure

1. Valve operation shall be verified.

2. Operation of controls, interlocks and alarms will be verified.

Acceptance Criteria

Valves, controls, interlocks and alarms shall function per design.

14.2.12.3.2 TURBINE ELECTROHYDRAULIC CONTROL

Test Objectives

To demonstrate the operation of the turbine electrohydraulic control system and its associated protective devices.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.
2. T/G lube oil system is available to support turning gear operation.
3. Turbine building closed cooling water is available.
4. Electrical power is available to turbine electrohydraulic control system components and controls.

Test Procedure

1. Pumps shall be performance tested.
2. Operation of controls, interlocks and alarms will be verified.

Acceptance Criteria

1. Pump performance shall meet design requirements.
2. Controls, interlocks and alarms shall function per design.

14.2.12.3.3 FEEDWATER HEATER DRAINS

Test Objectives

To demonstrate the ability of the feedwater heater drains system to respond to process signals and interlocks.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.
2. Instrument air is available.
3. Electrical power is available to feedwater heater drains system components and controls.

Test Procedure

1. Valve operation shall be verified.
2. Operation of controls, interlocks and alarms will be verified.

Acceptance Criteria

Valves, controls, interlocks and alarms shall function per design.

14.2.12.3.4 MAKE-UP DEMINERALIZER

Test Objective

1. To demonstrate the ability of the make-up demineralizer system to meet design requirements for flow and effluent water chemistry.

2. To demonstrate operation of associated controls, interlocks and alarms

Prerequisites and Initial Conditions

1. C&IO testing has been completed.

2. Instrument air, service air, liquid chlorine and service water systems are available for operation.

3. Electrical power is available to make-up demineralizer system components and controls.

Test Procedure

1. Pumps shall be performance tested.

2. Operation of controls, interlocks and alarms will be verified.

3. Effluent water quality shall be verified.

Acceptance Criteria

1. Pump performance shall meet design requirements.

2. Controls, interlocks and alarms shall function per design.

3. Effluent shall meet the design requirements for flow and chemistry.

14.2.12.3.5 CYCLED CONDENSATE/MAKE-UP CONDENSATE

Test Objective

1. To demonstrate the ability of the cycled condensate/make-up condensate system to provide flow to components served.

2. To demonstrate operation of associated controls, interlocks and alarms.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.

2. Instrument air, make-up water systems are available..

3. Electrical power is available to cycled condensate/make-up condensate system components, controls and heat tracing.

Test Procedure

1. Pumps shall be performance tested.

2. Operation of controls, interlocks and alarms shall be verified.

3. Operation of containment isolation valves shall be verified.

Acceptance Criteria

1. Pump performance shall meet design requirements.

2. Controls, interlocks and alarms shall function per design.

3. Containment isolation valves shall operate per design.

14.2.12.3.6 CONDENSER VACUUM

Test Objectives

1. To demonstrate the ability of the condenser vacuum system to evacuate and maintain vacuum on components served.

2. To demonstrate operation of associated controls, interlocks and alarms.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.

2. The following systems shall be available:

   instrument air
   turbine building closed cooling water
   plant service water
   cycled condensate/make-up condensate
   condensate system
   off gas
   main steam

3. Electrical power is available to condenser vacuum system components and controls.

Test Procedure

1. Pumps will be performance tested.

2. Operation of controls, interlocks and alarms shall be verified.

Acceptance Criteria

1. Pump performance shall meet design requirements.
2. Controls, interlocks and alarms shall function per design.

14.2.12.3.7 PROCESS SAMPLING

Test Objective

1. To demonstrate the ability of the process sampling system to analyze samples.
2. To verify operation of heat tracing.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.
2. Turbine building closed cooling and component cooling water shall be available.
3. Sample systems shall be available as required.
4. Electrical power is available to process sample system components and controls.

Test Procedure

1. Sample panels shall be performance tested.
2. Instrumentation and control operation shall be verified.
3. Verify heat tracing will maintain the system within temperature range.

Acceptance Criteria

1. Instrumentation and controls shall function per design.
2. System temperature is maintained within range.

14.2.12.3.8 PLANT SERVICE WATER

Test Objectives

1. To demonstrate the ability of the plant service water system to supply water to the various components it serves.
2. To demonstrate operation of associated controls, interlocks and alarms.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.
2. Components served by the plant service water system shall be available.

3. Electrical power shall be available for plant service water components and controls.

Test Procedure

1. Pumps will be performance tested.
2. Operation of controls, interlocks and alarms shall be verified.
3. Flow to components served shall be verified.

Acceptance Criteria

1. Pump performance shall meet design requirements.
2. Controls,interlocks and alarms shall function per design.
3. Flow to components served shall meet design requirements.

14.2.12.3.9 TURBINE BUILDING CLOSED COOLING WATER

Test Objectives

1. To demonstrate the ability of the turbine building closed cooling water system to supply water to the various components it serves.
2. To demonstrate operation of associated controls, interlocks and alarms.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.
2. Components served by turbine building closed cooling water shall be available.
3. Electrical power shall be available to turbine building closed cooling water system components and controls.

Test Procedure

1. Pumps will be performance tested.
2. Operation of controls, interlocks and alarms shall be verified.
3. Flow to components served shall be verified.

Acceptance Criteria

1. Pump performance shall meet design requirements.
2. Controls, interlocks and alarms shall function per design.
3. Flow to components served shall meet design requirements.

14.2.12.3.10 CONDENSATE POLISHING

Test Objectives

1. To demonstrate the ability of the condensate polishing system to meet design requirements for flow and effluent water chemistry.

2. To demonstrate operation of associated controls, interlocks and alarms.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.

2. The following systems are available as required.

   cycled condensate
   instrument air
   service air
   condensate
   condensate booster
   reactor feedwater
   turbine building closed cooling water
   acid/caustic
   process sampling

3. Electrical power is available to condensate polishing system components and controls.

Test Procedure

1. Pumps will be performance tested.

2. Operation of controls, interlocks and alarms shall be verified.

3. Polisher effluent water quality shall be verified.

Acceptance Criteria

1. Pump performance shall meet design requirements.

2. Controls, interlocks and alarms shall function per design.

3. Polisher effluent water quality shall meet design requirements.

14.2.12.3.11 PLANT BREATHING AIR

Test Objectives

1. To demonstrate the ability of the plant breathing air system to provide breathing air to various locations throughout the plant.

2. To demonstrate the operation of associated controls, interlocks and alarms.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.

2. Electrical power is available to plant breathing air components and controls.

Test Procedure

1. Compressers and air dryers will be performance tested.

2. Operation of controls, interlocks and alarms will be verified.

3. Operation of containment isolation valves will be verified.

Acceptance Criteria

1. Compresser/air dryer performance shall meet design requirements.

2. Control, interlocks and alarms shall function per design.

3. Containment isolation valves shall operate per design.

Note: The Breathing Air Compressors, Filter Train and associated instrumentation have been Abandoned/Retired in place. The Control Room Emergency Breathing Air System is still operable.

14.2.12.3.12 SUPPRESSION POOL CLEANUP AND TRANSFER

Test Objectives

1. To demonstrate the ability of the suppression pool cleanup and transfer system and the fuel pool cooling and cleanup demineralizers to the design requirements for flow and effluent water chemistry.

2. To demonstrate the ability to use the condensate polisher system with the suppression pool cleanup system.

3. To demonstrate the operation of associated controls, interlocks and alarms for the suppression pool cleanup and transfer system and the fuel pool cooling and cleanup demineralizers.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.

2. The following systems are available as required.

   Cycled Condensate
   Service and Instrument Air
   Condensate Polisher System
   Fuel Pool Cooling and Cleanup Demineralizers

3. Electrical power is available to suppression pool cleanup and transfer system and fuel pool cooling and cleanup demineralizers.

Test Procedure

1. Pumps will be performance tested.
2. Operation of controls, interlocks and alarms for the suppression pool cleanup and transfer system and fuel pool cooling and cleanup will be verified.
3. Suppression pool cleanup using the condensate polisher system shall be verified.
4. Fuel pool demineralizer effluent water quality shall be verified.
5. Operation of containment isolation valves will be verified.

Acceptance Criteria

1. Pump performance shall meet design requirements.
2. Controls, interlocks and alarms shall function per design.
3. Fuel pool demineralizer effluent water quality shall meet design requirements.
4. Containment isolation valves shall function per design.

14.2.12.3.13 PROCESS COMPUTER

Test Objective

To verify the Process Computer's ability to input and process plant signals, perform nuclear and balance of plant performance calculations, and present this data to plant personnel.

Prerequisites and Initial Conditions

1. C&IO testing has been completed.
2. Issued software is loaded into the Process Computer.

Test Procedure

1. Plant input signal processing and alarming shall be verified.
2. System graphic displays shall be verified.
3. System reconfiguration shall be verified.
4. System auto-restart shall be verified.
5. Nuclear steam supply performance calculations shall be verified.
6. Balance of plant performance calculations shall be verified.

Acceptance Criteria

1. Plant input signals are processed and displayed per design.

2. System reconfiguration and auto-restart function per design.

14.2.12.3.14 EMERGENCY OPERATING FACILITY (EOF)

This subsection is historical. The EOF has been moved to a centralized EOF.

Test Objectives

1. To demonstrate the operability of the following EOF subsystems:

   a. Fire Protection

   b. Security System

   c. HVAC

   d. PMS/DCS

   e. Radiation Monitoring System

Prerequisites and Initial Conditions

C&IO testing is complete

Test Procedure

1. The fire protection controls, alarms, interlocks, and logic are checked for proper operation.

2. Smoke detectors and heat detectors will be tested.

3. The security system controls, alarms, interlocks and logic will be tested for proper operation.

4. The HVAC fans, damper, heater and air conditioner controls, interlocks, permissive, trips, and alarms will be verified.

5. The PMS/DCS data link will be verified.

6. The radiation monitoring system alarms, trips, and interlocks will be verified.

Acceptance Criteria

1. Fire protection controls, alarms, and logic operate as designed.

2. The security system will operate as designed.

3. HVAC fan and damper controls, interlocks, and alarms function as designed.

4. The PMS/DCS data link will perform as designed.

5. The radiation monitoring system will function as designed.

14.2.12.3.15 SCREEN HOUSE FLOOR AND EQUIPMENT DRAINS

Test Objectives

To demonstrate operation of the Screen House Floor and Equipment Drain System.

Prerequisites and Initial Conditions

1. C&IO testing is complete.

2. Electrical power is available to sump pumps.

Test Procedure

1. System pumps will be performance tested.

2. Operation of controls, alarms and interlocks will be verified.

Acceptance Criteria

1. System shall drain areas and equipment served.

2. Controls, alarms and interlocks shall function per design.

TABLE 14.2-1
REGULATORY GUIDES USED
IN THE DEVELOPMENT OF THE
INITIAL TEST PROGRAM

1.8	Personnel Selection and Training
1.18	Structural Acceptance Test for Concrete Primary Reactor Containment
1.20	Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing
1.29	Seismic Design Classification
1.37	Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water-Cooled Nuclear Power Plants
1.41	Preoperational Testing of Redundant On-Site Electric Power Systems to Verify Proper Load Group Assignments
1.52	Design, Testing, and Maintenance Criteria for Post Accident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants
1.56	Maintenance of Water Purity in Boiling Water Reactors
1.68	Initial Test Program for Water-Cooled Reactor Power Plants
1.68.1	Preoperational and Initial Startup Testing of Feedwater and Condensate Systems for Boiling Water Reactor Power Plants
1.68.2	Initial Startup Test Program to Demonstrate Remote Shutdown Capability for Water-Cooled Nuclear Power Plants
1.80	Preoperational Testing of Instrument Air Systems
1.95	Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release
1.108	Periodic Testing of Diesel Generators Used as Onsite Electric Power Systems at Nuclear Power Plants
1.140	Design, Testing, and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants

Note: Exceptions taken to these Regulatory Guides are described in Section 1.8.

TABLE 14.2-2
PREOPERATIONAL TESTS

TABLE 14.2-2 (Cont'd)
PREOPERATIONAL TESTS

Subsection	Test Title	Page
14.2.12.1.32	Drywell Purge Ventilation System	14.2-77
14.2.12.1.33	Drywell Cooling System	14.2-78
14.2.12.1.34	Containment Building HVAC System	14.2-79
14.2.12.1.35	Standby Gas Treatment System	14.2-80
14.2.12.1.36	Diesel Generator System	14.2-82
14.2.12.1.37	Reactor Vessel Flow Induced Vibration	14.2-84
14.2.12.1.38	125 VDC Systems	14.2-85
14.2.12.1.39	Containment Monitoring System	14.2-87
14.2.12.1.40	Loss of Offsite Power/Integrated ECCS	14.2-88
14.2.12.1.41	Auxiliary Building HVAC	14.2-90
14.2.12.1.42	Radwaste Building HVAC	14.2-91
14.2.12.1.43	Fuel Building HVAC System	14.2-92
14.2.12.1.44	Off-Gas Vault HVAC System	14.2-93
14.2.12.1.45	Fire Protection System	14.2-94
14.2.12.1.46	Instrument and Service Air System	14.2-95
14.2.12.1.47	Condensate	14.2-96
14.2.12.1.48	Environs Monitoring System	14.2-97
14.2.12.1.49	Condenser Circulating Water System	14.2-98
14.2.12.1.50	Communications Systems	14.2-99
14.2.12.1.51	Cranes	14.2-100
14.2.12.1.52	Drywell Leakage	14.2-101
14.2.12.1.53	Primary Containment Leak Rate	14.2-102
14.2.12.1.54	Turbine Building HVAC System	14.2-103
14.2.12.1.55	Loose Parts Monitoring System	14.2-104
14.2.12.1.56	Drain System	14.2-105
14.2.12.1.57	Emergency Lighting System	14.2-106
14.2.12.1.58	Integrated Aux Power Logic Test	14.2-107
14.2.12.1.59	480VAC Aux Power Test	14.2-108
14.2.12.1.60	Remote Shutdown System	14.2-109
14.2.12.1.61	Hydrogen Ignition System	14.2-111
14.2.12.1.62	Nuclear Systems Protection System (NSPS) Self Test and Analog Trip Sub-Systems	14.2-112

TABLE 14.2-2 (Cont'd)
PREOPERATIONAL TESTS

TABLE 14.2-3
STARTUP TESTS

TABLE 14.2-3 (Cont'd)
STARTUP TESTS

TABLE 14.2-4
<u>STARTUP TEST PROGRAM</u>

FSAR 14.2.12.2 SECTION	TEST NAME	COLD TEST OR OPEN RPV	HEAT UP	TEST CONDITIONS 1	2	3	4	5	6	WARRANTY
1	Chemical & Radiochemical	X	X	X		X			X	
2	Radiation Measurements	X	X	X	X	X		X	X	X[20]
3	Fuel Loading	X								
4	Full Core Shutdown Margin	X								
5	CRD	X	X		X				X	
6	SRM Perf. & Control Rod Seq.	X	X							
9	IRM Performance	X	X	X						
10	LPRM Calibration		X	X		X			X	
11	APRM Calibration		X	X	X	X		X	X	
12	Process Computer	X	X		X[3]	X			X	
13	RCIC		X	X[13]	X					
14	Selected Process Temperatures, Water Level Ref. Leg Temp.		X	X	X	X	X		X	
15	System Expansion	X	X[19]	X					X	
17	Core Performance			X	X	X	X	X	X	X[20]
19	Pressure Controller: Set Point Changers			xLorF BP	xLorF CV,BP	xLorF,M, CV,CV+ BP	17	xLorF CV,BP	xLorF,M CV,BP	
	Fail to Backup			xLorF BP	xLorF CV,BP	xLorF,M, CV			xLorF,M CV,BP	

NOTE: Master (Auto/Manual) and Flow (Auto/Manual) control modes have been deleted for the Reactor Recirculation flow Control System.

TABLE 14.2-4 (Cont'd)

FSAR 14.2.12.2 SECTION	TEST NAME		COLD TEST OR OPEN RPV	HEAT UP	TEST CONDITIONS 1	2	3	4	5	6	WARRANTY
20	FW System: FW Pump Trip									$_x$M,13,14	
	Water Level Set Point Change And Stability Verification					x^{LorF}	x^{LorF}			x^{LorF}	
	And Manual Flow Steps					x^{LorF}	x^{LorF}			x^{LorF}	
	Heater Loss									X^{12}	
	Maximum Runout Capability and Performance						X^{3}			X^{5}	
21	Turbine Valve Surveillance						X^{4}				
22	MSIVs:	Each Valve		x^{L}	x^{L}						
		Flow Element Calibration					X^{4}			X^{5}	
		Full Isolation								$x^{2,6,13,}$SD	
23	Relief Valves:	Flow Demonstration and Operational		$X^{13,L}$							
		Flow Monitor Adjustment		X						X	
24	Turbine Trip and Generator Load Rejection:	Turbine Trip				$x^{L,SP}$					
		Bypass Valve Calibration					x^{4}				
		Generator Load Rejection								$x^{2,13,SD,14}$	
25	Shutdown From Outside C Room					x^{SD}					
26	Recirculation Flow Control System						$x^{M,L,F}$				
										$x^{M,L,F,5}$	

TABLE 14.2-4 (Cont'd)

FSAR 14.2.12.2 SECTION			COLD TEST OR OPEN RPV	HEAT UP	TEST CONDITIONS						WARRANTY
27	Recirc. System:	Trip One Pump					X[13]				
		Trip Two Pumps (RPT)					X[13]				
		System Performance			x	x	x[4]	x		X[5]	
		Non-Cavit. Verif.					x	x			
28	Loss of Turbine Generator and Offsite Power				x[L,13,SD]						
29	Drywell Piping Vibration				x	x	x		x	x	
30	Recirc. System Flow Calibration						x			x	
31	Reactor Water Cleanup System			x	x						
32	Residual Heat Removal System			x						x[18,13]	
33	Drywell Atmosphere Cooling			x		x				x	
34	MSIV Leakage Control			x[15]							
35	Offgas System			x	x	x	x			x	
36	Penetration Cooling			x	x	x	x			x	
37	Steam Production										x[20]
38	Neutron Flux Noise Surveillance							x			

TABLE 14.2-4 (Cont'd)

1. See Figure 14.2-6 for Test Conditions region map.
2. Perform FSAR 14.2.12.2 Section 5, to determine timing of 4 slowest control rods in conjunction with these scrams as determined in STP-05-2.
3. Between Test Conditions 1 and 3.
4. Between Test Conditions 2 and 3.
5. Between Test Conditions 5 and 6.
6. Before 100% Load Rejection.
7. Future maximum power test point.
8. Determine maximum power without scram.
9. Deleted.
10. Deleted.
11. Deleted.
12. 80-90% Power and near 100% core flow.
13. Do drywell piping vibration test in conjunction with this test.
14. Demonstrate Recirculation System Runback Feature.
15. Any time reactor scram and shutdown from any temperature with pressure above 20 psig, and with MSIVs closed.
16. 60 to 80 percent power, ≥95 percent core flow.
17. Bypass valve incipient response test with recirculation system at local flow control mode (L) or automatic flow control mode (F) only.
18. Demonstrate RHR system in shutdown cooling mode of operation following a planned or unplanned reactor scram or shutdown from any test condition.
19. Measure possible shakedown effects at ambient temperature after shutdown or scram with an immediate plant cooldown being required and the plant having experienced at least three thermal cycles.
20. The warranty test condition and its associated tests may be conducted prior to the completion of testing in Test Condition 6.

L = Local Flow Control Mode (POS)

M = Master Manual Flow Control Mode (FLX)

F = Automatic Flow Control Mode (FLO)

SP = Scram Possibility

SD = Scram Definite

BP = Bypass Valve Response

CV = Control Valve Response

CV+BP = Bypass Valve Incipient Response

TABLE 14.2-5
ACCEPTANCE TESTS

TABLE 14.2-6
STARTUP STAFF CERTIFICATION LEVELS

LEVEL I (REQUIRED FOR FLUSHING, HYDRO'S, CALIBRATIONS, ETC.)

High school graduate plus one year of experience in construction and/or pre-operational testing experience.

LEVEL II (REQUIRED FOR CONDUCTING PRE-OPERATIONAL AND STARTUP TESTS)

Engineering or Science degree plus two years of commensurate experience. One year of experience should be associated with nuclear facilities.

OR

High school diploma plus four year of experience. One year of experience should be associated with nuclear facilities.

LEVEL III (REQUIRED FOR APPROVAL OF PRE-OPERATIONAL AND STARTUP TEST PROCEDURES AND RESULTS)

Engineering or Science degree plus five years of experience. Two year of experience should be associated with nuclear facilities.

OR

High school diploma plus ten year of commensurate experience. Five years of this experience should be associated with nuclear facilities.

NOTE: Table previously located in USAR Section 13.1 as Table 13.1-2.

							Start Preop Testing		Cold Hydro	NRC License Exam	Fuel Load	Hot License Exam
Months →		42	36	30	24	17	15	12	6		0	3
Manager - Clinton Power Station	1	2 & 3										11
Asst. Manager - Clinton Power Station				1,6,2&3	4 & 5		8		11	7 & 10	12	
Director - Plant Maintenance			2&3				8					
Director - Plant Operations	1 & 6	2 & 3			4 & 5		8		11	7 & 10	12	
Director - Plant Technical	1 & 6		2 & 3		4 & 5		8		11	7 & 10	12	
Director - Plant Radiation Protection			2 & 3				8					
Supervisor - Elec. Maint.							8	2 & 3				
Supervisor - Mech. Maint.			2 & 3				8					
Supervisor - C&I Maint.			2 & 3				8					
Supervisor - Compliance		8										
Shift Supervisor	1 & 6	2 & 3			4 & 5		8 & 9		11	7 & 10	12	
Asst. Shift Supervisor	1 & 6	2 & 3			4 & 5		8 & 9		11	7 & 10		
Control Room Operator	1 & 6	2 & 3			4 & 5		8 & 9		11	7 & 10		
Unit Attendant							8 & 9					
Auxiliary Operator							8 & 9					
Radiation Protection Personnel							8 & 9					
Radwaste Personnel							8 & 9					
Chemistry Personnel							8 & 9					
Maintenance Personnel							8 & 9					
Supervisor - Plant Operations	1 & 6	2 & 3			4 & 5		8		11	7 & 10		
Shift Technical Advisor						2 & 3	8 & 9 *		11	10		

1 - Reactor Fundamentals
2 - NSSS Systems
3 - BOP Systems
4 - BWR Operator Training
5 - Observation
6 - Reactor Startup
7 - License Review
8 - Specialty Training
9 - On-the-Job Training
10 - Operator Requalification
11 - Core Damage Mitigation
12 - Initial Test Program

NOTE: Month 0 is Jan. '86.

*STA trainees who do not hold licenses will participate in an abbreviated simulator training program as part of specialist training.

** Training in this position is not required. Either the power plant manager or the assistant power plant manager operations shall have this training. However, the core damage mitigation training will be completed by the power plant manager prior to the plant exceeding 5% power.

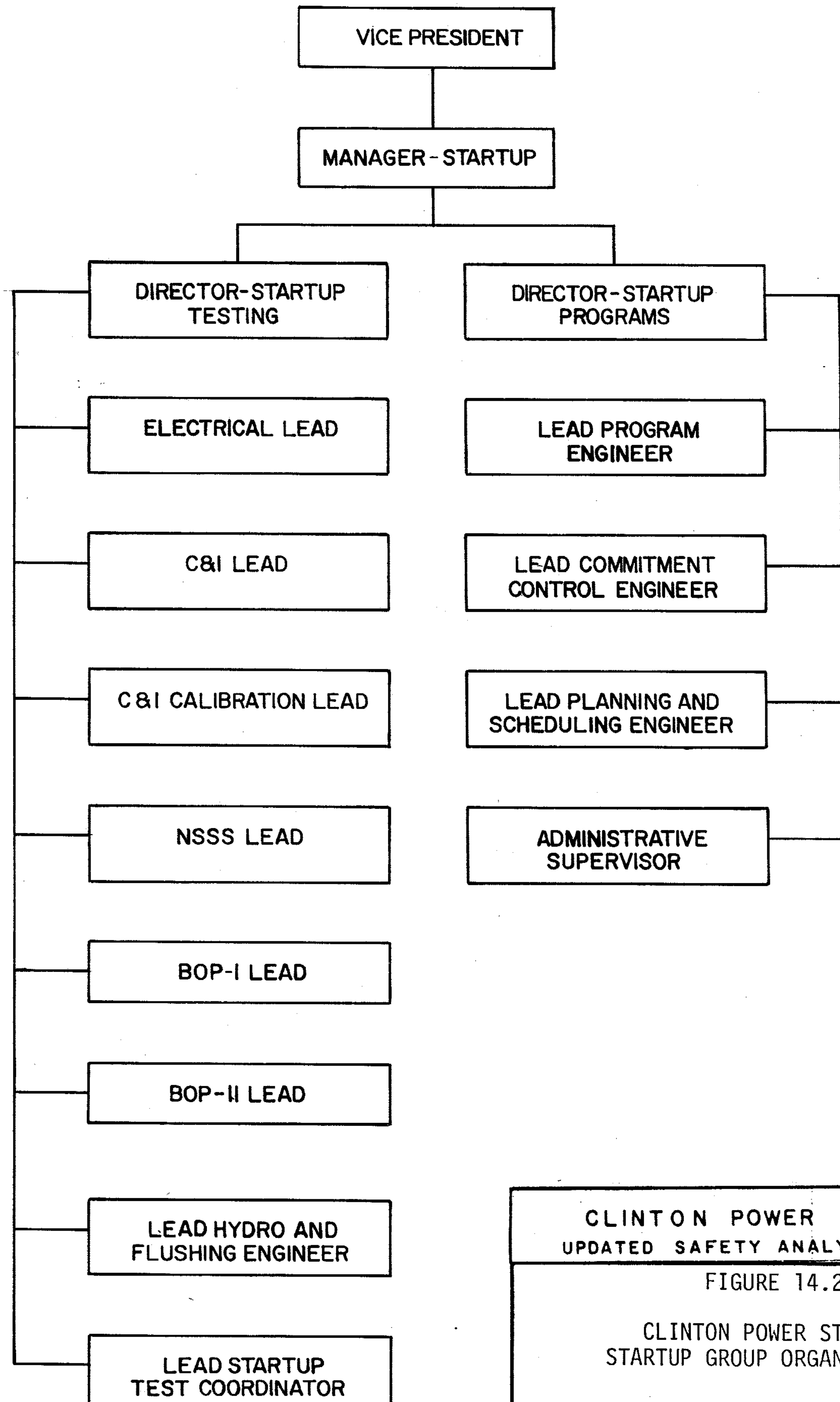
Figure 14.2-1

PREOPERATIONAL

CPS TRAINING SCHEDULE

FOR KEY STAFF POSITIONS

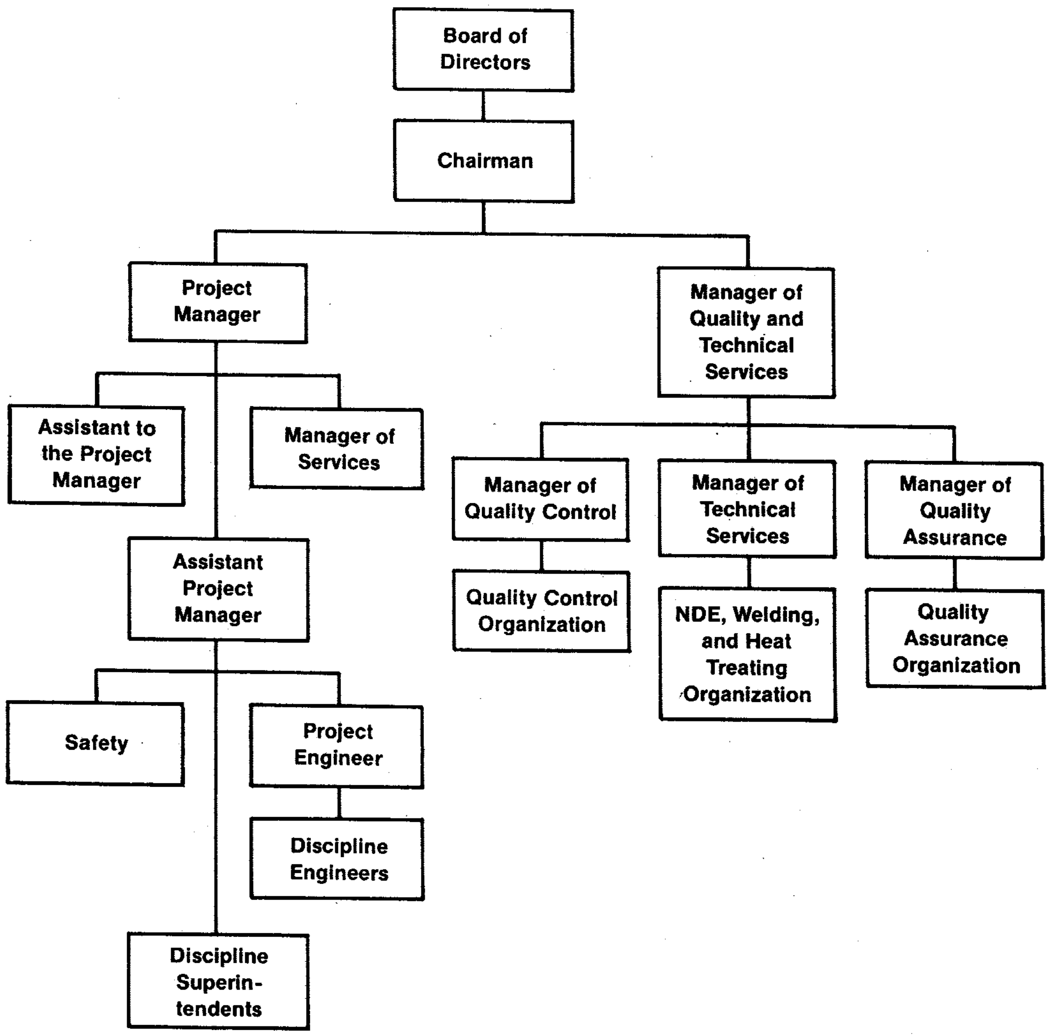
NOTE: Figure previously located in USAR Section 13.2.



CLINTON POWER STATION
UPDATED SAFETY ANALYSIS REPORT

FIGURE 14.2-2

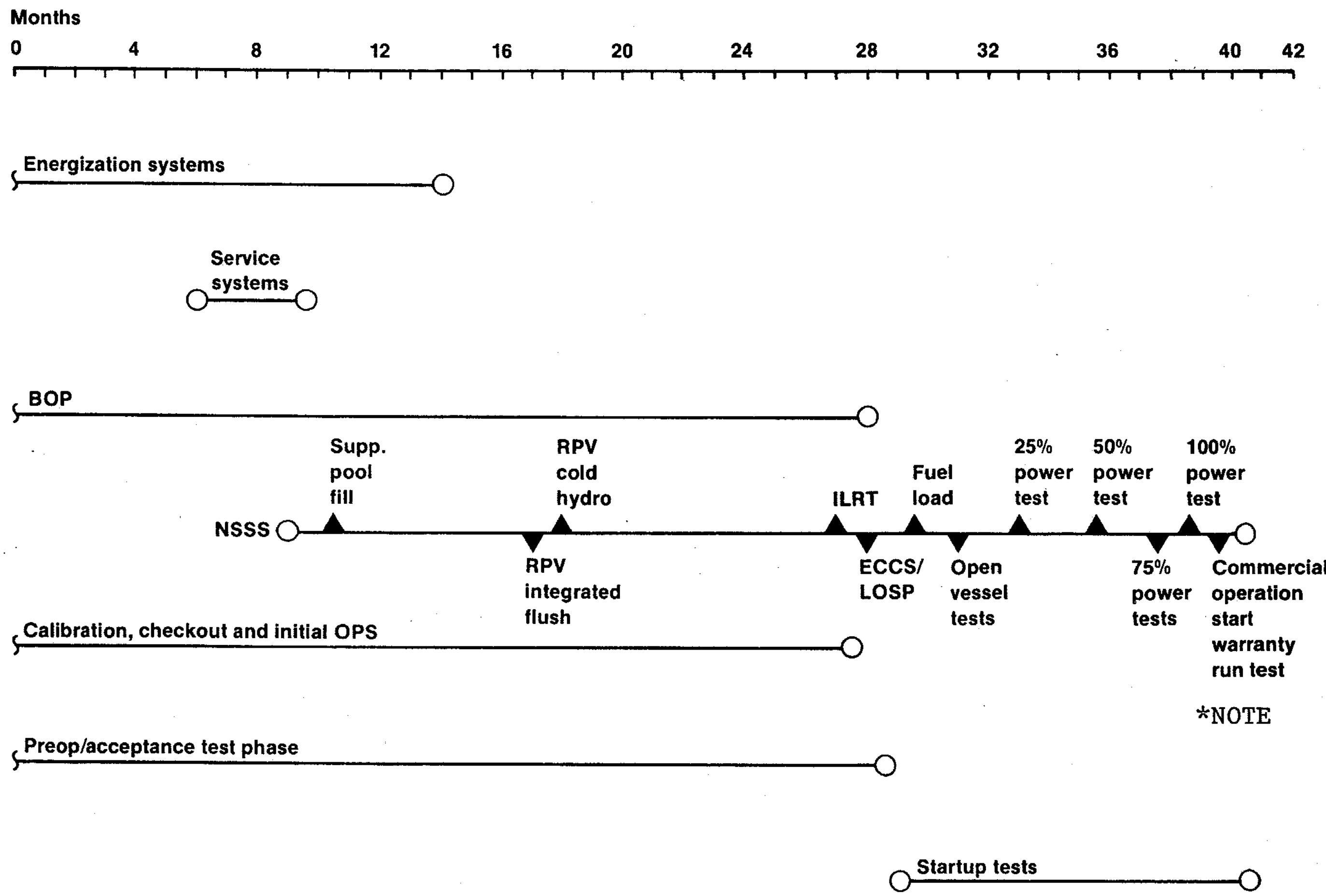
CLINTON POWER STATION
STARTUP GROUP ORGANIZATION



CLINTON POWER STATION
UPDATED SAFETY ANALYSIS REPORT

FIGURE 14.2-3

BALDWIN ASSOCIATES'
CLINTON POWER STATION
CONSTRUCTION ORGANIZATION

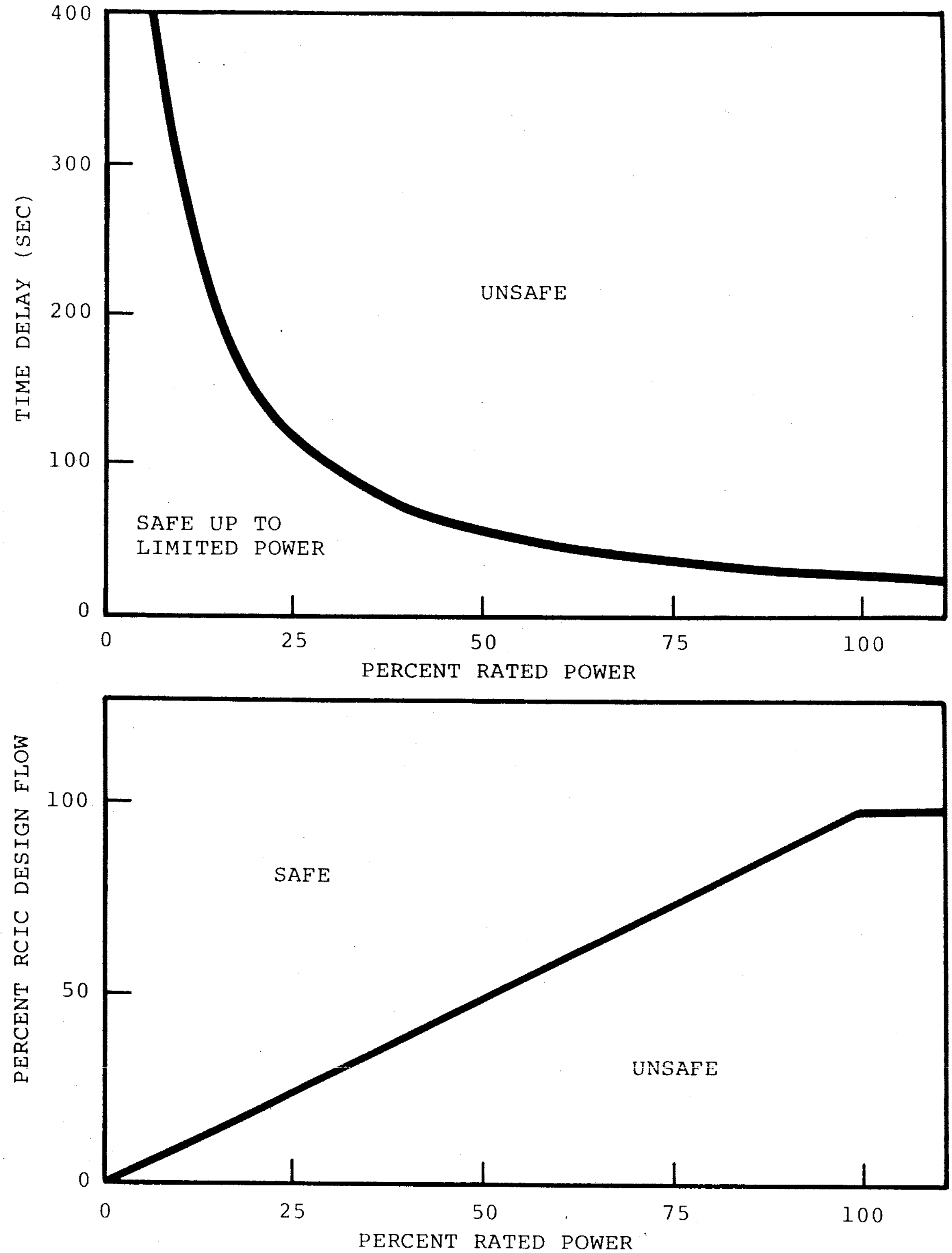


*NOTE: Warranty run tests may be conducted prior to the completion of 100% power tests at the end of startup test program.

CLINTON POWER STATION
UPDATED SAFETY ANALYSIS REPORT

FIGURE 14.2-4

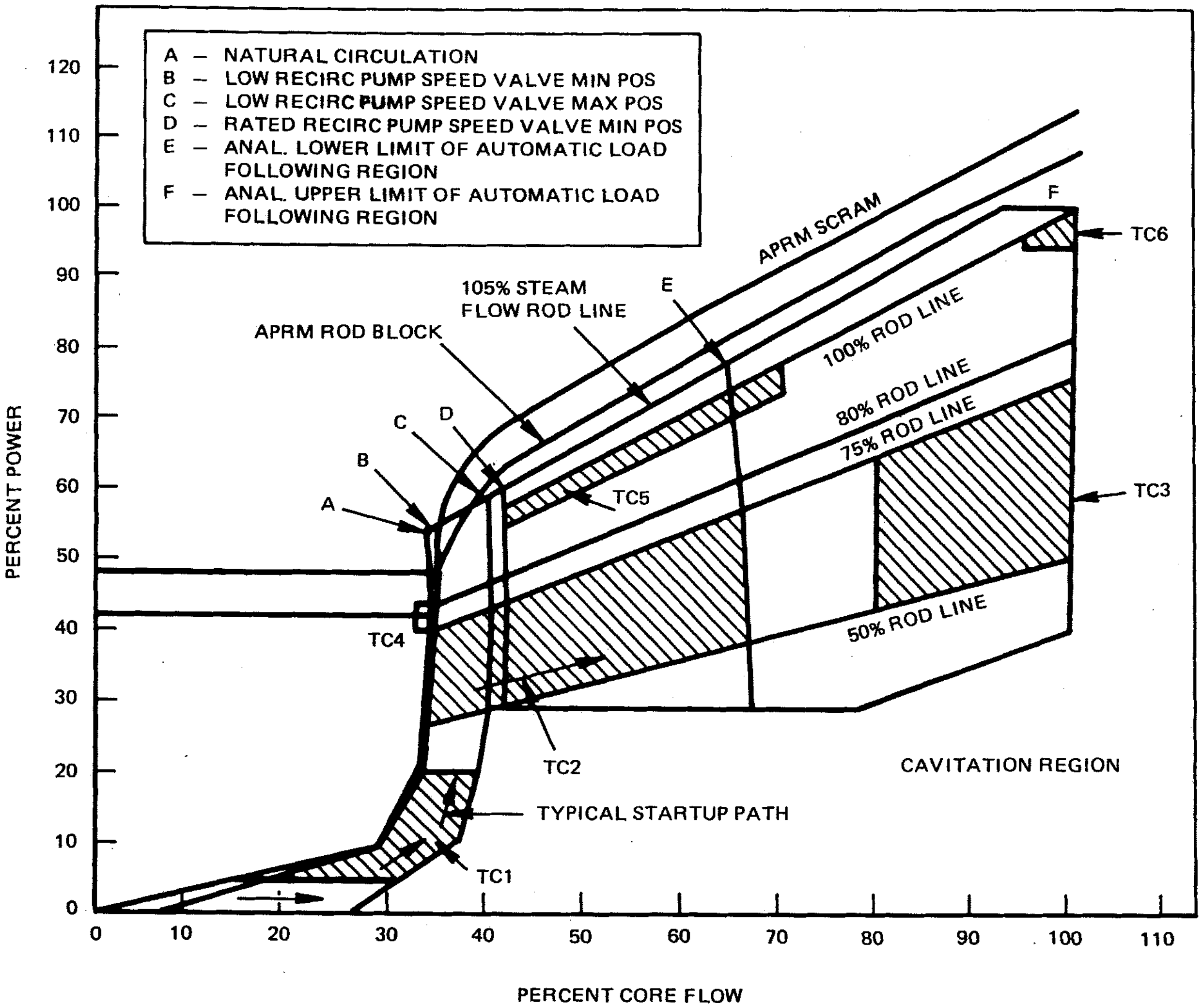
CALIBRATION AND CHECKOUT, PREOPERATIONAL TEST AND STARTUP TEST PHASE SCHEDULE FOR UNIT 1



CLINTON POWER STATION
UPDATED SAFETY ANALYSIS REPORT

FIGURE 14.2-5

RCIC ACCEPTANCE CRITERIA CURVES FOR
CAPACITY AND ACTUATION TIME



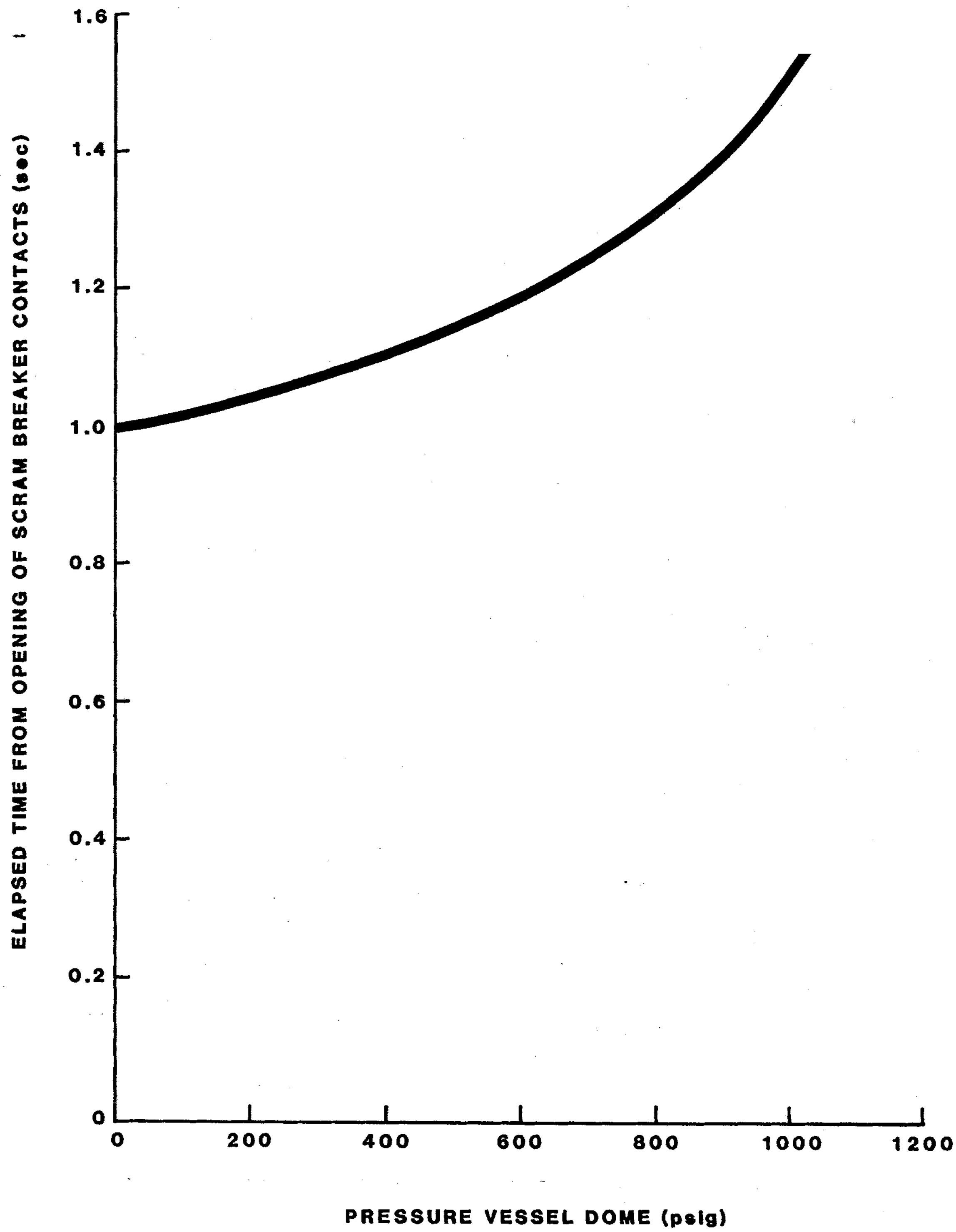
TEST CONDITION (TC) REGION DEFINITIONS

TEST CONDITION (TC)	POWER FLOW MAP REGION AND NOTES
1	BEFORE OR AFTER MAIN GENERATOR SYNCHRONIZATION FROM 5 TO 20% THERMAL POWER AND OPERATING ON RECIRCULATION PUMP LOW FREQUENCY POWER SUPPLY
2	AFTER MAIN GENERATOR SYNCHRONIZATION FROM 50 TO 75% CONTROL ROD LINES, AT OR BELOW THE ANALYTICAL LOWER LIMIT OF MASTER FLOW CONTROL MODE AND WITH THE LOWER POWER CORNER WITHIN BYPASS VALVE CAPACITY
3	FROM 50 TO 75% CONTROL ROD LINES ABOVE 80% CORE FLOW, AND WITHIN MAXIMUM ALLOWED RECIRCULATION CONTROL VALVE POSITION
4	ON THE NATURAL CIRCULATION CORE FLOW LINE WITHIN 5% BELOW THE INTERSECTION WITH THE 80% POWER ROD LINE
5	FROM THE 100% ROD LINE TO 5% BELOW THE 100% ROD LINE AND BETWEEN MAXIMUM FLOW AT RATED RECIRCULATION PUMP SPEED (MINIMUM VALVE POSITION) TO 5% ABOVE THE ANALYTICAL LOWER LIMIT OF THE AUTOMATIC FLOW CONTROL RANGE
6	WITHIN 0 TO –5% OF RATED 100% THERMAL POWER, AND WITHIN 5% OF RATED 100% CORE FLOW RATE

Figure 14.2-6. Startup Test Condition Power Flow Map

FIGURE 14.2-7

HAS BEEN DELETED



CLINTON POWER STATION
UPDATED SAFETY ANALYSIS REPORT

FIGURE 14.2-8

RANGE OF 75% SCRAM INSERTION TIMES AS MEASURED BY THE PICKUP TIME OF THE POSITION 11 SWITCH