CHAPTER 14

INITIAL TEST PROGRAM

14.1 SPECIFIC INFORMATION TO BE INCLUDED IN PSAR

Not Applicable.

14.2 SPECIFIC INFORMATION TO BE INCLUDED IN FSAR - INITIAL TEST PROGRAM

14.2.1 Summary of Test Program and Objectives

The Nine Mile Point Nuclear Station - Unit 2 (Unit 2) startup and test program consists of three phases, which begin as systems and components and structures are nearing construction completion, and end with the rated power warranty run for the Station.

The objectives of the startup and test program are as follows:

1. Ensure that the construction of the plant is acceptable.

2. Ensure that the initial test program is properly completed and documented.

3. Demonstrate, to the extent practical, that the plant structures, systems, and components operate in accordance with their design and performance requirements.

4. Utilize and evaluate, to the extent possible, the plant procedures.

5. Provide training and hands-on experience to the plant operating and maintenance personnel.

6. Demonstrate, where practical, that the plant is capable of withstanding anticipated transients and postulated accidents.

7. Effect a safe and efficient fuel loading.

8. Bring the plant to rated capacity and sustained power operation.

The three major phases of the test program are intended to provide a systematic and controlled approach to plant startup. The three phases, preliminary testing, preoperational testing, and startup testing, are described in the following paragraphs. All three phases are conducted under the direction of Niagara Mohawk Power Corporation (NMPC) with the preliminary and preoperational phases administratively controlled by the startup administration procedures (SAPs) and the startup phase by the site administrative procedures (APs).

14.2.1.1 Initial Test Program Phases

The three phases of the initial test program can be summarized as follows:

1. Preliminary testing - tests performed subsequent to release of the equipment, system, or structure from construction. This test phase verifies proper installation and operation of equipment, systems and, where applicable, structures. Preliminary test activities may be categorized into two phases:

    a. Component verification - includes cleaning, calibration, electrical logic and equipment tests, initial energizing, and equipment operation.

    b. System preparation - includes flushing and initial system operation.

2. Preoperational testing - performed after system turnover and usually prior to fuel load to verify that the performance of plant systems and components will meet applicable performance design and regulatory requirements. Two types of tests are included in the term preoperational testing:

    a. Preoperational tests - performed to provide verification that structures, systems, and components meet performance requirements and satisfy the design criteria to the extent possible. These tests are performed on safety-related systems as specified in Regulatory Guide (RG) 1.68, systems designated under the augmented quality assurance (QA) program and other systems important to reactor safety or the safe shutdown of the reactor.

    b. Acceptance tests - similar to preoperational tests except they are performed on nonsafety systems and are not specified in RG 1.68.

3. Startup testing - consists of fuel loading, precritical, low power, and power ascension tests that ensure fuel loading in a safe manner, confirm the design bases, demonstrate where practical that the plant is capable of withstanding the anticipated transients and postulated accidents, and ensure that the plant is safely brought to rated capacity and sustained power operation.

14.2.1.2 Preliminary Testing

Typically, preliminary tests include, but are not limited to:

1. Valves

    a. Inspect, adjust packing and packing followers, check operator alignment, and verify lubrication.

b. Verify and adjust motor-operated valve (MOV) torque and limit switches, verify operation, and control capability.

c. Verify setpoints or bench test relief and vacuum valves.

2. Piping

a. Verify installation and adjust hangers and supports.

b. Verify completion and/or complete integrity testing.

c. Hydrostatic testing.

d. Flow balancing.

3. Flushing/cleaning

a. Includes general flushing, proof flushing, wipe tests, and coupon tests.

b. May include low velocity flushes to rinse or chemically clean pipe, vessel, and tanks or high velocity to remove foreign material.

4. Rotating equipment

a. Check anchoring, align and lubricate as necessary.

b. Confirm correct rotation.

c. Measure operating parameters.

5. Electrical circuits

a. Verify annunciator operation.

b. Verify control and interlock logic.

c. Confirm equipment sizing.

d. Verify installation, calibrate and set protective devices and relays and thermal overloads.

6. Instrumentation

a. Calibrate instruments and process loops.

b. Adjust setpoints.

c. Verify instrument circuit continuity and operation.

14.2.1.3 Preoperational Test Phase

The preoperational test phase commences after system turnover which normally occurs as construction and preliminary testing near completion. During this period, some preliminary testing may be ongoing in addition to the preoperational tests. Plant operating and surveillance procedures are used to the extent practical during the preoperational test phase to operate the systems and to support the test program. In some cases, interim operating procedures may be used to operate systems and equipment during the preliminary and preoperational phases to compensate for nonstandard system conditions and/or to debug the intended operating procedure.

During this period, systems are operated in accordance with the preoperational or acceptance tests in which system parameters are tested, adjusted and recorded in as many modes of operation as can be simulated. The systems are also operated in conjunction with other systems during integrated tests to verify performance characteristics under near-actual operating conditions. The following are some of the types of data that may be checked and recorded during a preoperational test:

1. Design characteristics.

2. System interlocks.

3. Pump head, capacity.

4. System flows.

5. Heatup characteristics, when attainable.

6. Tuning of system controls.

7. Response to simulated safety signals and/or loss of power.

8. Operating times.

This phase of testing verifies the ability of the plant to support fuel load and power operations.

14.2.1.4 Initial Startup Test Phase

The initial startup test phase commences with the receipt of the operating license and the preparation for fuel load, and extends through the 100-percent rated power/100-hr warranty demonstration. The initial startup test phase is divided into seven testing plateaus: open vessel (including fuel loading), heatup, test plateaus 1, 2, 3, 4, and warranty run. Testing performed during this phase of the program ensures that fuel loading is accomplished in a safe manner, confirms the plant design basis, demonstrates, to the extent possible, the plant's ability to withstand anticipated transients and postulated accidents and verifies that the plant can be safely brought to rated power and sustained power operations.

14.2.2 Organization and Staffing

The Unit 2 startup and test organization and interfaces to plant operations, Stone & Webster Engineering Corporation (SWEC), General Electric (GE), and other selected NMPC organizations, are shown on Figure 14.2-7 and are discussed in the following sections.

The Unit 2 operational organization is discussed in Chapter 13.0. The initial startup test phase is performed under the control of the Station Superintendent and coordinated by the Power Ascension Manager. The responsibilities of the Operations organization during the startup and test program are discussed in the following sections.

Staffing levels during the startup and test program will be commensurate with schedule and project needs and requirements.

14.2.2.1 Startup and Test Organization and Responsibilities

The startup and test organization, under the direction of the Startup Manager, has overall responsibility for the development, implementation, control, and conduct of the preliminary and preoperational phases of the Unit 2 test program. This organization is comprised of NMPC Test Engineers and Technicians augmented by personnel from other NMPC organizations, SWEC, GE, and others, as contractually established.

The Startup Manager reports to the Station Superintendent for the implementation and conduct of the test program and to the Project Director for startup and test activities in support of the project budget and schedule. During this period, the Unit 2 staff supports the test program as directed by the Startup Manager. Upon receipt of the operating license, the Startup Manager and his staff support fuel load and the power ascension program, as directed by the Station Superintendent and Supervisor Operations.

14.2.2.1.1 Station Superintendent

The responsibilities of the Station Superintendent are discussed in Section 13.1. Additionally, included among his responsibilities, but not limited to, are the following startup and test program responsibilities:

1. Technical adequacy of the startup and test program and its compliance with Nuclear Regulatory Commission (NRC) regulations and licensing commitments.

2. Approval of procedures during the startup test phase, as established in the Technical Specifications and APs.

3. Report test program status and problems to the NMPC General Superintendent Nuclear Generation.

4. Coordinate Station department heads in their job assignments of plant staff to support and accomplish test program objectives.

5. Manage and direct the startup test phase of the plant.

14.2.2.1.2 Startup Manager

The responsibilities of the Startup Manager include the following:

1. Chairperson of the Joint Test Group (JTG).

2. Review plans, schedules, methods, procedures, and data systems for the testing and evaluation of all plant equipment and systems to permit acceptance and licensing.

3. Provide management direction to the startup and test program, coordinate plant operations and all others involved in testing the plant to assure a thorough and efficient integration of the testing and operations efforts.

4. Manage and direct test program personnel relating to the attainment of startup and test program objectives.

5. Manage and direct assigned personnel in obtaining specifications and procedures to provide or assist in the establishment of qualitative and/or quantitative acceptance criteria.

6. Provide recommendations, dispositions, and effect corrective actions where equipment, system and/or program deficiencies could adversely affect the performance of safety-related functions.

7. Preparation and control of the SAPs.

8. Review and approval of preoperational tests and their results as the chairperson of the JTG.

9. Review and concur with all staffing requirements of the startup and test department.

14.2.2.1.3 Test Group Managers

Test Group Managers report to the Startup Manager. The responsibilities of a Test Group Manager include:

1. Represent the startup and test organization on the JTG.

2. Assume the responsibilities of the Startup Manager as described in Section 14.2.2.1.2 and the SAPs during his absence and any other duties specifically delegated.

3. Directing the preparation of program status and other startup and test program related reports.

4. Develop, monitor, and coordinate the preparation and implementation of plans, schedules, methods, and procedures for testing and evaluation of plant systems and components for verification of performance and acceptance.

5. Manage, direct, coordinate and monitor the activities of test personnel and others performing tests or other test program activities during the Startup and Test Program.

6. Identify problem areas and recommend and/or implement corrective actions where deficiencies could adversely affect the performance, safety-related functions or operating efficiency of plant systems or equipment.

7. Certification of test personnel.

8. Review and approval of preoperational and acceptance tests and their results as the startup and test member of the JTG, or as the designated alternate to the Startup Manager.

9. Review and approval of other test procedures and their results as procedurally established.

14.2.2.1.4 Lead Engineers

Lead Engineers report to a Test Group Manager. The responsibilities of a Lead Engineer include:

1. Provide discipline expertise, guidance, and direction to test personnel and others.

2. Review and approve test procedures and their results as procedurally established.

14.2.2.1.5 Test Group Supervisors

Test Group Supervisors report to a Test Group Manager. The responsibilities of a Test Group Supervisor include:

1. Review and evaluate test procedures, test results, and other documentation as procedurally established.

2. Ensure that systems and equipment are properly tested and operated.

3. Provide direction and guidance to test personnel.

14.2.2.1.6 Test Engineers

Test Engineers prepare and perform tests and inspections on plant systems and equipment, are responsible for all tests performed on their assigned systems, document deficiencies and their resolutions, provide corrective measures, methods and recommendations, as appropriate, for the correction of deficiencies and other problems. Test Engineers are assigned duties and certified commensurate with their technical background, experience, and prior satisfactory performance of assigned tasks.

1. A Level I Test Engineer generally assists other Test Engineers on their assigned systems. The extent of unassisted independent assignment is dependent on certification and past performance.

2. A Level II Test Engineer generally functions as a System Engineer, performs all tests and inspections for which he is certified, and evaluates their results for acceptability and initiates corrective action, where appropriate.

3. A Level III Test Engineer performs the same functions as a Level II Test Engineer, and additionally provides guidance and technical expertise to other Test Engineers, and may provide review or approval of activities and their results as designated in the appropriate procedures or as delegated.

14.2.2.1.7 Test Support Personnel

Test Support personnel assist the System Engineer or other Test Engineer in the performance of startup and test activities.

1. A Test Support Person, Level I, performs limited startup and test activities under the direction, direct control, and/or supervision of the Test Engineer. These activities may include, but are not limited to,

data recording, test setup, performance, or direction of approved test procedures. The Test Engineer or other certified individual verifies and/or monitors the entire activity performed and assures that each step or portion was performed properly and is acceptable.

2. A Test Support Person, Level II, performs various tests and inspections based on certification and as directed by the Test Engineer. These activities do not require the Test Engineer to verify each step or portion of the activity. The Test Engineer monitors the process, provides overall direction, and determines the acceptability of the activity.

14.2.2.2 Startup and Test Program Staff Organization and Responsibilities

14.2.2.2.1 Project Advisory Engineer

The Project Advisory Engineer (PAE) is the senior SWEC Advisory Operations Division (AOD) representative onsite. The PAE reports to the Startup Manager. The responsibilities of the PAE include:

1. Provide technical support and liaison with AOD and SWEC Engineering and other SWEC organizations.

2. Represent or designate SWEC representative on the JTG.

3. Manage the SWEC AOD Cherry Hill Operations Center (CHOC) support.

4. Conduct pressure test activities for ASME systems in accordance with SWEC's ASME III QA Manual.

14.2.2.2.2 Startup Administrative Manager

The Startup Administrative Manager reports to the Startup Manager and is responsible to manage and direct the startup and test organization administrative, planning and scheduling, jurisdictional transfer, and turnover functions.

14.2.2.3 Station Staff Responsibilities During the Startup and Test Program

14.2.2.3.1 Plant Operations

Plant Operations consists of those personnel who operate Unit 2 under the direction of the Superintendent Operations, as described in Chapter 13. This group is responsible for the operation of plant equipment and systems during the startup and test program.

The startup test program is implemented by the plant Operations Department using procedures developed and approved in accordance with the APs. These procedures are prepared by members of the Station staff and others as required under the direction of the Station Superintendent. Technical expertise from other organizations and GE is used whenever necessary.

14.2.2.3.2 Station Support Staff

The Station Support Staff consists of those Station personnel who maintain Unit 2. Duties and general responsibilities are provided in Chapter 13. The Station Support Staff, under the technical direction of the Station Superintendent, supports the startup and test program by maintaining all plant equipment, systems, and structures after release to NMPC and by providing technical assistance and manpower support to the extent practical.

The Station staff assumes complete control and responsibility for the operation, testing and maintenance of Unit 2 at fuel load.

The Power Ascension Manager is responsible to the Station Superintendent for ensuring that all startup test phase procedures are written, reviewed, and approved; coordinating startup test phase testing; ensuring proper documentation of the startup test phase testing; and maintaining test results.

14.2.2.4 General Electric Company

14.2.2.4.1 Site Operations Manager

The GE Site Operations Manager (SOM) is the senior nuclear steam supply system (NSSS) vendor representative onsite at or near fuel loading and is the official GE spokesman for preoperational and startup testing concerns and requirements. He coordinates with the Station Superintendent and the Startup Manager for the performance of his duties, which include the following:

1. Review of NSSS test procedures, including changes and results.

2. Acts as liaison with GE on testing matters involving GE NSSS-supplied equipment.

3. Provide administrative support and supervision to GE onsite personnel involved in the test program.

4. Represent GE on the JTG.

14.2.2.4.2 Operations Superintendent

The GE Operations Superintendent is responsible to the GE SOM for the administrative and technical supervision of GE Shift

Superintendents. The Operations Superintendent works directly with the NMPC Superintendent Operations and provides GE technical support to the operating organization.

14.2.2.4.3 Startup Test Operations (STO) Engineer

The GE STO Engineers provide technical support to the Unit 2 shift operations personnel in the testing and operation of GE-supplied systems. They provide 24-hr dayshift coverage as required, beginning with fuel loading, and report to the GE Operations Superintendent.

14.2.2.4.4 Lead Engineer Startup Test, Design and Analysis (STD&A)

The GE Lead Engineer STD&A is responsible to the GE SOM for supervising the GE STD&A Engineers and documenting that the performance of the NSSS and its components conform to acceptance criteria. He works with the Power Ascension Manager or his representative to coordinate and effect implementation of the startup test program, including any special testing required to confirm these acceptance criteria.

14.2.2.4.5 GE Startup Test, Design and Analysis Engineers

The GE STD&A engineers assist in the execution of the initial startup test phase.

14.2.2.5 Joint Test Group Membership and Responsibilities

The JTG is a committee representing organizations responsible for the content, conduct and/or results of startup and test program activities during the preliminary and preoperational phases of the startup and test program. The JTG provides a coordinated independent technical review of procedures and their results, resolution to unacceptable items, signifies which item or items must be repeated or performed in addition to completed items or procedures to satisfactorily complete the test or activity. Some of the specific responsibilities of the JTG include:

1. Approval of all preoperational and selected preliminary test procedures and their revisions (see Section 14.2.3.2).

2. Approval of the results of all preoperational test procedures.

3. Ensuring the adequacy of test procedures and methods.

4. Ensuring that test procedures meet the requirements of the Final Safety Analysis Report (FSAR).

5. Approval of any contractor test procedures and their results when used to satisfy startup and test program requirements on safety-related systems.

6. Approval of the results of preliminary test procedures which satisfy preoperational test acceptance criteria.

7. Approval of the SAPs, except those specifically reserved to Site Operations Review Committee (SORC) in Section 14.2.2.7.

The JTG membership and their individual responsibilities consists of the following:

14.2.2.5.1 Startup Manager

The Startup Manager is the chairman of the JTG. He is responsible to convene and conduct the meetings and to attempt to achieve a consensus from its membership.

14.2.2.5.2 Startup and Test

A Test Group Manager represents the startup and test organization and is responsible for providing a technical review of the proposed activities, documents and their results. The Test Group Manager serves as Chairman during the absence of the Startup Manager.

14.2.2.5.3 Plant Operations Representative

The Plant Operations Representative provides an operational review of the proposed activities, documents and their results. He additionally ensures that plant operating, emergency, and surveillance procedures are available as required to support the startup and test program.

14.2.2.5.4 NMPC Site Technical Representative

The NMPC Site Technical Representative is responsible to review the JTG items for compatibility with license commitments, general design requirements, Technical Specifications, surveillance, and operational assessment requirements. He additionally acts as liaison to the SORC, obtains SORC reviews as necessary, and communicates any SORC comments to the JTG.

14.2.2.5.5 Stone and Webster Engineering Corporation

The PAE or designee represents SWEC on the JTG and is responsible for the SWEC engineering review of preoperational test acceptance criteria and other items within SWEC's scope of design.

14.2.2.5.6 General Electric Company

The GE SOM or designee represents GE on the JTG and is responsible for JTG agenda items within GE's scope of design for compatibility with GE requirements.

14.2.2.5.7 Conditional Members

Conditional members are representatives from any organization having responsibility and/or expertise in an area of the JTG meeting agenda. In this situation, the representative will be requested to attend the meeting by the JTG Chairman.

14.2.2.6 Unit 2 Support of the Startup and Test Program

14.2.2.6.1 Unit 2 Project Management

The Unit 2 Project Management organization is managed and directed by the Project Director and is described in the Preliminary Safety Analysis Report (PSAR). Support to the startup and test program is provided through the various project groups. Included in this support are such functions as:

1. Preparation, review, approval, and maintenance of the integrated project schedules.

2. Completion of construction activities in preparation for release and turnover of systems to NMPC.

3. Design control and control of design documents.

14.2.2.6.2 NMPC Quality Assurance

Project Quality Assurance

The NMPC Project Quality Assurance organization is described in the PSAR.

Quality Assurance - Nuclear

The Quality Assurance - Nuclear organization is described in Chapter 17.

14.2.2.6.3 Stone and Webster Engineering Corporation

SWEC provides engineering services required for construction, system release and turnover, testing, and design-related problems discovered during the startup and test program. Additionally, SWEC reviews preoperational test procedure acceptance criteria and other items within their scope of design through the SWEC PAE.

14.2.2.6.4 General Electric Company

GE is the supplier of the boiling water reactor (BWR) NSSS for Unit 2 and is responsible for generic and specific Unit 2 designs and the supply of the NSSS. During the construction phase, the GE Resident Site Manager is responsible for all NSSS equipment disposition.

14.2.2.7 Site Operations Review Committee

The SORC is described in Chapter 13 and provides direction to the startup and test program by performing the following:

1. Review and approval of the SAPs governing the organizational makeup and responsibilities of the startup and test organization and the JTG.

2. Review of system preoperational test results after JTG approval for system acceptance and readiness to support plant operation.

3. Review and approval of initial startup test procedures and their results.

4. Authorizing the progressive levels of the power ascension program.

14.2.2.8 Qualifications

14.2.2.8.1 General

Personnel performing startup and test program activities are selected for their positions based on procedural requirements and as determined by the Startup Manager.

Related experience and training may be used to satisfy academic and experience requirements of each position/level on a one-for-one basis. However, when this is required, the time or training may not be used to satisfy other areas of qualification requirements.

14.2.2.8.2 Evaluation for Certification

When each individual is evaluated for certification and qualification, the following criteria are considered and, where appropriate, noted on the individual's certification form:

1. Previous experience in the nuclear or related industry.

2. Candidate's past performance.

3. Demonstration of capability by actual performance, while under the guidance of an individual certified in the area(s), to evaluate the individual's ability to be certified to perform independently.

4. Oral and/or written exams.

5. Training and education.

6. Other factors/criteria, as appropriate.

Details for the certification of startup and test personnel during preliminary and preoperational testing are contained in the SAPs. During the startup test phase, all personnel are certified in accordance with the methods described in Section 14.2.2.8.9.

14.2.2.8.3 Startup Manager

The minimum qualifications of the Startup Manager (Level III) are a Bachelor's degree or equivalent in Engineering or related field and 10 yr experience in power plant operations or testing, or an associate level education or equivalent and 12 yr experience in power plant operations or testing. At least 7 yr should be nuclear. Previous experience in testing and supervisory/management roles during a preoperational test program is mandatory. The Startup Manager must have a good understanding of regulatory requirements, codes, and standards and must have the ability to communicate effectively in an oral and written capacity.

14.2.2.8.4 Test Group Manager

The minimum qualifications of a Test Group Manager (Level III) are a Bachelor's degree or equivalent in Engineering or related field and 8 yr experience in power plant operations or testing, or an associate level education or equivalent and 10 yr experience in power plant operations or testing. At least 5 yr should be nuclear. Previous experience in testing and supervisory/management roles during a preoperational test program is mandatory. A Test Group Manager must have a good understanding of regulatory requirements, codes, and standards and must have the ability to communicate effectively in an oral and written capacity.

14.2.2.8.5 Lead Engineer

The minimum qualifications of a Lead Engineer (Level III) are a Bachelor's degree or equivalent in Engineering or related field and 7 yr experience in power plant operations or testing, or an associate level education or equivalent and 9 yr experience in power plant operations or testing. At least 4 yr should be nuclear. Previous experience in testing and supervisory/management roles during a preoperational test program is desirable. A Lead Engineer must have a good understanding of regulatory requirements, codes and standards related to his field or discipline and must have the ability to communicate effectively in an oral and written capacity.

14.2.2.8.6 Test Group Supervisor

The minimum qualifications of a Test Group Supervisor (Level III) are a Bachelor's degree or equivalent in Engineering or related field and 5 yr experience in power plant operations or testing, or an associate level education or equivalent and 7 yr experience in power plant operations or testing. At least 3 yr should be nuclear. Previous experience in a testing role during a preoperational test program is desirable. A Test Group Supervisor should have a good understanding of regulatory requirements, codes and standards and must have the ability to communicate effectively in an oral and written capacity.

14.2.2.8.7 Test Engineers

<u>Test Engineer (Level I)</u>

The minimum qualifications of a Test Engineer (Level I) are a Bachelor's degree or equivalent in Engineering or related field, or an associate level education or equivalent and 2 yr experience in power plant operations or testing. A Test Engineer, Level I, should have a general understanding of regulatory requirements, codes and standards as related to his activities and discipline and must have the ability to communicate effectively in an oral and written capacity.

<u>Test Engineer (Level II)</u>

The minimum qualifications of a Test Engineer (Level II) are a Bachelor's degree or equivalent in Engineering or related field and 2 yr experience in power plant operations or testing, or an associate level education or equivalent and 4 yr experience in power plant operations or testing. Previous experience in a testing role during a preoperational test program is desirable. A Test Engineer, Level II, should have a general understanding of regulatory requirements, and a good understanding of codes and standards as related to his activities and discipline and must have the ability to communicate effectively in an oral or written capacity.

<u>Test Engineer (Level III)</u>

The minimum qualifications of a Test Engineer (Level III) are a Bachelor's degree or equivalent in Engineering or related field and 4 yr experience in power plant operations or testing, or an associate level education or equivalent and 6 yr experience in power plant operations or testing. At least 2 yr should be nuclear. Previous experience in a testing role during a preoperational test program is desirable. A Test Engineer, Level III, should have a good understanding of regulatory requirements, codes and standards as related to his activities and discipline, and must have the ability to communicate effectively in an oral or written capacity.

14.2.2.8.8 Test Support Personnel

Level I

The minimum qualifications of a Level I are a high school degree or GED equivalent. Technical training or some on-the-job training (OJT) for a particular discipline is desirable. A Test Support Person, Level I, should have a general understanding of the administrative and technical procedures and requirements, and any codes and standards relative to his activities and discipline, and must have the ability to communicate effectively in an oral or written capacity.

Level II

The minimum qualifications of a Level II are a high school degree or GED equivalent and either technical training in a particular discipline and 3 yr experience in power plant operations or testing, or 5 yr OJT for a particular discipline, and have demonstrated the ability to perform the activities for which they will be certified. A Test Support Person, Level II, should have a good understanding of the administrative and technical procedures and requirements, and any codes and standards relative to his activities and discipline, and must have the ability to communicate effectively in an oral or written capacity.

14.2.2.8.9 Plant Personnel

Operating, maintenance or other unit or site personnel when performing normal plant operating, maintenance, etc., activities are qualified in accordance with the requirements discussed in Chapter 13 and Section 1.8.

When plant unit or site personnel perform preliminary and preoperational test activities as described in the SAPs, they shall be qualified and certified in accordance with the requirements of Section 14.2.2.9.

14.2.2.8.10 Joint Test Group

JTG members are qualified to perform the duties and responsibilities of the JTG by their respective position qualifications and certifications.

14.2.2.9 Certification of Test Personnel

14.2.2.9.1 Certification Authorities

The Startup Manager is certified by the Station Superintendent and approved by the General Superintendent Nuclear Generation; Test Group Managers are certified by the Startup Manager and approved by the Station Superintendent.

All other startup and test personnel are certified by a Test Group Manager and approved by the Station Superintendent or Startup Manager.

14.2.2.9.2 Certification

Startup and test personnel are evaluated and certified based on the criteria and methods described in the SAPs. Each certification describes the area and level to which each individual is certified.

14.2.2.9.3 Recertification

Recertification and reevaluation of startup and test personnel are conducted, as a minimum, on a yearly basis.

14.2.3 Test Procedures

14.2.3.1 Test Procedure Development and General Information

The Unit 2 SAPs establish the methods for preparing, approving, revising and controlling preliminary, preoperational and acceptance test procedures. The site APs establish the methods for preparing, approving, revising and controlling initial startup test procedures. Both also define and specify procedure content, format and style guidelines.

Test procedures are developed by startup and test, site/unit personnel and others, as required, utilizing the appropriate design documents, vendor information, codes, standards, etc., in order to provide detailed methods to demonstrate the capability of the equipment, systems and structures to perform their design functions.

14.2.3.1.1 Plant Procedures

The following program outlines the qualification and interface of plant operating procedures with the test procedures utilized during the startup and test program:

1. If required, procedures to operate equipment and systems and to support testing have been prepared and approved before preoperational testing begins on the associated system using the best information currently available from the principal designer and responsible equipment suppliers.

2. Preoperational test procedures will utilize these procedures as nearly as possible (see Section 14.2.9).

3. Plant procedures required to support startup testing will be updated and revised, if previously drafted, developed, and approved utilizing the results of preoperational testing, including the use-testing of plant procedures where practical, before startup testing of the applicable systems. Exceptions will be those plant procedures required to be verified during the startup test phase.

4. Startup test procedures will either be updated, if already drafted, or developed utilizing the results of preoperational testing and the updated plant procedures.

14.2.3.2 Preliminary Test Procedures

Preliminary test procedures are developed and used to initially verify equipment, systems, and structures as described in Section 14.2.1.2. The format and content requirements are similar to preoperational test procedures and are described in the SAPs.

Preliminary test procedures that are utilized to verify safety-related functions of equipment or which will be used to satisfy a preoperational test procedure acceptance criteria and revisions are reviewed and approved by the JTG; all other preliminary test procedures are approved by a Test Group Manager.

14.2.3.3 Preoperational and Initial Startup Test Procedures

Preoperational and initial startup test procedure content is similar to that described in RG 1.68, the format varies but all the elements discussed in the guide are included.

All preoperational test procedures and their revisions are reviewed by the Quality Assurance - Nuclear Department for any applicable quality requirements.

All preoperational test procedures are approved by the JTG.

All startup test procedures and their revisions are approved by the General Superintendent Nuclear.

Review and approval of preoperational and startup test procedures is controlled in accordance with the SAPs and APs, respectively.

Figure 14.2-1 shows the review and approval cycle for preliminary and preoperational test procedures, and Figure 14.2-2 shows the review and approval cycle of initial startup test procedures.

14.2.4 Conduct of Testing

14.2.4.1 Preliminary Testing

Preliminary testing is conducted in accordance with the SAPs under the control of the Unit 2 Startup and Test Department subsequent to the release of equipment, system, or structure from construction.

This test phase verifies proper installation and operation of equipment, systems and, where applicable, structures. At the time of the initial equipment run, the equipment and systems are operated by plant Operations personnel as directed by the Test Engineer. Subsequent operation is under the control of the Station Shift Supervisor (SSS). To support test activities, these operations may be under the general direction of the Test Engineer. During these operations, operating parameters for equipment will be monitored and recorded as necessary in accordance with the system operating procedures, interim operating procedures, or as determined by the SSS and/or Test Engineer to ensure that the operating envelopes of the equipment are not inadvertently exceeded.

Preliminary test procedures may be generic or specific type procedures. Generic tests are performed repetitively on groups or types of components and equipment. The range and installed systems may vary but the basic test method remains the same. During the performance of generic procedures the step-by-step details and sequence are determined by the Test Engineer. Specific procedures are applied to a limited scope and provide greater detail than generic procedures. Test results obtained during preliminary testing may be used in place of retesting during preoperational testing provided the preliminary test and its results are approved by the JTG. These preliminary tests shall be identified in the preoperational test procedure.

14.2.4.2 Preoperational Testing

Preoperational testing on a system commences after the required preliminary testing of individual equipment, subsystems, or systems is completed. Testing is performed with preoperational test procedures approved in accordance with the SAPs.

Since a significant period of time may have elapsed between the time a preoperational test was approved and the time the test is to be performed, the test is reviewed prior to initiating the test; any changes in the equipment or system since the procedures approval are researched and the procedure revised as necessary in accordance with 14.2.3.3. The procedure may then be approved for performance by the Startup Manager.

14.2.4.2.1 Pretest Review

Approval by the Startup Manager to perform a preoperational test requires completion of a pretest review. This review includes, as a minimum, the following elements:

1. Review of the status of the procedures (operating or other) required to support the test. The Startup Manager shall be notified if a required procedure is unavailable to support the test.

2. Attaching a copy of the system flow diagram for mechanical systems or an electrical one-line diagram for electrical systems marked up with any design changes that are installed in the field but not yet incorporated on the drawing, to show system design configuration at the time of the test.

3. Check to ensure that the test prerequisites can be met.

14.2.4.2.2 Test Performance

Responsibilities

1. Implementation and scheduling all tests is the responsibility of the Startup Manager.

2. The performance of the test procedure, its direction, coordination and verification is the responsibility of the Test Director.

3. The responsibility for operation of systems and equipment, coordination of in-process tests, maintaining and controlling plant operating status and assignment of operating personnel to assist in performance of the test procedures rests with the plant Operations group through the on-duty SSS.

4. In emergencies, the Test Director or SSS are authorized to depart from approved procedures where necessary to prevent injury to personnel or the public or to prevent damage to the facility and its equipment.

Pretest and Preshift Briefings

Prior to test commencing, the Test Director and SSS discuss the test, its effects on other systems, control room indications, alarms, expected start and stop times, and any other factors that may influence test performance or plant conditions.

When the personnel that are to be involved in the test are assembled, the Test Director and SSS, if available, shall conduct a pretest briefing to explain the test and the involvement required of all participating personnel.

Additional briefings and updates are conducted for oncoming shift personnel and at other times as necessary during test performance by the Test Director.

Reverification of Prerequisites

Following a test interruption which results in a halt in testing during a preoperational test, the Test Director shall review the test prerequisites for possible reverification. The results of the review are entered in the test summary and any reverified prerequisites listed.

Preoperational Test Summary

A preoperational test summary shall be prepared by the Test Director for all preoperational test procedures. The test summary includes significant events during the test, a description of any problems found during the test and reference to their resolution, any reverification of prerequisites required and an evaluation of the test results with reference to the acceptance criteria. This shall in particular note if any acceptance criteria have not been met. The test summary is attached to the record copy of the test procedure.

14.2.4.3 Initial Startup Testing

Startup testing is conducted by personnel from plant operations, startup and test, GE, and groups as required under the direction of the on-duty SSS in accordance with the APs.

During this phase, plant operating procedures are utilized in conjunction with the approved test procedures.

The final authority to start, continue, or end a test is the responsibility of the SSS after all required approvals have been obtained.

The master tracking system is used to ensure that prerequisites for initial fuel loading and the beginning of initial startup testing are fulfilled. The master tracking system may be replaced by a similar tracking system as the preoperational test phase nears completion. In addition, each individual startup test procedure specifies prerequisites that must be validated prior to test performance. The on-duty SSS and respective test personnel ensure that all prerequisites are satisfied prior to performance of any initial startup test.

14.2.4.4 Modifications to Test Procedures During Testing

14.2.4.4.1 Preliminary Tests

During performance, any changes to a preliminary test procedure that changes the intent, scope, or acceptance criteria of the test are made on a field revision form (FRF) prior to implementation of the change in accordance with the SAPs.

14.2.4.4.2 Preoperational Tests

During performance, no changes may be made to the procedure that change the intent, scope or acceptance criteria of the test without the prior approval of the JTG. These changes are made on a FRF in accordance with the SAPs. The Test Director may elect to perform unaffected sections of the test while awaiting resolution from JTG, provided test sequence is not mandatory.

Other exceptions and minor corrections to the test procedure are authorized in accordance with the SAPs.

14.2.4.4.3 Startup Tests

Modifications to initial startup test procedures are classified as major or minor changes. A major change changes the intent of the procedure and requires development of a revision to the procedure. Such a revision requires approval of the organizations that originally approved the test procedure. When a procedure in progress cannot be followed or completed and a major change to the procedure is required, the test is held at that point, the system placed in a stable condition, and the necessary approvals obtained in accordance with the APs prior to continuing the test.

Minor changes do not change the intent of the test procedure and may be made with the concurrence of a Senior Reactor Operator (SRO) licensed member of the plant staff at the time the test is run. Minor changes to procedures are made in accordance with the APs which detail the method of entry of the change and the required approvals.

14.2.4.5 Modifications and Deficiencies

14.2.4.5.1 Preliminary and Preoperational Phases

The SAPs contain administrative controls for identifying, reporting, and tracking of deficiencies and modifications during these phases.

Changes to plant system and equipment design are reviewed and approved in the same manner as the original design by the approved design organization.

Deficiencies not requiring a change to the plant design are reviewed, resolved, approved, and corrected by the appropriate personnel in accordance with the SAPs.

To ensure the validity of test results during these phases, work on equipment after preliminary testing is administratively controlled by the SAPs. Control is accomplished by the use of work control documents and equipment tagging. The work control documents establish the scope, inspection and retesting required to complete the activity. Tagging is utilized to alert personnel that the equipment may be tested and in service and will require authorization prior to performing any work affecting the equipment.

14.2.4.5.2 Initial Startup Test Phase

Modifications and deficiencies during this phase are handled in accordance with the requirements established for the operational phase described in Chapter 13 and controlled in accordance with the APs.

14.2.5 Test Procedure Results Review and Approval

14.2.5.1 Preliminary Test Procedures

The Test Engineer reviews the results of each preliminary test to ensure it meets the requirements noted on the data sheet and/or procedure acceptance criteria. Where test results are unacceptable, the Test Engineer shall initiate steps to obtain corrective action as described in the SAPs.

A Lead Engineer reviews the results of all preliminary tests and approves the results of all generic preliminary tests. A Test Group Manager approves the results of all nongeneric preliminary test procedures.

Preliminary test results which require JTG approval are attached to their associated preoperational test for review and approval during the review and approval of the preoperational test results.

14.2.5.2 Preoperational Test Procedures

Completed preoperational test procedures are reviewed in accordance with the SAPs.

After the initial review, the preoperational test is submitted to the JTG for review and approval.

When the preoperational tests for a system are complete and approved by the JTG, the completed procedures are submitted to the SORC and Station Superintendent for review and acceptance.

Figure 14.2-3 shows the review and approval cycle for preliminary and all preoperational test results.

14.2.5.3 Initial Startup Test Procedures

The various startup test plateaus are described in Section 14.2.10. Startup test conditions are shown in Figure 14.2-5. The decision to proceed from one startup test plateau to the next will be based upon successful completion of the tests and the discretion of the SORC and General Superintendent Nuclear Generation. Any required retesting is determined during the review cycle. If a startup test is not fully acceptable, the SORC and General Superintendent Nuclear Generation can approve the procession to the next plateau in accordance with the APs.

The review and approval cycle for initial startup test procedure results is controlled in accordance with the APs and is shown on Figure 14.2-4.

14.2.6 Test Records

Test records and procedures are kept in accordance with the SAPs and APs which contain the generic procedures for filing and recordkeeping to be applied to test documentation.

14.2.7 Conformance of Test Program with Regulatory Guides

The Unit 2 startup and test program complies with the intent of the following regulatory guides with exceptions as noted or described in the appropriate sections of the FSAR. Areas where the guide(s) do not apply are not considered exceptions.

<u>Regulatory Guide 1.9</u> - See Section 8.3.

<u>Regulatory Guide 1.20</u> - The alternative approved for vibration testing of reactor internals will be in accordance with the provisions of RG 1.20 for nonprototype Category IV plants.

<u>Regulatory Guide 1.22</u> - See Chapter 7.

<u>Regulatory Guide 1.30</u> - See Chapter 17.

<u>Regulatory Guide 1.52</u> - The standby gas treatment system (SGTS) will be tested in accordance with RG 1.52 as described in Table 14.2-77. The design of the SGTS is described in Section 6.5.1. Alternative methods used to meet the intent of the regulatory guide are discussed in Section 1.8.

<u>Regulatory Guide 1.58</u> - During the design and construction phase, startup and test personnel involved in testing met the requirements of RG 1.58 and ANSI N45.2.6-1978, with exceptions as discussed in this chapter.

Unit 2 plant personnel met the requirements of this regulatory guide as discussed in Chapter 13 and Section 1.8.

GE startup operations personnel supporting the startup test phase met the requirements of this regulatory guide as discussed in Section 1.8 and Table 14.2-403.

During the operations phase, the qualification of Nuclear Power Plant Inspection, Examination, and Testing personnel is stated in NMPC QA Program requirements and is satisfied as specified in the Quality Assurance Program Topical Report for Nine Mile Point Nuclear Station Operations, NMPC QATR-1.

Regulatory Guide 1.68 - Unit 2 complies with this regulatory guide with the exception of the format as described in Appendix C of RG 1.68. The difference is not considered an exception, however, as the guide specifies required elements while merely implying a format. Table 14.2-1a outlines how abstracts comply with RG 1.68 Appendix A.

Regulatory Guides 1.68.1 and 1.68.2 - Unit 2 complies with RGs 1.68.1 (Tables 14.2-27, 30, 31, 222, 224, 303, and 304) and 1.68.2 (Table 14.2-232).

Regulatory Guide 1.68.3 - Unit 2 complies with the intent of RG 1.68.3 as described in Section 1.8.
Regulatory Guide 1.108 - Unit 2 complies with RG 1.108 with the exception of the sequence discussed in Regulatory Position C.2.a(5). Unit 2 will comply with the intent of this position by noting the stabilized operational parameters of the diesel generators at the completion of the test described in C.2.a(3) during the diesel generator preoperational tests (Tables 14.2-125 and 126). Prior to performance of one of the sections of the loss of power preoperational test (Table 14.2-129) in which the requirements of C.2.a(2) will be verified, the diesel generators will be started, loaded and allowed to run until the same operating parameters have been reached and stabilized. The units will then be shut down and the test performed while the equipment is still at operating temperatures.

Regulatory Guide 1.128 - See Section 8.3.2.

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

Since every reactor/plant in a GE BWR product line is an evolutionary development of the previous plant in the product line (and each product line is an evolutionary development from the previous product line), it is evident that the current plants have the benefits of experience associated with the successful and safe starting of 25 or more previous BWR plants. The operational experience and knowledge gained from these plants and other reactor types has been factored into the procedures related to the startup and test program.

Additionally, a committee of NMPC Operations technical staff and staff engineers (technical services review) reviews reactor operating and testing experiences. The group routinely reviews licensee event reports (LERs), information from the nuclear plant reliability data system (NPRDS), NRC I&E Bulletins, NRC circulars, and NRC, INPO, and NSAC information reports. This group reviews test procedures for the startup and test program through the technical staff representative to the JTG and SORC. These same individuals continue to provide input to Operations management after commercial operation.

14.2.9 Trial Use of Plant Operating and Emergency Procedures

To the extent practical throughout the startup and test program, test procedures utilize operating and emergency procedures where applicable in the performance of the tests. Additionally, after the equipment and systems have been initially tested and placed in service to support other test activities, these procedures are utilized as applicable and to the extent consistent with the completion status of the equipment and system. The use of these procedures is intended to achieve the following:

1. Prove the specific procedure or identify where changes may be required.

2. Provide training of plant personnel in the use of these procedures.

3. Increase the level of knowledge of plant personnel of the systems being tested.

Test procedures may use these operating and emergency procedures by referencing the procedure directly or by extracting a series of steps from the procedure or they may use a combination of both methods. A description and summary of plant procedures and a schedule for their development are given in Section 13.5.

14.2.9.1 Interim Operating Procedures

Interim operating procedures (IOPs) are utilized to trial test the Station operating procedures and to allow operation of systems in nonstandard configurations during the test program due to incomplete testing or construction. IOPs are reviewed, approved, and revised in accordance with the SAPs.

14.2.10 Initial Fuel Loading and Initial Criticality

14.2.10.1 Fuel Loading and Shutdown Power Level Tests

Fuel loading and initial criticality are conducted in accordance with written procedures after the applicable prerequisite tests have been satisfactorily completed and an operating license has been issued. In the actual sequence for performing startup tests

(SUTs), the tests are grouped into plateaus. All tests within a plateau will be completed, or justification given for exceptions, before proceeding to the next plateau (Sections 14.2.4.3 and 14.2.5.3). The test plateaus are defined as follows:

Test Plateau OV	-	Covers preparation for fuel loading, fuel loading, and open vessel testing below 1 percent rated core thermal power.
Test Plateau HU	-	Covers all testing during the initial nuclear heatup to rated temperature and pressure (1 to 5 percent power).
Test Plateau 1	-	Covers all testing at test condition 1 (5 to 20 percent power).
Test Plateau 2	-	Covers all testing at test condition 2 (between the 50 and 75 percent load lines).
Test Plateau 3	-	Covers all testing at test condition 3 (between the 50 and 75 percent load lines).
Test Plateau 4	-	Covers all testing at test conditions 5 and 6 (between the 95 and 100 percent load lines except during natural circulation testing).
Test Plateau WR	-	Covers the 100-hr NSSS warranty demonstration which may be performed concurrently or sequentially with Test Plateau 4.

The normal sequence of tests within the program is as follows:

1. Core performance analysis.
2. Steady-state testing.
3. Control system tuning.
4. Major trips.

The actual testing sequence can vary from the recommended test sequence because of equipment problems and other considerations. Prior to approving fuel loading, certain actions must be verified by the steps in the following sections, which are performed at the completion of most of the preoperational testing.

14.2.10.1.1 Loss of Power Demonstration - Standby Core Cooling Required (Table 14.2-129)

This test demonstrates the capability of the emergency diesel generators to start automatically and assume all of the emergency core cooling loads in a loss of normal auxiliary power and the capability of the offsite power system to supply power to start and run emergency core cooling and selected normal loads during a simulated loss-of-coolant accident (LOCA) condition.

14.2.10.1.2 Cold Functional Testing

Cold functional testing is defined as an integrated system operation of various plant systems that can be operated prior to fuel loading. The intent is to observe any unexpected operational problems from either an equipment or a procedural standpoint and to provide an opportunity for further Operator familiarization with the system operating procedures under operating conditions.

Some cold functional testing is accomplished during the preoperational test program. For example, integrated and simultaneous operation of the following systems may take place during the flush of the total system: condensate system, condensate demineralizer (CND) system, low-pressure coolant injection (LPCI) system, core spray systems, reactor water cleanup (RWCU) system, service water (SWP) systems, turbine building closed loop cooling water (TBCLCW) system, reactor building closed loop cooling water (RBCLCW) system, and others. As required, additional integrated system performance will be demonstrated prior to fuel loading.

14.2.10.1.3 Routine Surveillance Testing

Because the interval between completion of a preoperational test on a system and system operation may be of considerable length, a number of routine surveillance tests must be performed prior to fuel loading and must be repeated on a routine basis. The Technical Specifications detail the test frequency. In general, this surveillance test program is instituted prior to fuel loading by the plant operating staff.

14.2.10.1.4 Master Tracking System

A detailed list of items that must be completed, including work requests, design changes, and proper disposition of all exceptions noted during preoperational testing, is rechecked to verify completion prior to the final approvals for fuel loading and for those items required, at each significant new step such as heatup, opening main steam isolation valves (MSIVs), and turbine generator operation. The master tracking system (MTS) may be replaced by a similar tracking system as the preoperational test phase nears completion.

14.2.10.1.5 Initial Fuel Loading (Open Vessel Plateau)

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 operability checks of installed neutron instrumentation are made at predetermined intervals throughout the loading, thus demonstrating reliable monitoring capability to ensure subcriticality is maintained throughout fuel loading. A complete check is made of the fully-loaded core to ascertain that all assemblies are properly installed, correctly oriented, and occupying their designated positions.

14.2.10.1.6 Zero Power Level Tests (Open Vessel Plateau)

At this point, a number of tests are conducted that are best described as initial zero power level tests. Chemical and radiochemical tests are made in order to check the quality of the reactor water before and after fuel loading and to establish base and background levels that are required to facilitate later analysis and instrument calibrations. Plant and site radiation surveys are made at specific locations for comparison with the values obtained at the subsequent operating power levels. Control rod drive (CRD) system testing takes place in preparation for initial criticality and initial heatup.

14.2.10.2 Initial Criticality and Heatup to Rated Temperature and Pressure

Initial criticality and heatup follows the satisfactory completion of the fuel loading and zero power level tests (Sections 14.2.10.1.5 and 14.2.10.1.6). Further checks are made of coolant chemistry together with radiation surveys at the selected plant locations. All CRDs are scram-timed prior to initial heatup. 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 rated pressure. 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 in the drywell, mainly as a function of expansion, are recorded for comparison with design data.

14.2.10.3 Power Testing from 25 to 100 Percent of Rated Output

The power test phase comprises the following tests, many of which are repeated several times at the different test levels. While a certain basic 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 tests and radiation surveys are made at various test levels to preserve a safe and efficient power increase.

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

3. Following the first reasonably accurate average power range monitor (APRM) calibration (test condition 1), the intermediate range monitors (IRMs) are reset.

4. At test conditions 2, 3, and 6, the local power range monitors (LPRMs) are calibrated.

5. The APRMs are calibrated initially, after major power level changes, and following LPRM calibration.

6. Completion of the process computer checkout is made for all variables, and the various options are compared with independent calculations as soon as significant power levels are available.

7. Collection of data from the system expansion tests is completed for those piping systems that have not previously reached full operating temperatures.

8. The axial and radial power profiles are explored fully by means of the traversing in-core probe (TIP) system at representative power levels during the power ascension.

9. Core performance evaluations are made at test points above the 25-percent power level and for selected flow conditions; the work involves determination of the core thermal power, maximum linear heat generation rate (MLHGR), minimum critical power ratio (MCPR), and other thermal parameters.

10. Overall plant stability in relation to minor perturbations is shown by the following group of tests that are made at appropriate test points:

    a. Pressure regulator setpoint change.

    b. Water level setpoint change.

    c. Recirculation flow setpoint change.

    The first two tests require that the changes made approximate as closely as possible to a step change in demand. The remaining test is performed to properly adjust the control loop of the recirculation system.

For all of these tests, 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 failure of the operating pressure regulator to permit takeover by the backup regulator.

11. The category of major plant transients includes full closure of all MSIVs, fast closure of turbine generator control valves and stop valves, loss of the main generator and offsite power, tripping of a feedwater pump, and trips of the recirculation pumps. The plant transient behavior is recorded for each test and the results may be compared with the acceptance criteria and the predicted design performance.

12. A test is made of the main steam safety relief valves (SRVs) in which leak-tightness and general operability are demonstrated.

13. The jet pump flow instrumentation is calibrated at test conditions 3 and 6.

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

14.2.11 Test Program Schedule

Preoperational and startup testing is planned to be conducted in accordance with the following schedule. This schedule is based on current information and is updated onsite to consider actual construction and testing progress. It is included to provide general information and sequence but is not considered to be identical to the schedules in use during the startup and test program.

1. The preoperational/acceptance test phase commences in December 1984 and continues until fuel loading.

2. The startup test program commences with fuel load and continues through power ascension testing which is completed at the end of the 100-hr warranty run.

3. In general, the startup and preoperational test procedures will be available for NRC review at least 60 days prior to fuel load.

14.2.12 Individual Test Descriptions

Currently scheduled preoperational, cold functional, hot functional, and startup testing cover tests outlined in

Appendices A, B, C, and D to the BWR Owners' Group (BWROG) response to NUREG-0737 I.G.1. Tests outlined in Appendix E are RCIC system preoperational or startup tests and are performed as part of the reactor vessel instrumentation preoperational test or as part of the containment integrated leak rate tests.

14.2.12.1 Preoperational Tests

Test abstracts for the preoperational tests are provided in Tables 14.2-2 through 14.2-132. The abstracts identify each test by system; specify the major prerequisites and operating conditions necessary for each (mode of operations of major control systems); provide general test objectives, a summary of the test method, and a summary of the acceptance criteria. Some abstracts may require more than one test depending on variables such as plant status and availability, optimization of resources, and schedule restraints. When additional tests are required they are approved by the JTG, numbered, and included on the current Test Index in accordance with the SAPs.

14.2.12.2 General Discussion of Initial Startup Tests

All tests comprising the initial startup test phase are discussed in Tables 14.2-201 through 14.2-307. A test objective, test prerequisites, test description, and statement of test acceptance criteria are provided for each test where applicable.

The operating and safety-oriented characteristics of the plant being explored are described in the test objectives.

Where applicable, a definition of the relevant acceptance criteria for the test is given and designated 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, component system or associated equipment. If a Level 1 criterion is not satisfied, the plant is placed in a stable condition until resolution is obtained. Tests compatible with this stable condition may be continued. Following resolution, applicable tests are repeated as necessary to verify that the requirements of the Level 1 criterion are now 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. Investigations of the measurements and of the analytical techniques used for the predictions would be started.

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.

During the conduct of the initial startup test phase the Technical Specifications will be followed.

TABLE 14.2-1

THIS TABLE HAS BEEN DELETED.

TABLE 14.2-1a
(Sheet 1 of 5)

COMPARISON OF REGULATORY GUIDE 1.68, APPENDIX A, WITH TEST ABSTRACTS

Regulatory Guide Section	
1.b(1)	The rod block monitor subsystem is tested in the rod block monitoring preoperational test (Table 14.2-118).
1.d(3), 1.d(4)	The relief valves and safety valves are tested as follows: Safety/relief mode has been factory tested offsite (see Section 5.2.2.10). Operational verification for open/closure will be verified for the SRVs in the relief mode during the automatic depressurization preoperational test (Table 14.2-52).
1.e(3)	The MSIVs are tested during the main steam system preoperational testing (Table 14.2-25).
1.e(6)	The turbine bypass valves are tested as follows: Controls are verified as part of the EHC system preoperational testing (Table 14.2-44). Capacity/response time testing is performed during the power test program (Table 14.2-231).
1.h	The main steam flow restrictors themselves will not be tested. Associated instrumentation is tested as part of the main steam system preoperational testing (Table 14.2-25).
1.h(7)	Verification of emergency heat removal rates cannot be performed during the preoperational test phase due to the lack of heat-producing sources. Measurements of the applicable parameters (temperatures and flows) will be performed during the startup test phase during the various tests in which sufficient heat is

TABLE 14.2-1a
(Sheet 2 of 5)

COMPARISON OF REGULATORY GUIDE 1.68, APPENDIX A, WITH TEST ABSTRACTS

Regulatory Guide Section	
	produced in ESF equipment areas. These values will be reviewed and evaluated by NMPC Engineering to ensure that the heat removal rates are adequate and correspond to the design calculations.
1.h(8)	The ECCS discharge line fill systems are tested as part of each ECCS system preoperational testing (Tables 14.2-49, 14.2-50, and 14.2-51).
1.h(10)	The ultimate heat sink, Lake Ontario, will not be tested. All safety-related components of the service water system necessary to transfer lake water into or out of the plant will be tested as a portion of the service water system preoperational testing (Table 14.2-1b).
1.i(10)	The containment and suppression pool vacuum breakers will be tested as part of the containment purge system preoperational testing (Table 14.2-76).
1.j(7)	ECCS leak detection systems will be tested as follows: Leak detection systems as described in Section 7.6.1.3 will be tested in the leak detection system preoperational testing (Table 14.2-112). Leak detection associated with each ECCS system will be tested as a portion of each system preoperational testing.
1.j(12)	A failed fuel detection system is not provided as an independent system. Instrumentation to detect failed fuel is tested within appropriate system preoperational testing.

TABLE 14.2-1a
(Sheet 3 of 5)

COMPARISON OF REGULATORY GUIDE 1.68, APPENDIX A, WITH TEST ABSTRACTS

Regulatory Guide Section	
1.j(13)	Source range monitors (SRM) are tested as part of the neutron monitoring preoperational testing (Table 14.2-117).
1.j(21)	Reactor mode switch and associated functions are tested as part of the reactor protection system (RPS) preoperational testing (Table 14.2-123).
1.j(23)	The hydrogen and oxygen analyzer system is tested as part of the containment monitoring system preoperational testing (Table 14.2-108).
1.L(5)	Condenser offgas isolation and logic associated with this feature are tested as part of the radiation monitoring (Table 14.2-106) and offgas (Table 14.2-60) systems' preoperational tests.
1.L(7)	Liquid radwaste effluent isolation - Instrumentation and logic associated with this feature are tested as part of the radiation monitoring systems (Table 14.2-105).
1.n(3)	Ventilation chilled water systems will be tested during the heating, ventilation and air conditioning (HVAC) preoperational tests.
1.m(3)	Leak tests of sectionalizing devices and drains, gasket or bellows leak tests in the refueling canal will be tested prior to the fuel pool cooling system preoperational test (Table 14.2-56).
1.m(4)	Dynamic and static load testing of cranes, hoists, and associated fuel storage and handling systems, except the polar crane, will be performed in the fuel handling and vessel servicing equipment system preoperational testing (Table 14.2-57).

TABLE 14.2-1a
(Sheet 4 of 5)

COMPARISON OF REGULATORY GUIDE 1.68,
APPENDIX A, WITH TEST ABSTRACTS

Regulatory Guide Section	
1.m(5)	Appropriate tests for fuel transfer devices will be performed in the fuel handling and vessel servicing equipment system preoperational testing (Table 14.2-57).
1.o(1)	Polar crane and hoist dynamic and static load tests will be performed as a prerequisite to the polar crane preoperational test (Table 14.2-110).
2.a	A shutdown margin calculation will be performed as part of the startup test program for a partially-loaded core (Table 14.2-203).
2.c	Final test of the RPS is not planned as system design features are verified during the RPS preoperational testing and cold functional testing (Table 14.2-123).
2.d	Final reactor leak rate tests during pressurizations of the reactor pressure vessel (RPV) leak rates within the containment are monitored to be within Technical Specifications limits.
5.g	Rod block monitor testing is performed during the rod block monitoring preoperational testing (Table 14.2-118).
5.k	High-pressure coolant spray (HPCS) tests are not scheduled to be performed during startup testing. HPCS to RPV injection tests will be conducted during the preoperational testing program (Table 14.2-51).
5.s	Startup test abstracts for the feedwater system will be modified to verify performance of the control system at test conditions 1, 2, 3, 5, and 6. The hotwell level control system performance is tested during the preoperational testing program (Tables 14.2-28 and 14.2-222).

TABLE 14.2-1a
(Sheet 5 of 5)

COMPARISON OF REGULATORY GUIDE 1.68,
APPENDIX A, WITH TEST ABSTRACTS

5.w	A sample of containment penetration concrete temperatures will be verified by survey to assure that the penetrations will not be subject to temperatures over 200°F. The sample will be chosen from the worst-case temperature conditions to conservatively bound all installed containment penetrations.
5.i.i	Startup testing of the recirculation system will demonstrate response of the plant in accordance with design limits specified by General Electric (Tables 14.2-123, 14.2-234, 14.2-235, 14.2-236, and 14.2-237).
5.g.g	The operability of equipment provided for anticipated transient without scram (ATWS) is tested during preoperational testing of systems within which the equipment is provided (Tables 14.2-47, 14.2-48, 14.2-54, 14.2-123, and 14.2-128).

TABLE 14.2-1b
(Sheet 1 of 4)

SERVICE WATER PUMP NET POSITIVE SUCTION HEAD

QUESTION 1

The SWP system test (Table 14.2-36) should include testing which demonstrates the operability (adequate NPSH and absence of vortexing) of the service water pumps under the worst postulated conditions (minimum water level and maximum water temperature) (1.h.10).

RESPONSE

The following is provided in response to your concern. A service water pump characteristic curve is provided on Figure 14.2-1b-1.

Service Water Pump NPSH

Minimum lake elevation = 236.2 ft USLS (Table 9.2-8, see note 2 - postulated level is lowest lake level based on PMWS conditions)

Minimum service water bay water level based on five pumps at 10,000 gpm each = 233.1 ft (page 9.2-33)

Centerline of pump impeller = 227.875 ft

*NPSH required = 21 ft (from Gould Catalog, page 145, 9,000 gpm at 185 ft, Model No. 3415, 14 x 16 - 22H at 1,180 rpm)

NPSH required ≤ NPSH available at critical condition

NPSH = Ha + Hz - Hf - Hvp

Where:

Ha = Atmospheric pressure = 33.7 ft

Hz = Elevation head (233.1 - 227.875) = 5.23

Hf = Friction head (assume 2.0 ft) (1 ft/100 ft of 24-in pipe at 10,000 gpm Cameron hydraulic data + 0.6 ft from Clow valve data)

* Test data from Gould on the same model pump with same impeller at approximately 8,100 gpm yields a required NPSH of 16 ft, which verifies the published curve.

TABLE 14.2-1b
(Sheet 2 of 4)

SERVICE WATER PUMP NET POSITIVE SUCTION HEAD

Hvp = Vapor pressure (at 80°F maximum service water temperature)

= 1.2 (Daugherty & Franziny, page 557)

Therefore,

NPSH = Ha + Hz - Hf - Hvp

NPSH = 33.7 + 5.23 - 2.0 - 1.2

= 35.73

Conclusion:

21 ft ≤ 35.73 ft; therefore, NPSH is not a concern.

Depth Required to Avoid Vortexing

From: J. L. Gordon, "Vorticies at Intake," Water Power, 1970

Submergence to avoid vortexing must satisfy
$0.3\ vd^{1/2} \leqq s \leqq 0.4\ vd^{1/2}$

Case #1

For normal shutdown - Five service water pumps at 10,000 gpm with two intakes available and lowest postulated lake level. Resulting service water bay level of 233.1 ft.

d = 2.0 ft

Q = 10,000 gpm = 22.28 cfs

v = $Q/A = 22.28/\frac{\pi(2)}{4}$ = 7.0 cfs

TABLE 14.2-1b
(Sheet 3 of 4)

SERVICE WATER PUMP NET POSITIVE SUCTION HEAD

s = 0.4 (7.0)(2.0)$^{1/2}$ = 4.0 ft

Intake pipe centerline = 226.17 ft

Therefore, required minimum pump bay water elevation

= 226.17 + d/2 + s

= 226.17 + 1.0 + 4.0

= 231.17

Conclusion:

231.17 ≤ 233.1

Case #2

For LOCA conditions - Two service water pumps at 7,000 gpm, with one intake available and lowest postulated lake level.

d = 2.0 ft

Q = 7,000 gpm = 15.6 cfs

v = Q/A = $15.6/\frac{\pi(2)^2}{4}$ = 4.97 cfs

s = 0.4 (4.97)(2.0)$^{1/2}$ = 2.81 ft

Therefore, required minimum pump bay water elevation

= 226.17 + d/2 + s

= 226.17 + 1.0 + 2.81

= 229.98 ft

Two pumps at 7,000 gpm/pump = 14,000 gpm total

Q = 31.2 cfs

Pump bay water level = lake elevation - K_2Q^2 - 0.72 ft

where K_2 = 3.8502×10^{-4}

TABLE 14.2-1b
(Sheet 4 of 4)

SERVICE WATER PUMP NET POSITIVE SUCTION HEAD

$= 236.2 - K_2 (31.2)^2 - 0.72$

$= 235.21$ ft

Conclusion:

$229.98 \leq 235.21$

Therefore, there is sufficient margin to ensure that, during all conditions, the service water pump intake will be submerged to a depth to avoid vortexing.

TABLE 14.2-2
THROUGH
TABLE 14.2-24

TABLES 14.2-2 THROUGH 14.2-24 HAVE BEEN DELETED.

TABLE 14.2-25
(Sheet 1 of 2)

MAIN AND AUXILIARY STEAM SYSTEM

System 1

Test Objectives

1. To demonstrate the operation of the main and auxiliary steam system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. Auxiliary systems needed for this procedure are available for test support.

Test Procedure

1. The test procedure will verify that various components of the main and auxiliary steam system operate within their design requirements.

2. The MSIVs are tested for proper operation.

3. The instrumentation associated with the main steam flow restrictors will be tested.

4. Applicable control instrumentation and interlocks will be verified for proper response.

5. The reactor head vent valves' operation is verified.

TABLE 14.2-25
(Sheet 2 of 2)

MAIN AND AUXILIARY STEAM SYSTEM

System 1

Acceptance Criteria

1. System controls, interlocks, and valves function as described in Section 10.3.

2. The system functions as described in Section 10.3.

3. The reactor head vents function as described in Section 1.10, II.B.1.

TABLE 14.2-26

THIS TABLE HAS BEEN DELETED.

TABLE 14.2-27
(Sheet 1 of 2)

CONDENSATE SYSTEM

System 3

<u>Test Objectives</u>

1. To demonstrate the operation of the condensate system and components.

2. To ensure the system is properly designed and constructed.

<u>Safety Precaution</u>

Follow NMPC safety rules and proper procedures during testing.

<u>Prerequisites</u>

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. Applicable support systems are available for test use.

<u>Test Procedure</u>

1. The test procedure will verify logic and trip modes for the condensate and condensate booster pumps for different system configurations and transient conditions.

2. Annunciators, alarms, control instrumentation, and interlocks will be tested for proper response for each transient.

3. The condensate and condensate booster pump recirculation flow control valves will be verified to open when their associated pumps are running and to close when they are stopped.

TABLE 14.2-27
(Sheet 2 of 2)

CONDENSATE SYSTEM

System 3

Acceptance Criteria

1. The condensate pump automatic starts operate as described in Section 10.4.7.

2. The condensate FCVs operate to open and close as described in Section 10.4.7.

3. The condensate booster pump automatic starts/trips operate as described in Section 10.4.7.

4. The condensate booster FCVs operate to open and close as described in Section 10.4.7.

TABLE 14.2-28
(Sheet 1 of 2)

CONDENSATE STORAGE AND TRANSFER SYSTEM

System 4

Test Objectives

1. To demonstrate the operation of the condensate storage and transfer systems and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. Makeup water storage and transfer system is available to support the test.

Test Procedure

1. The capability of the makeup water storage system to supply water to the CSTs is verified.

2. Full flow tests of both condensate transfer pumps will be conducted to verify pump operability.

3. Pump autostart and trip features are verified for both pumps.

4. Condenser hotwell level control system is tested for proper operation of makeup and drawoff valves and alarms associated with hotwell level.

TABLE 14.2-28
(Sheet 2 of 2)

CONDENSATE STORAGE AND TRANSFER SYSTEM

System 4

<u>Acceptance Criteria</u>

1. Condensate transfer pumps auto-start on low discharge header pressure or high pump discharge header flow demand in accordance with Section 9.2.6.

2. The condenser hotwell can be maintained at the normal level automatically by the normal makeup and drawoff valves in accordance with Section 9.2.6.

3. The condensate emergency makeup valve opens automatically on low hotwell level as described in Section 9.2.6.

4. The condensate transfer system is capable of supplying water to the appropriate plant systems as listed in Section 9.2.6.

TABLE 14.2-29
(Sheet 1 of 2)

CONDENSATE DEMINERALIZATION AND RESIN REGENERATION

System 5

Test Objectives

1. To demonstrate the operation of the condensate demineralization and resin regeneration systems and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. The test procedure will verify the proper operation of automatic resin transfers and automatic regenerations.

2. Proper operation of the ultrasonic resin cleaner will be verified.

3. All applicable system trips, logic, and instrumentation will be verified.

4. The waste recovery system will be tested to verify it can properly collect, treat, and transfer regenerant waste to the LWS system.

TABLE 14.2-29
(Sheet 2 of 2)

CONDENSATE DEMINERALIZATION AND RESIN REGENERATION

System 5

5. Resin transfers that can only be accomplished by remote manual means will be performed to verify proper system operation.

6. Sampling will be performed to verify water quality meets design specification.

7. System alarms and annunciators will be verified for proper response in conjunction with the tests performed.

Acceptance Criteria

1. System trips and logic will operate within design requirements as described in Section 10.4.6.5.

2. The system operates to properly transfer, regenerate, and ultrasonically clean the condensate demineralizers, as referenced in Section 10.4.6.

3. The waste recovery system operates to properly collect, treat, and transfer regenerant waste, as referenced in Section 10.4.6.

4. System water quality meets specifications, as outlined in Section 10.4.6 and RG 1.56.

TABLE 14.2-30
(Sheet 1 of 2)

FEEDWATER SYSTEM

System 6

Test Objectives

1. To the extent practical, demonstrate the operation of the FWS system and its components.

2. To ensure the FWS system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources that supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are complete.

4. The main condenser is available as a water source and discharge point for the reactor feed pumps.

5. The CND system is available to provide a flow path and the required NPSH for the reactor feed pumps.

Test Procedure

1. All remotely-operated valves are verified for proper manual and automatic operation.

2. The reactor feed pump auxiliary lubrication oil pumps are verified to operate both manually and in response to automatic signals.

TABLE 14.2-30
(Sheet 2 of 2)

FEEDWATER SYSTEM

System 6

3. Both high- and low-energy feedwater cycle cleanup control valves are demonstrated to be operable from their remote manual loading stations.

4. The reactor feed pump minimum flow recirculation control valves are demonstrated to open and modulate to provide minimum flow for the reactor feed pumps.

5. The reactor feed pump logic and trip modes are demonstrated in various system configurations and transient conditions.

6. Associated annunciators, computer points, alarms, control instrumentation, and interlocks are demonstrated for proper response during the test.

<u>Acceptance Criteria</u>

1. The reactor feed pumps and their various logic modes operate as described in Section 10.4.7.

2. Remotely-operated feedwater valves, along with their associated permissives, interlocks, and controls function as described in Section 10.4.7.

3. Auxiliary lube oil pumps start automatically to provide lubrication until the gear-driven lube oil pump discharge pressure is sufficient to maintain lubrication and on low discharge pressure of the gear-driven lube oil pump.

TABLE 14.2-31
(Sheet 1 of 1)

FEEDWATER CONTROL SYSTEM

System 7

Test Objectives

1. To demonstrate to the extent practical the operation of the feedwater control systems and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Following NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. All applicable control equipment and instrumentation calibration has been completed.

Test Procedure

1. Proper operation of the motor-driven pump discharge regulating valve will be verified with the pump tripped and with no feedwater flow.

2. Proper system response is verified as simulated signals for reactor level, feedwater flow, and steam flow are injected into the feedwater control system.

3. Verification will be made that feedwater control level and flow indicators, recorders, and computer inputs respond to simulated signals and that associated annunciators function according to the system design.

Acceptance Criteria

The feedwater control system operates as described in Section 7.7.1.3.

TABLE 14.2-32
(Sheet 1 of 1)

FEEDWATER HEATERS AND EXTRACTION STEAM SYSTEM

System 8

Test Objectives

1. To demonstrate to the extent practical the operation of the feedwater heaters and extraction steam systems and associated components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. The heater drain pump permissives, interlocks, and control instrumentation will be tested.

2. The heater drain pumps will be tested for proper operation.

3. The normal and emergency level control valves along with their control instrumentation will be verified for proper response to signals generated from level sensing devices.

TABLE 14.2-32
(Sheet 2 of 2)

FEEDWATER HEATERS AND EXTRACTION STEAM SYSTEM

System 8

<u>Acceptance Criteria</u> 1. The heater drain pumps and their various logic modes operate as described in Section 10.4.10. 2. The feedwater heater extraction isolation valves along with their associated permissives, interlocks, and controls function as described in Section 10.4.10. 3. The level control valves operate as described in Section 10.4.10.

TABLE 14.2-33
(Sheet 1 of 1)

CONDENSER AIR REMOVAL SYSTEM

System 9

Test Objectives

1. To demonstrate the operation of the condenser air removal system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. All applicable controls, interlocks, and valves are checked for proper operation to ensure performance is within system specifications.

2. Vacuum pump trips and automatic system isolations will be tested for proper operation.

3. System instrumentation is tested for proper response to simulated signals or actual parameter variation.

4. System performance is verified to ensure that air is evacuated from the main condenser.

Acceptance Criteria

The condenser air removal pumps evacuate the condenser to approximately 5 in Hg abs and deliver discharge gases to the main stack at atmospheric pressure.

TABLE 14.2-34
(Sheet 1 of 2)

CIRCULATING WATER SYSTEM

System 10A

Test Objectives

1. To demonstrate the operation of the CWS system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. The SWP, IAS, TBCLC acid treatment, and hypochlorite systems are available as required to support this test.

Test Procedure

1. The cooling tower is operated in its four modes of operation.

2. Applicable annunciators, trip signals, interlocks, and controls are verified for proper operation.

3. The six circulating water pumps and associated equipment are tested to ensure they are capable of delivering water at the required system flows and pressures.

TABLE 14.2-34
(Sheet 2 of 2)

CIRCULATING WATER SYSTEM

System 10A

Acceptance Criteria 1. The circulating water pumps operate as described in Section 10.4.5.5. 2. Circulating water blowdown operates as described in Section 10.4.5.2. 3. The cooling tower controls operate as described in Section 10.4.5.5.

TABLE 14.2-35

THIS TABLE HAS BEEN DELETED.

TABLE 14.2-36
(Sheet 1 of 2)

SERVICE WATER SYSTEM

System 11

Test Objectives

1. To demonstrate the operation of the SWP systems and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. The CWS system is capable of receiving water from this system during these tests.

Test Procedure

1. Intake and discharge equipment is tested for normal and reverse flow using appropriate logic controls.

2. All service water pumps are tested for proper operation of automatic starts and trips, flow rates, and appropriate interlocks.

3. All applicable MOVs and AOVs are operated to verify that they open and close properly.

4. The service water flow path to the spent fuel pool is verified.

TABLE 14.2-36
(Sheet 2 of 2)

SERVICE WATER SYSTEM

System 11

5. The system and its associated logic functions for supplying water to the emergency diesels, HPCS diesel, and RBCLC systems are verified.

6. The system is run to verify that it can supply flows to systems that it supports.

7. The capability of the SWP system to supply adequate diesel cooling water flows.

Acceptance Criteria

1. The applicable controls and interlocks function as described in Section 9.2.1.

2. Each service water pump and associated discharge strainer will provide its rate flow for all normal and emergency operating conditions as described in Section 9.2.1.

3. The intake and discharge structures and associated gates and valves function as designed. The intake and discharge structure will supply and discharge lake water in accordance with Table 9.2-8.

4. Under normal operating conditions, the service water system supplies lake water to the components listed in Table 9.2-2 to meet the power generation design objectives of Section 9.2.1.1.2.

5. During a LOOP, the SWP system is able to supply lake water to the components listed in Table 9.2-1 to meet the safety design objectives of Section 9.2.1.1.1.

6. The service water pumps are capable of supplying the total system flow rate required as described in Section 9.2.1.2.

TABLE 14.2-37

THIS TABLE HAS BEEN DELETED.

TABLE 14.2-38
(Sheet 1 of 2)

REACTOR BUILDING CLOSED LOOP
COOLING WATER SYSTEM

System 13

Test Objectives

1. To demonstrate the operation of the RBCLCW system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. Applicable preliminary tests are completed and the system turned over to NMPC.

2. Applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. The SWP, IAS, and MWS transfer systems are available to support this test.

Test Procedure

1. All applicable controls, interlocks, and valves are checked for proper operation and performance in accordance with design requirements.

2. The autostart and trip features of the RBCLC main and booster pumps will be verified.

3. The system temperature control valves are modulated to verify proper operation.

TABLE 14.2-38
(Sheet 2 of 2)

REACTOR BUILDING CLOSED LOOP
COOLING WATER SYSTEM

System 13

4. The expansion tank level control valve operation is verified.

5. Motor-operated isolation valves will be verified.

6. System flow and flow paths are verified.

Acceptance Criteria

1. All applicable controls, interlocks, and trips function as described in Section 9.2.2.5.

2. The autostart and trip features of the RBCLC main and booster pumps function in accordance with Section 9.2.2.5.

3. The expansion tank level control valve maintains level in accordance with Section 9.2.2.5.

4. The system supplies water to the components listed in Table 9.2-3.

5. The RBCLC pumps are capable of supplying the total system flow required from Table 9.2-3.

TABLE 14.2-39
(Sheet 1 of 2)

TURBINE BUILDING CLOSED LOOP COOLING WATER SYSTEM

System 14

Test Objectives

1. To demonstrate the operation of the TBCLCW system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. The IAS, SWP and MWS transfer systems are available to support this test.

5. The TBCLCW system is operating in a two-pump, two-heat exchanger mode with the third pump and heat exchanger vented and in standby.

Test Procedure

1. System controls and interlocks are verified for the three system pumps in the various modes of operation.

2. System surge and makeup tank level is monitored and verified for proper operation.

TABLE 14.2-39
(Sheet 2 of 2)

TURBINE BUILDING CLOSED LOOP COOLING WATER SYSTEM

System 14

3. System control valves are modulated to verify proper operation.

4. The automatic response for the offgas condenser outlet valves is checked for proper response.

5. With the TBCLCW system in a two-pump mode, the baseline operating data is collected and recorded.

<u>Acceptance Criteria</u>

1. The automatic trip and start features for the TBCLCW pumps operate according to Section 9.2.7.5.

2. Temperature control valves operate in accordance with Section 9.2.7.5.

3. The system supplies water to the required plant components in accordance with Table 9.2-9.

4. In a two-pump mode, the TBCLCW system is capable of meeting the maximum design flow rate (16,000 gpm) in accordance with Section 9.2.7.2.

TABLE 14.2-40
(Sheet 1 of 1)

MAKEUP WATER TRANSFER AND STORAGE SYSTEM

System 16

Test Objectives

1. To demonstrate the operation of the makeup water transfer and storage system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. WTS system is available to support this test.

Test Procedure

1. All controls, interlocks, and valves are verified for proper operation to ensure performance with system specifications.

2. Applicable setpoints are verified.

3. Pump autostart, trip features, and associated alarms and annunciators will be verified for proper operation by varying several parameters including: tank level, pump suction and discharge pressure, and system flow.

Acceptance Criteria

1. Each transfer pump will deliver at least 200 gpm as described in Section 9.2.3.2.

2. The system functions as described in Section 9.2.3.

TABLE 14.2-41
(Sheet 1 of 2)

PROCESS SAMPLING SYSTEM

System 17

Test Objectives

1. To demonstrate the operation of the turbine, reactor, and radwaste buildings sampling systems and components.

2. To ensure the systems are properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. The TBCLC and RBCLC systems are available to support testing.

Test Procedure

1. The test procedure verifies proper system instrumentation response by simulated signals or actual parameter variation.

2. All applicable controls, interlocks, and valves are verified for proper operation to ensure performance within system specifications.

   Note: Temperature reduction equipment will be tested during the startup testing phase when hot samples are available.

TABLE 14.2-41
(Sheet 2 of 2)

PROCESS SAMPLING SYSTEM

System 17

3. All applicable alarms and annunciators are verified for proper operation in conjunction with the tests performed.

Acceptance Criteria

1. All air-operated sample system isolation valves operate from their respective sample panels.

2. With the exception of the equipment used to reduce hot sample temperature, all applicable system instrumentation, interlocks, and trips function as designed in accordance with Section 9.3.2.

3. The ability to take a grab sample from each system will be verified.

TABLE 14.2-42
(Sheet 1 of 2)

POST-ACCIDENT SAMPLE SYSTEM

System 17

Test Objectives

1. To demonstrate to the extent practical the operation of the PASS and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. The sample line solenoid valves are verified for proper operation.

2. The sample line solenoid valve permissive switch is verified for proper operation.

3. The control logic of the sample panel is verified.

4. Where required, simulated signals are used to verify that valves respond properly and sample panel functions according to design.

5. Heat tracing operation will be verified.

TABLE 14.2-42
(Sheet 2 of 2)

POST-ACCIDENT SAMPLE SYSTEM

System 17

Acceptance Criteria

1. The system is capable of obtaining a representative sample of gas or liquid in 30 min or less from the time of initiating the sample.
2. The system is capable of collecting liquid or gas samples from the locations described in Section 1.10, Table 1.10-1, Section II.B.3.

TABLE 14.2-43
(Sheet 1 of 2)

SERVICE AND INSTRUMENT AIR SYSTEM

System 19

Test Objectives

1. To demonstrate the operation of the service and instrument air systems and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. The test procedure will verify that the instrument and service air system is capable of supplying the plant's compressed air requirements during normal operation.

2. The autostart feature of the compressors will be verified.

3. The air compressor trip modes will be verified for various transients, simulated during testing.

4. Air compressor capacity and load time will be verified.

5. The test will ensure that the instrument air dryers and associated instrumentation operate according to design.

TABLE 14.2-43
(Sheet 2 of 2)

SERVICE AND INSTRUMENT AIR SYSTEM

System 19

6. System controls and interlocks will be verified for correct response.

7. A loss-of-air-supply test (RG 1.68.3) will be conducted on those portions of the instrument air system which interface with safety-related systems to verify that the air-controlled components supplied directly from the instrument air system will respond as designed. A listing of all air- and nitrogen-operated safety-related valves is in Table 14.2-43A. This testing may be performed in the individual system preoperational tests.

8. The test procedure will verify there are no crossties between the service air and instrument air systems which will degrade system operation.

9. Alarms and annunciators will be verified for proper response in conjunction with the various tests performed.

Acceptance Criteria

1. The air compressors supply clean, dry, oil-free air or nitrogen, as applicable, as described in Section 9.3.1.1.1.

2. The trip and autostart modes for the air compressors function as described in Section 9.3.1.1.5.

3. Applicable system controls and interlocks operate as described in Section 9.3.1.1.5.

4. The system functions as described in Section 9.3.1.1.5.

5. The air- and nitrogen-operated safety-related valves listed in Table 14.2-43A fail in their fail-safe positions on a loss of air/nitrogen.

TABLE 14.2-43A
(Sheet 1 of 2)

LOSS OF AIR TEST

(AIR OPERATED)

Valve No.	Fails
2SWP*AOV20A,B	F.O.
2SWP*AOV22A,B	F.O.
2SWP*AOV97A,B	F.O.
2SWP*AOV571	F.O.
2SWP*AOV572	F.O.
2SWP*AOV573	F.O.
2SWP*AOV574	F.O.
2SWP*AOV581	F.O.
2SWP*AOV154A,B	F.O.
2SWP*AOV78A,B	F.O.
2HVR*AOD1A,B	F.C.
2HVR*AOD6A,B	F.O.
2HVR*AOD9A,B	F.C.
2HVR*AOD10A,B	F.C.
2HVR*AOD34A,B	F.C.
2HVR*AOD204	F.C.
2HVP*AOD4A,B,C,D	F.O.
2HVP*AOD5A,B	F.O.
2HVY*AOD34A,B	F.C.
2HVC*AOD61A,B	F.O.
2HVC*AOD117	F.C.
2HVC*AOD120	F.C.
2HVC*AOD6A,B	F.O.
2HVC*AOD12A,B	F.O.
2HVC*AOD145	F.C.
2HVC*AOD142	F.C.
2HVC*AOD148	F.C.
2HVC*AOD54A,B	F.O.
2HVC*AOD182	F.C.
2HVC*AOD183	F.O.
2HVC*AOD192	F.C.
2HVC*AOD193	F.O.

TABLE 14.2-43A
(Sheet 2 of 2)

LOSS OF AIR TEST

(AIR OPERATED)

Valve No.	Fails
2HVC*AOD169	F.C.
2HVC*AOD170	F.O.
2HVC*AOD171	F.C.
2HVC*AOD177	F.C.
2HVC*AOD178	F.O.
2HVC*AOD179	F.C.
2HVC*AOD212	F.O.
2HVC*AOD213	F.O.
2HVC*AOD214	F.O.
2HVC*AOD215	F.O.
2CPS*AOV104	F.C.
2CPS*AOV105	F.C.
2CPS*AOV110	F.C.
2CPS*AOV111	F.C.
2ICS*AOV109	F.C.
2ICS*AOV110	F.C.
2ICS*AOV130	F.C.
2ICS*AOV131	F.C.
2GTS*AOV101	F.C.
2SFC*AOV19A,B	F.C.
2SFC*AOV33A,B	F.C.
2SFC*AOV153	F.C.
2SFC*AOV154	F.C.
2RDS*AOV123	F.C.
(NITROGEN OPERATED)	
2CPS*AOV106	F.C.
2CPS*AOV107	F.C.
2CPS*AOV108	F.C.
2CPS*AOV109	F.C.
2RCS*AOV45A	F.O.
2RCS*AOV45B	F.O.

TABLE 14.2-44
(Sheet 1 of 2)

ELECTROHYDRAULIC CONTROL (EHC) SYSTEM

System 23

<u>Test Objectives</u>

1. To demonstrate the operation of the turbine EHC system and components.

2. To ensure the system is properly designed and constructed.

<u>Safety Precaution</u>

Follow NMPC safety rules and proper procedures during testing.

<u>Prerequisites</u>

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

<u>Test Procedure</u>

1. The hydraulic control subsystem is verified to ensure that hydraulic fluid is supplied at appropriate pressure to control operating and trip devices for turbine stop valves, control valves, bypass valves, and CIVs.

2. Control switches, appropriate alarms, and annunciators are verified for proper operation.

3. Remote-operated valves with appropriate interlocks and setpoints are verified.

4. The electro-control subsystem is tested to verify that simulated control signals, generated hydraulically, modulate turbine control valves to control turbine generator speed, load, and reactor pressure.

TABLE 14.2-44
(Sheet 2 of 2)

ELECTROHYDRAULIC CONTROL (EHC) SYSTEM

System 23

5. System alarms and annunciators are verified.

Acceptance Criteria

1. The hydraulic fluid pumps and associated equipment operate as described in Section 10.2.2.

2. Turbine control valves, bypass valves, and combined intermediate valves respond correctly to simulated signals related to turbine speed, load, and reactor pressure, as described in Section 10.2.2.

TABLE 14.2-45

THIS TABLE HAS BEEN DELETED.

TABLE 14.2-46
(Sheet 1 of 1)

NUCLEAR BOILER INSTRUMENTATION

System 28

Test Objectives

1. To demonstrate to the extent practical the operation of the nuclear boiler instrumentation system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. Reactor water level instruments shall be verified over the full range for response to actual reactor vessel water level changes and, where practical, the level instruments should be checked against known physical levels in the vessel.

2. All applicable alarms and annunciators will be verified for proper operation in conjunction with the tests performed.

Acceptance Criteria

1. Instruments provide proper control room indication of the parameter being measured.

2. Applicable interlocks and trips function as described in GE Test Specification 22A2271BA, Section B4.3.6.

TABLE 14.2-47
(Sheet 1 of 2)

REACTOR RECIRCULATION SYSTEM

System 29

Test Objectives

1. To demonstrate to the extent practical the operation of the reactor recirculation system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. All applicable water quality standards should be met and maintained throughout testing.

Test Procedure

1. The test will verify proper operability of the reactor recirculation system during slow speed pump conditions under normal and transient operating conditions.

2. MOVs and flow control valves, along with their corresponding controls and instrumentation, will be verified for proper response.

3. The recirculation pumps will demonstrate required hydraulic performance at different reactor conditions and flow control valve settings.

4. Proper operation of the hydraulic power units and their associated equipment will be verified.

TABLE 14.2-47
(Sheet 2 of 2)

REACTOR RECIRCULATION SYSTEM

System 29

Acceptance Criteria

1. Recirculation system MOV operating times are as described in GE Test Specification 22A2271BA, Section B8.5.2 and 3.

2. The recirculation pumps are capable of being run from the LFMG sets.

3. The recirculation FCVs operate as described in GE Test Specification 22A2271BA, Sections B8.5.4.

TABLE 14.2-48
(Sheet 1 of 2)

CONTROL ROD DRIVE HYDRAULIC SYSTEM

System 30

Test Objectives

1. To demonstrate the operation of the CRD hydraulic system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. The reactor manual control and rod position indication system is available to support this test.

5. The CRD vessel internals have been installed.

Test Procedure

1. The test will verify proper operation of sensors, recording devices, and other controls.

2. Valve operability will be confirmed.

3. All pumps and filters will be tested to confirm performance in accordance with design specifications.

4. The capacity of the system to deliver a sufficient steady water supply through normal and alternate routes will be verified.

TABLE 14.2-48
(Sheet 2 of 2)

CONTROL ROD DRIVE HYDRAULIC SYSTEM

System 30

5. Each HCU, CRD, and any applicable annunciators will be verified for proper functioning using normal insert/withdrawal modes and by scram testing.

Acceptance Criteria

1. The applicable parameters, i.e., response times, flows, temperatures, and pressures, are within their design requirements as described in Section 4.6.1.1.

2. The applicable interlocks and trips function as described in Section 4.6.1.1.

TABLE 14.2-49
(Sheet 1 of 2)

RESIDUAL HEAT REMOVAL SYSTEM

System 31

NOTE: Steam-condensing mode of RHR is abandoned in place. Reference to steam condensing is for historical information only.

Test Objectives

1. To demonstrate to the extent practical the operation of the RHR system and components in all modes except steam condensing.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. The suppression pool suction strainer is 50-percent hooded.

4. Valve lineups are completed.

Test Procedure

1. All applicable valves, sensors, and logic are verified.

2. Water leg pumps are checked to verify their ability to pressurize the RHR system piping.

TABLE 14.2-49
(Sheet 2 of 2)

RESIDUAL HEAT REMOVAL SYSTEM

System 31

3. Tests of each RHR operation mode (LPCI, containment spray cooling, shutdown cooling, suppression pool cooling) are performed to demonstrate satisfactory operability.

4. Air-flow tests will be conducted using test paths that overlap the water-flow test paths of the pumps to verify that there is no blockage in the containment spray flow paths.

<u>Acceptance Criteria</u>

1. The system functions as described in Sections 5.4.7.2.1, 6.3.2.2.4, and 6.3.2.2.5.

2. Valve stroke times are within the requirements listed in GE Test Specification 22A2271BA, Section B5.5.

3. Pump flows/pressures are within the requirements of GE Test Specification 22A2271BA, Section B5.5.

4. NPSH for the RHR pumps is within the requirements of GE Test Specification 22A2271BA, Section B5.5.

5. LPCI logic operates as described in Section 7.3.1.1.1.4.

TABLE 14.2-50
(Sheet 1 of 2)

LOW-PRESSURE CORE SPRAY SYSTEM

System 32

Test Objectives

1. To demonstrate the operation of the LPCS system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. The suppression pool suction strainer is 50-percent hooded.

Test Procedure

1. Proper operation of MOVs and AOVs will be verified.

2. System logic will be tested to verify its proper performance.

3. Operation of the core spray pump and motor assembly will be verified.

4. Flow and hydraulic characteristics of the system will be determined.

TABLE 14.2-50
(Sheet 2 of 2)

LOW-PRESSURE CORE SPRAY SYSTEM

System 32

5. The system's capability of performing its intended function under emergency conditions upon automatic initiation will be demonstrated.

6. The operability of the water leg pump, including its ability to pressurize the LPCS system piping, will be verified.

Acceptance Criteria

1. The LPCS system MOV operating times are within the requirements of GE Test Specification 22A2271BA, Section B12.5.

2. The system functions as described in Sections 6.3.2.2.3 and 7.3.1.1.1.3.

3. The system flows/pressures are within the requirements of GE Test Specification 22A2271BA, Section B12.5.

4. System operating times are within the requirements of GE Test Specification 22A2271BA, Section B12.5.

TABLE 14.2-51
(Sheet 1 of 2)

HIGH-PRESSURE CORE SPRAY SYSTEM

System 33

Test Objectives

1. To demonstrate the operation of the HPCS system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. All applicable sensors, pressure switches, gauges, instruments, and protective relays have been calibrated.

4. The suppression pool suction strainer is 50-percent hooded.

5. Valve lineups are complete.

Test Procedure

1. Proper operation of MOVs and AOVs will be verified.

2. System logic will be tested to verify proper operation.

3. Pump and motor operation is verified.

4. System performance characteristics are obtained and verified to meet design requirements.

TABLE 14.2-51
(Sheet 2 of 2)

HIGH-PRESSURE CORE SPRAY SYSTEM

System 33

5. System initiation on low water level and high drywell pressure is checked to verify ability of system pump to start, the injection valve to open, and the system's ability to deliver rated flow to the vessel in the required time interval.

6. The operability of the water leg pump, including the ability of the pump to pressurize the HPCS system piping, will be verified.

Acceptance Criteria

1. The system functions as described in Sections 6.3.2.2.1 and 7.3.1.1.1.1.

2. The system MOVs operate in the times specified in GE Test Specification 22A2271BA, Section B13.5.

3. System flows/pressures are within the requirements of GE Test Specification 22A2271BA, Section B13.5.

4. NPSH to the HPCS pump is within the requirements of GE Test Specification 22A2271BA, Section B13.5.

TABLE 14.2-52
(Sheet 1 of 2)

AUTOMATIC DEPRESSURIZATION SYSTEM

System 34

Test Objectives

1. To demonstrate the operation of the ADS system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow all NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.
4. Instrument and service air, ADS N_2 system, RPS, and nuclear boiler instrumentation systems are available to support testing.

Test Procedure

1. The test verifies controls, interlocks, and valves for proper operation.

2. Nitrogen supply is verified along with the volume of the tanks that their capacity is adequate to meet the stroke requirements of valves.

3. ADS air compressor and dryers are checked to verify that pressurized air can be provided to the valves' pneumatic actuators.

TABLE 14.2-52
(Sheet 2 of 2)

AUTOMATIC DEPRESSURIZATION SYSTEM

System 34

4. ADS logic is verified including auto initiation signals, time delay relay and reset functions, core spray and RHR permissives.

5. The operation of the SRVs in the relief (pneumatic) mode is verified.

6. The reactor vessel overpressure penetration logic of the ADS system is verified.

7. The SRV solenoid valves will be verified to open when the solenoid coil is energized.

8. ADS accumulator leak rates will be measured to verify that the ADS SRVs remain operable if their source of air or nitrogen is lost.

<u>Acceptance Criteria</u>

1. The system logic operates as described in Sections 6.3.2.2.2 and 7.3.1.1.1.2.

2. Accumulator capacity meets design requirements per GE Test Specification 22A2271BA, Section B4.5.7.

3. The SRVs operate properly in the relief (pneumatic) mode in accordance with Section 5.2.2.4.1.

4. The accumulators for the ADS relief valves maintain pressure for at least the relief cycle after a loss of nitrogen supply.

TABLE 14.2-53
(Sheet 1 of 1)

REACTOR CORE ISOLATION COOLING SYSTEM

System 35

Test Objectives

1. To demonstrate to the extent practical the operation of the RCIC system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. The suppression pool suction strainer is 50-percent hooded.

Test Procedure

1. Proper operation of AOVs and MOVs will be verified.

2. The system sensors and interlocks will be verified to control logic circuitry.

3. The flow controller adjustments and calibrations will be verified.

4. The various flow paths for the system will be verified.

Acceptance Criteria

1. Valve operating times are within the requirements of GE Test Specification 22A2271BA, Section B6.5.4.

2. System logic operates as described in Section 7.4.1.1.

TABLE 14.2-54
(Sheet 1 of 2)

STANDBY LIQUID CONTROL SYSTEM

System 36

Test Objectives

1. To demonstrate the operation of the SLCS and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are complete.

4. The system is filled with demineralized water.

5. Sufficient quantities of reactor grade boric acid and borax are available at the storage tank location when required to support neutron absorber mixing and loading.

Test Procedure

1. Valve, sensor, heat tracing, and logic tests are performed to verify proper operation.

2. The performance of applicable system pumps, motors, instrumentation, motor-operated outlet valves, check globe valves, and relief valves is verified.

TABLE 14.2-54
(Sheet 2 of 2)

STANDBY LIQUID CONTROL SYSTEM

System 36

3. A system injection test, using demineralized water, is performed prior to fuel loading with the reactor vessel at atmospheric or hydro pressure, firing one of the squib valves while observing all of the components operate properly.

4. Neutron absorber is prepared, analyses performed, and demineralized water introduced into the system according to specifications.

Acceptance Criteria

1. System logic operates as described in Section 7.4.1.2.

2. The system functions as described in Section 9.3.5.

TABLE 14.2-55
(Sheet 1 of 2)

REACTOR WATER CLEANUP SYSTEM

System 37

Test Objectives

1. To demonstrate the operation of the RWCU system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow all NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. The various system flow paths will be verified.

2. The proper functioning of interlocks and instrumentation is verified.

3. The test will verify isolation and cleanup pump trip logic under transient conditions.

4. Performance of all valves, heat exchangers, and various operating sequences of the filter/demineralizer will be verified.

5. Alarms and annunciators will be verified for proper operation in conjunction with the tests performed.

TABLE 14.2-55
(Sheet 2 of 2)

REACTOR WATER CLEANUP SYSTEM

System 37

Acceptance Criteria

1. System isolation logic functions as described in Section 7.3.1.1.2.

2. The system operates as described in Section 5.4.8.

TABLE 14.2-56
(Sheet 1 of 2)

FUEL POOL COOLING AND CLEANUP SYSTEM

System 38

Test Objectives

1. To demonstrate the operation of the fuel pool cooling and cleanup system.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow all NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. Electrical lineups are completed.

5. The static head pressure test of the reactor head cavity, fuel pool, and reactor internals storage pools and the verification of integrity of sectionalizing devices, drains, and gasket leak tests are completed.

Test Procedure

1. The test verifies that the system is capable of maintaining, during normal and abnormal conditions, design flow and water chemistry requirements.

2. Anti-siphon devices will be verified.

TABLE 14.2-56
(Sheet 2 of 2)

FUEL POOL COOLING AND CLEANUP SYSTEM

System 38

3. Filter on-line, on-hold, backwash, and precoat functions will be verified.

4. System backups from RHR and service water will be verified.

5. Applicable system control instrumentation and interlocks will be verified for correct response.

6. Alarms and annunciators are verified for proper response in conjunction with the tests performed.

Acceptance Criteria

1. Autotrips for SFP cooling pumps function as described in Section 9.1.3.5.

2. Filter operation and sequencing functions according to Delaval Manual Inst. 16.550-5000A.

3. System functions as described in Section 9.1.3.

TABLE 14.2-57
(Sheet 1 of 2)

FUEL HANDLING AND REACTOR SERVICE EQUIPMENT SYSTEM

System 39

Test Objectives

1. To demonstrate the operation of the fuel handling and reactor service equipment system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Dynamic testing using a dummy fuel bundle and static load tests at 125 percent of that load will be performed on the refueling grapple and platform auxiliary hoists.

Test Procedure

1. All applicable interlocks and logic associated with the refueling platform and service platform are verified.

2. The refueling equipment is checked for proper operation and installation.

3. The in-vessel servicing equipment, such as peripheral orifice servicing, control rod assembly servicing, instrument servicing, and in-vessel fuel assembly servicing, is checked for correct assembly and operation.

TABLE 14.2-57
(Sheet 2 of 2)

FUEL HANDLING AND REACTOR SERVICE EQUIPMENT SYSTEM

System 39

4. The reactor vessel servicing equipment is checked for proper assembly and operation.

5. The fuel service equipment is checked for proper installation and operation.

6. The servicing aids are checked for proper assembly and operation.

7. The under-reactor vessel servicing equipment, including CRD servicing equipment and in-core instrumentation servicing equipment, is tested for correct installation and operation.

Acceptance Criteria

The system operates as described in Section 9.1.4.

TABLE 14.2-58
(Sheet 1 of 2)

LIQUID RADWASTE SYSTEM

System 40

Test Objectives

1. To demonstrate the operation of the LWS system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow all NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. The LWS program is checked to verify that it controls the mechanical process sequence.

2. All applicable interlocks, alarms, setpoints, and annunciators are verified.

3. The test verifies alarms associated with LWS chemistry in connection with the tests performed.

4. The test verifies the auxiliary steam supply is adequately controlled to maintain and operate the necessary equipment.

5. The radwaste computer functions are verified.

TABLE 14.2-58
(Sheet 2 of 2)

LIQUID RADWASTE SYSTEM

System 40

Acceptance Criteria

1. The waste collection system can receive, store, and process water as described in Section 11.2.2.1.

2. The floor drain system can receive, store, and process liquids, as described in Section 11.2.2.2.

3. Waste collector pumps (1A, B, C, D) autotrip as described in Section 11.2.2.6.2.

4. A low liquid level in the floor drain filters shuts down the associated pumps.

5. The regenerant waste system collects and processes liquids as described in Section 11.2.2.3.

6. The phase separator system functions to collect, decant, and hold liquids/liquid-solid solutions, as described in Section 11.2.2.4.

TABLE 14.2-59
(Sheet 1 of 2)

SOLID RADWASTE HANDLING SYSTEM

System 41

Test Objectives

1. To demonstrate the operation of the solid radwaste handling system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. The WSS program is verified to ensure it controls mechanical process sequence.

2. Applicable system valves, interlocks, and controls are verified.

3. The capability of the system to transfer waste to and from desired destination is verified using simulated waste variation.

4. The steam supply from the WSS electric boiler is verified.

5. Using a simulated waste stream, waste will be processed via the extruder evaporator to ensure proper mixing and no freestanding water.

TABLE 14.2-59
(Sheet 2 of 2)

SOLID RADWASTE HANDLING SYSTEM

System 41

<u>Acceptance Criteria</u> 1. The system can receive and process solid wastes as described in Section 11.4. 2. The solidified product should be a homogeneous mixture with no freestanding water.

TABLE 14.2-60
(Sheet 1 of 1)

OFFGAS SYSTEM

System 42

Test Objectives

1. To demonstrate the operation of the offgas system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. The test procedure verifies system controls and interlocks to ensure performance in accordance with specifications.

2. The operation of the offgas vacuum pumps is verified.

3. The offgas control panel is tested to ensure all control functions and remote monitoring of the offgas system are provided.

4. Applicable alarms are verified in conjunction with the tests performed.

Acceptance Criteria

1. The vacuum pumps maintain the system subatmospheric, as described in Section 11.3.2.1.

2. System automatic trips operate as described in Section 11.3.2.1.

TABLE 14.2-61
(Sheet 1 of 2)

FIRE PROTECTION (WATER) SYSTEM

System 43

Test Objectives

1. To demonstrate the operation of the FPW system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. The test will verify the operation of the electric and diesel fire pumps and the pressure maintenance pumps for all modes of operation.

2. The high-low level switches and their associated instrumentation for the pressure maintenance pump supply tank will be tested for proper response.

3. Motor-operated deluge valves, including those in the transformer zone, will be tested for automatic operation.

4. The remote-manual operation of these valves from associated fire panels will be verified.

5. All motor-operated preaction valves will be tested for automatic operation in conjunction with a fire detector trip.

TABLE 14.2-61
(Sheet 2 of 2)

FIRE PROTECTION (WATER) SYSTEM

System 43

6. Corresponding annunciators, alarms, control instrumentation, and system interlocks will be tested for proper response in conjunction with the various tests conducted.

<u>Acceptance Criteria</u>

1. The fire pumps autostart as described in Section 9.5.1.2.2.

2. Automatic valves open in response to a detector signal, as described in Section 9.5.1.

3. System pressure can be maintained between 125 and 135 psig by the fire jockey pumps.

TABLE 14.2-62
(Sheet 1 of 2)

FOAM FIRE PROTECTION SYSTEM

System 44

<u>Test Objectives</u>

1. To demonstrate the operation of the foam fire protection system and components.

2. To ensure the system is properly designed and constructed.

<u>Safety Precaution</u>

Follow NMPC safety rules and proper procedures during testing.

<u>Prerequisites</u>

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. The foam concentrate tanks are filled to half normal level.

<u>Test Procedure</u>

1. The test verifies system controls, interlocks, and valves for proper operation to ensure performance is within specifications.

2. The test will verify the autostart and trip features of the foam pumps and the actuation of automatic valves upon receipt of a signal from the fire detection system or a control switch.

3. Corresponding computer alarms and annunciators associated with the foam fire protection system will be tested for proper response in conjunction with the various tests performed.

TABLE 14.2-62
(Sheet 2 of 2)

FOAM FIRE PROTECTION SYSTEM

System 44

Acceptance Criteria
1. The autostart and trip features of fixed hazard foam pumps function upon receipt of an actuation signal.
2. Automatic valves function in response to a detection signal.
3. Foam concentrate utilized is acceptable per NFPA Standard 16 requirements, as described in Section 9A.3.6.3.7.

TABLE 14.2-63
(Sheet 1 of 2)

FIRE PROTECTION CO_2

System 45

Test Objectives

1. To demonstrate the operation of the fire protection CO_2 system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation.

3. Valve lineups are completed.

4. The fire computer, fire detection, and ventilation systems are available to support testing.

Test Procedure

1. The CO_2 storage tanks are filled.

2. The CO_2 hose reels are verified for proper operation.

3. The CO_2 hazard valves are puff tested, with the CO_2 zone piping isolated and its bypass open, from the local fire panel, main fire panel, and associated detection zones in both manual and automatic modes of operation. Concentration tests are performed on total-flooding systems, as defined in Section 9.5.1.2.9, in accordance with NFPA 12-1985: Carbon Dioxide Systems.

4. The generator hydrogen and CO_2 subsystems are tested for CO_2 flow.

5. Alarms and annunciators are verified for proper response in conjunction with the various tests performed.

TABLE 14.2-63
(Sheet 2 of 2)

FIRE PROTECTION CO_2

System 45

Acceptance Criteria

1. Total-flooding systems automatically actuate on a signal from associated detectors, as described in Section 9.5.1.2.9.

2. Ventilation dampers associated with total-flooding systems close on initiation of gas flow, as described in Section 9A.3.5.6.7.

3. CO_2 concentrations for total-flooding systems, as defined in Section 9.5.1.2.9, are in accordance with NFPA Codes - Volume 1, Code 12: Carbon Dioxide Systems.

4. Ventilation equipment associated with total-flooding systems shut down on a fire signal, as described in Section 9A.3.5.6.7.

TABLE 14.2-64
(Sheet 1 of 2)

FIRE PROTECTION (HALON) SYSTEM

System 46

Test Objectives

1. To demonstrate the operation of the fire protection (Halon) system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. All auxiliary systems needed for this procedure are operable and available for test use.

Test Procedure

1. The test will verify proper operation of the Halon fire protection system for various operating conditions.

2. The autostart/stop modes of the Halon fire protection system upon a detector trip will be verified.

3. For each fire zone the test verifies that the proper concentration of Halon is reached in a specified time period.

4. Manual operation of the Halon system will be verified from corresponding control panels.

TABLE 14.2-64
(Sheet 2 of 2)

FIRE PROTECTION (HALON) SYSTEM

System 46

5. Corresponding alarms, annunciators, and computer points will be verified for proper response in conjunction with the various tests conducted.

<u>Acceptance Criteria</u>

1. The Halon 1301 system functions as designed and provides the required concentration as specified in NFPA Standard 12A and BTP CMEB 9.5-1, Section C.6.e.

2. The system functions as described in Section 9.5.1.2.10.

TABLE 14.2-65
(Sheet 1 of 2)

SMOKE, FLAME, AND TEMPERATURE DETECTION

System 47

Test Objectives

1. To demonstrate the operation of the smoke, flame, and temperature system and components.
2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow all NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.
2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.
3. Valve lineups are completed.

Test Procedure

1. The test will verify that the fire detection system is capable of interacting with the fire protection systems in accordance to Station specifications.
2. The automatic functions of the local fire panels for each zone will be verified for a detector trip.
3. The manual remote functions of the local fire panels will be verified.
4. Corresponding annunciations, alarms, and computer points will be verified in conjunction with the various tests conducted.
5. The supervision modes for the various components of the fire detection system will be verified.

TABLE 14.2-65
(Sheet 2 of 2)

SMOKE, FLAME, AND TEMPERATURE DETECTION

System 47

<u>Acceptance Criteria</u>

1. Fire detectors and associated instrumentation function to detect a fire emergency and provide alarms and initiation signals.

2. The supervision modes for areas that contain or present a fire exposure to safety-related equipment is operable, as described in Section 9A.3.6.

TABLE 14.2-66

THIS TABLE HAS BEEN DELETED

TABLE 14.2-67
(Sheet 1 of 2)

HOT WATER AND GLYCOL HEATING SYSTEMS

System 49

Test Objectives

1. To demonstrate the operation of the hot water and glycol heating systems and components.

2. To ensure the systems are properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. Applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. The test procedure will verify that the reactor building, turbine building, and radwaste building glycol heating systems operate according to design specifications.

2. Mechanical equipment such as the glycol heating pumps and valves will be tested to demonstrate proper performance.

3. The test ensures applicable controls, interlocks, and valves are checked for proper operation.

4. Annunciators and computer alarms are verified in conjunction with the tests performed.

TABLE 14.2-67
(Sheet 2 of 2)

HOT WATER AND GLYCOL HEATING SYSTEMS

System 49

Acceptance Criteria

1. The glycol circulating pumps' automatic start and trip functions operate as described in Section 9.4.11.5.

2. Hot water temperature control valves close automatically as described in Section 9.4.12.5.

3. Hot water makeup pumps function automatically as described in Section 9.4.12.5.

4. The glycol systems operate in response to temperature signals to maintain the temperatures specified in Table 9.4-1.

TABLE 14.2-68
(Sheet 1 of 2)

REACTOR BUILDING HVAC

System 52

Test Objectives

1. To demonstrate the operation of the reactor building systems and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. Controls interlocks, and trips for dampers, fans, unit heaters, and coolers are verified.

2. The emergency recirculation ventilation is tested to verify that cooling is provided during LOCA conditions.

3. The reactor head exhaust ventilation system is tested to ensure that air from beneath the vessel head is exhausted.

4. The operation of the associated chill water system is verified.

TABLE 14.2-68
(Sheet 2 of 2)

REACTOR BUILDING HVAC

System 52

Acceptance Criteria

1. The reactor building can be maintained at a slight negative pressure as described in Section 9.4.2.3.6.

2. The reactor building ventilation system responses to LOCA and high radiation signals are as described in Section 9.4.2.2.3.

3. Automatic starts and trips of system fans operate as described in Section 9.4.2.5.3.

4. The system responds to temperature signals to maintain the required area temperatures as described in Table 9.4-1.

5. The chill water system is capable of supplying water upon demand in response to a required cooling signal.

TABLE 14.2-69
(Sheet 1 of 2)

CONTROL BUILDING AIR CONDITIONING

System 53

Test Objectives

The purpose of this test is to demonstrate the operation of the control building air conditioning system.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests have been completed and the system turned over to NMPC.

2. Applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Applicable lineups have been completed.

Test Procedure

1. The test verifies system controls and interlocks.

2. The system will be started and test data taken to verify performance is within design specifications.

3. The operation of the associated chill water is verified.

Acceptance Criteria

1. The system is capable of maintaining the main control room and relay room as a positive pressure space, as described in Section 9.4.1.1.2.

2. The battery room ventilation subsystems are capable of maintaining their associated battery rooms at a slight negative pressure, as described in Section 9.4.1.1.7.

TABLE 14.2-69
(Sheet 2 of 2)

CONTROL BUILDING AIR CONDITIONING

System 53

3. Fan automatic start and trip functions operate as described in Section 9.4.1.

4. The control room ventilation subsystem functions to divert supply air, as described in Section 9.4.1.

5. The systems respond to temperature signals to maintain the required area temperatures, as described in Table 9.4-1.

6. The chill water system is capable of supplying water upon demand in response to a required cooling signal.

TABLE 14.2-70

THIS TABLE HAS BEEN DELETED

TABLE 14.2-71
(Sheet 1 of 2)

TURBINE BUILDING HVAC SYSTEM

System 55

Test Objectives

1. To demonstrate the operation of the turbine building HVAC system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. The glycol heating system is available to support testing.

Test Procedure

1. The elevator machine room ventilation fans and their interlocks with the inlet and outlet dampers are verified for proper operation.

2. The main stack substructure ventilation fans and exhaust dampers and associated interlocks are verified.

3. The turbine building main ventilation exhaust and supply fans and dampers are verified for proper operation.

4. The turbine building ventilation system's capability to maintain a negative pressure inside the turbine building is verified.

5. The operation of the associated chill water system is verified.

TABLE 14.2-71
(Sheet 2 of 2)

TURBINE BUILDING HVAC SYSTEM

System 55

Acceptance Criteria

1. The turbine building HVAC system can, under normal building conditions, maintain the turbine building at a slightly negative pressure in accordance with Sections 9.4.4.1 and 9.4.4.3.

2. The turbine building supply fans' automatic functions operate as described in Section 9.4.4.5.1.

3. The system responds to temperature signals to maintain the required area temperatures, as described in Table 9.4-1.

4. The chill water system is capable of supplying water upon demand in response to a required cooling signal.

TABLE 14.2-72
(Sheet 1 of 2)

RADWASTE BUILDING VENTILATION

System 56

Test Objectives

1. To demonstrate the operation of the radwaste building ventilation system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. An in-place DOP penetration test per RG 1.140 has been performed on the HEPA filters to confirm a satisfactory particulate removal efficiency.

Test Procedure

1. The test verifies system controls, interlocks, and fans are checked for proper operation in accordance with specifications.

2. The equipment exhaust subsystem fans and filter trains are verified.

3. Corresponding alarms and annunciators are verified for proper response in conjunction with various tests conducted.

TABLE 14.2-72
(Sheet 2 of 2)

RADWASTE BUILDING VENTILATION

System 56

4. All ductwork under positive pressure will be tested in accordance with procedures of the Associated Air Balance Council.

5. The operation of the associated chill water system is verified.

Acceptance Criteria

1. The filter bypass dampers operate to bypass upon receipt of a signal from a smoke detector, as described in Section 9.4.3.2.3.

2. Supply fan and exhaust fan interlocks function as described in Section 9.4.3.2.1.

3. The system responds to temperature signals to maintain the required area temperatures, as described in Table 9.4-1.

4. The chill water system is capable of supplying water upon demand in response to a required cooling signal.

TABLE 14.2-73
(Sheet 1 of 2)

DIESEL GENERATOR BUILDING HVAC SYSTEM

System 57

<u>Test Objectives</u>

1. To demonstrate the operation of the diesel generator building HVAC system and components.

2. To ensure the system is properly designed and constructed.

<u>Safety Precaution</u>

Follow NMPC safety rules and proper procedures during testing.

<u>Prerequisites</u>

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

<u>Test Procedure</u>

1. The remote manual controls for all fans, heaters, and dampers are verified.

2. The controls for the makeup air subsystem fan, damper, and heater are verified.

3. The controls of the normal supply subsystem fans and associated interlocks and dampers are verified.

4. The automatic and manual controls of the standby subsystem fans and associated interlocks and dampers are verified.

5. The operation of the SWP system is verified.

TABLE 14.2-73
(Sheet 2 of 2)

DIESEL GENERATOR BUILDING HVAC SYSTEM

System 57

Acceptance Criteria

1. The system responds to temperature signals to maintain temperature within the requirements of Table 9.4-1.

2. Automatic operation of ventilation fans is as described in Section 9.4.6.5.

3. The SWP system is capable of supplying water upon demand in response to a required cooling signal.

TABLE 14.2-74
(Sheet 1 of 1)

ELECTRIC TUNNELS VENTILATION SYSTEM

System 59A

Test Objectives

1. To demonstrate the operation of the electric tunnel ventilation system.

2. To ensure that the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve and damper lineups are completed.

Test Procedure

1. Interlock and control functions of fans and dampers will be verified.

2. System parameters will be verified to the extent practical.

3. The operation of the associated SWP system is verified.

Acceptance Criteria

1. The system responds to temperature signals to maintain temperatures in the tunnels/cable areas, as described in Section 9.4.1.2.6.

2. Smoke removal fans' interlocks and automatic trips function as described in Section 9.4.1.5.6.

3. The SWP system is capable of supplying water upon demand in response to a required cooling signal.

TABLE 14.2-75
(Sheet 1 of 1)

DRYWELL COOLING SYSTEM

System 60

Test Objectives

1. To demonstrate the operation of the drywell cooling system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. RBCLC system is available to support this test.

Test Procedure

1. The test will verify that the drywell unit coolers are capable of performing within design specifications.

2. Temperature sensors, system controls, and interlocks will be verified.

3. The system logic will be verified.

4. Alarms and annunciators are verified for response in conjunction with various tests performed.

Acceptance Criteria

1. Drywell coolers' interlocks and automatic trips function as described in Section 9.4.2.5.1.

TABLE 14.2-76
(Sheet 1 of 2)

PRIMARY CONTAINMENT PURGE SYSTEM

System 61

Test Objectives

1. To demonstrate the operation of the primary containment purge system and components.
2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.
2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.
3. Valve lineups are completed.
4. The drywell must be able to be closed.
5. The reactor building ventilation and SGTSs are available to support this test.

Test Procedure

1. The purge fan and its associated valves are verified.
2. System isolation controls and responses are verified.
3. Corresponding annunciators and computer alarms are verified in conjunction with various tests.
4. Drywell-to-suppression pool vacuum breakers will be verified for proper operation.

TABLE 14.2-76
(Sheet 2 of 2)

PRIMARY CONTAINMENT PURGE SYSTEM

System 61

Acceptance Criteria

1. Automatic fan trips operate on a low flow signal, as described in Section 9.4.2.5.2.
2. System controls and interlocks function to isolate on a manual isolation or LOCA, as described in Section 9.4.2.5.2.
3. Air inlet control valves close automatically on a high containment pressure signal, as described in Section 9.4.2.5.2.

TABLE 14.2-77
(Sheet 1 of 2)

STANDBY GAS TREATMENT SYSTEM

System 61

Test Objectives

1. To demonstrate the operation of the SGTS and components.

2. To verify that the SGTS can maintain the proper reactor building pressure.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. Reactor building ventilation system is available, and all reactor building doors and hatches can be closed.

Test Procedure

1. The test procedure will verify that the two gas treatment filter trains operate according to design specifications under normal and transient conditions.

2. System auto initiations will be demonstrated.

3. System controls and interlocks will be verified.

4. Standby gas treatment fan operation will be verified.

5. The test will verify that the SGTS will accomplish its design objective of reestablishing the reactor building pressure equal to or below -0.25 in W.G. within the required time internal.

TABLE 14.2-77
(Sheet 2 of 2)

STANDBY GAS TREATMENT SYSTEM

System 61

Acceptance Criteria

1. The SGTS starts automatically on any of the three signals described in Section 6.5.1.2.1.

2. The standby train of the SGTS starts automatically, as described in Section 6.5.1.5.

3. Each SGTS train can maintain reactor building pressure equal to or below -0.25 in W.G., as described in Section 6.2.3.1.

4. The secondary containment drawdown time to -0.25 in W.G. is less than or equal to 120 sec (see Technical Specification Section 3/4.6.5).

TABLE 14.2-78
(Sheet 1 of 1)

DBA HYDROGEN RECOMBINER SYSTEM

System 62

Test Objectives

1. To demonstrate the operation of the DBA hydrogen recombiner system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. The recombiner unit logic and trip modes will be verified.

2. Sensors and associated instrumentation will be verified.

3. Corresponding alarms will be verified in conjunction with various tests performed.

4. The operation of the SOVs and MOVs will be verified.

Acceptance Criteria

1. Air/water inlet valves operate automatically in response to the temperature and pressure signals described in Section 6.2.5.5.

2. Hydrogen recombiner interlocks prevent operation under the conditions described in Section 6.2.5.5.

3. The hydrogen recombiner unit blowers function to deliver required flow rates as described in Section 6.2.5.2.2.

TABLE 14.2-79
(Sheet 1 of 2)

REACTOR BUILDING DRAINS

System 63

Test Objectives

1. To demonstrate the operation of the reactor building drain systems and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. Makeup water storage of other clean water systems is available to support testing.

Test Procedure

1. Demineralized water will be used for testing the equipment drain tanks, and service water of fire protection water will be used for testing of the floor drain sumps.

2. The capacity of all of the reactor building floor drain sumps will be verified and compared to sump design volumes.

3. The autostart/stop and lead/lag features of the applicable system pumps are verified.

4. The ability of the system to transfer collected water to the LWS system will be verified.

TABLE 14.2-79
(Sheet 2 of 2)

REACTOR BUILDING DRAINS

System 63

Acceptance Criteria 1. Pump autostart and sequencing controls operate as described in Section 9.3.3.5. 2. The system is capable of transferring collected liquids to the LWS system.

TABLE 14.2-80
(Sheet 1 of 2)

TURBINE BUILDING DRAINS

System 64

Test Objectives

1. To demonstrate the operation of the turbine building drains system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system is turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. An appropriate clean water system is available to support testing.

Test Procedure

1. Clean water will be used to supply water for testing.

2. The autostart/autostop features of the sump pumps will be verified.

3. The test will verify the ability of the system to collect and process water to the LWS system.

4. Corresponding annunciators and alarms are verified in conjunction with the various tests performed.

5. The capacity of the pumps is verified and compared to sump design volumes.

TABLE 14.2-80
(Sheet 2 of 2)

TURBINE BUILDING DRAINS

System 64

<u>Acceptance Criteria</u> 1. Pump autostart and sequencing controls operate as described in Section 9.3.3.5. 2. The system is capable of transferring collected liquids to the LWS system.

TABLE 14.2-81
(Sheet 1 of 2)

RADWASTE BUILDING DRAINS

System 65

Test Objectives

1. To demonstrate the operation of the radwaste building drains system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. A clean water system is available to support testing.

Test Procedure

1. Clean water will be used to supply water for testing.

2. The autostart/stop features of the sump pumps will be verified.

3. The test will verify the ability of the system to collect and process water to the LWS system.

4. Corresponding annunciators and alarms are verified in conjunction with the various tests.

5. The capacities of the sumps verified and compared to sump design volumes.

TABLE 14.2-81
(Sheet 2 of 2)

RADWASTE BUILDING DRAINS

System 65

Acceptance Criteria

1. Pump auto and sequencing controls operate as described in Section 9.3.3.5.

2. The system is capable of transferring collected liquids to the radwaste system.

TABLE 14.2-82
(Sheet 1 of 2)

MISCELLANEOUS DRAINS - DIESEL GENERATOR BUILDING FLOOR DRAINS, AUXILIARY SERVICE BUILDING, REACTOR BUILDING MAT, CONDENSATE STORAGE BUILDING, AND MAIN STACK DRAIN SYSTEM

System 66

Test Objectives

1. To demonstrate the operation of the various miscellaneous drain systems and their components.

2. To ensure the systems are properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are satisfactorily completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. A clean water source is available to supply water for this test.

Test Procedure

1. The oil holding compartment is filled.

2. The diesel generator oil separator is verified so that it can handle flow from the three sumps and applicable monitors respond in accordance with design requirements.

3. The ability of the drain systems to transfer water for further processing and/or disposal will be verified.

TABLE 14.2-82
(Sheet 2 of 2)

MISCELLANEOUS DRAINS - DIESEL GENERATOR BUILDING FLOOR DRAINS, AUXILIARY SERVICE BUILDING, REACTOR BUILDING MAT, CONDENSATE STORAGE BUILDING, AND MAIN STACK DRAIN SYSTEM

System 66

4. Sump capacities are verified.

5. System automatic controls and associated alarm functions are verified.

Acceptance Criteria

1. The oil holding compartment will hold approximately 300 gal of oil in accordance with Purchase Specification No. NMP2-W014S.

2. The oil separator 2DFD-SP1 can handle hydraulic fluid flow from all three sumps individually, and applicable monitors respond as designed.

3. Sump pumps automatic start and, if applicable, sequencing operate, as described in Sections 9.3.3.2 and 9.3.3.5.

4. Each system is capable of transferring collected liquids to their associated disposal system, as described in Section 9.3.3.

TABLE 14.2-83
THROUGH
TABLE 14.2-85

TABLES 14.2-83 THROUGH 14.2-85 HAVE BEEN DELETED

TABLE 14.2-86
(Sheet 1 of 2)

DRYWELL FLOOR AND EQUIPMENT DRAIN SYSTEM

System 67

Test Objectives

1. To demonstrate the reliable operation of the drywell floor and equipment drain system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. All auxiliary systems needed for this test are available for support.

Test Procedure

1. The test will verify that the drywell equipment and floor drains operate within system design specifications.

2. The auto controls and associated alarm functions for the floor and equipment drain pumps will be verified.

3. Operation of remote-controlled equipment will be verified.
4. The ability of the system to transfer water for further processing and/or disposal will be verified.

5. Sump capacities will be verified.

TABLE 14.2-86
(Sheet 2 of 2

DRYWELL FLOOR AND EQUIPMENT DRAIN SYSTEM

System 67

Acceptance Criteria

1. Pump autostart and sequencing operates as described in Section 9.3.3.5.

2. System automatic isolation functions as described in Sections 9.3.3.3 and 9.3.3.5.

3. The system is capable of transferring liquids to the LWS system.

TABLE 14.2-87
THROUGH
TABLE 14.2-94

TABLES 14.2-87 THROUGH 14.2-94 HAVE BEEN DELETED

TABLE 14.2-95
(Sheet 1 of 2)

UNINTERRUPTIBLE POWER SUPPLY

System 71

Test Objectives

1. To demonstrate the operation of the UPS system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to control circuits and instrumentation are available.

3. All auxiliary systems needed for the preoperational test are available for use.

Test Procedure

1. The test procedure will demonstrate that the UPS performs as designed using normal and alternate ac supplies.

2. Proper voltage regulation of the UPS will be verified.

3. The ability of the UPS to carry and transfer full load will be demonstrated (from the UPS to the alternate ac source and vice versa automatically and manually).

4. The UPS will be tested to verify its capability to carry load on battery power.

5. Simulating an inverter loss, the static switch will be tested to show that it can transfer load to the alternate ac source without loss of load.

TABLE 14.2-95
(Sheet 2 of 2)

UNINTERRUPTIBLE POWER SUPPLY

System 71

6. Alarms and control instrumentation will be verified for proper operation in conjunction with the various tests conducted.

Acceptance Criteria

1. The UPS can supply regulated ac power using normal and backup power sources.

2. The UPS output can be maintained within the limits described in Section 8.3.1.1.2.

3. The static transfer switch operates to transfer load, without a power interruption or an inverter trouble, as described in Section 8.3.1.1.2.

TABLE 14.2-96
THROUGH
TABLE 14.2-99

TABLES 14.2-96 THROUGH 14.2-99 HAVE BEEN DELETED

TABLE 14.2-100
(Sheet 1 of 2)

NORMAL DC SYSTEMS

System 73

Test Objectives

1. To demonstrate the operation of the 24/48 V dc systems and components.
2. To ensure the system is properly designed and constructed.

Safety Precaution

1. Follow NMPC safety rules and proper procedures during testing.
2. Protective apron, gloves, and face shield shall be worn when measuring specific gravities.
3. Fresh water should be available in case acid is splashed on skin or eyes.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.
2. All applicable power sources to supply electric power to control circuits and instrumentation are available.
3. Control building ventilation or portable ventilation is available to exhaust the battery rooms.

Test Procedure

1. A load bank system will be used to establish desired loads during discharge test.
2. The test verifies that the batteries will function as designed by conducting a 4-hr capacity test.
3. The battery chargers will be tested to demonstrate their ability to recharge the batteries with steady-state load connected.

TABLE 14.2-100
(Sheet 2 of 2)

NORMAL DC SYSTEMS

System 73

Acceptance Criteria

1. Each battery set will demonstrate a capacity greater than that required for a 4-hr discharge at design load, as evidenced by the battery capacity, corrected to 77°F, equal to or greater than 90 percent of the manufacturer's rating at the 4-hr rate.

2. Batteries 3A, 3B, 3C, and 3D can be fully recharged in a 24-hr period from its minimum charge condition, utilizing the battery chargers with the calculated maximum steady-state load connected in accordance with Section 8.3.2.

3. Undervoltage alarms to PGCC will alarm with loss of voltage in accordance with Section 8.3.2.1.3.

TABLE 14.2-101
(Sheet 1 of 2)

EMERGENCY DC SYSTEMS

System 74

Test Objectives

1. To demonstrate the operation of the emergency dc systems and components.
2. To ensure the system is properly designed and constructed.

Safety Precaution

1. Follow NMPC safety rules and proper procedures during testing.
2. Protective apron, gloves, and face shield shall be worn when measuring specific gravities.
3. Fresh water shall be available in case acid is splashed on skin or eyes.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.
2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.
3. Control building ventilation or portable ventilation is available to exhaust the battery rooms.

Test Procedure

1. A load bank system and/or normal dc will be used to establish desired loads during discharge test, as available.
2. The batteries will be subjected to a 2-hr service test discharge in accordance with a precalculated load profile.

TABLE 14.2-101
(Sheet 2 of 2)

EMERGENCY DC SYSTEMS

System 74

3. The battery chargers will be tested to demonstrate their ability to recharge the batteries with a simulated maximum steady-state load connected from their minimum charge state.

4. The batteries will be subjected to a capacity test.

5. With the system in a low voltage condition as specified in Section 8.3.2.1.2, the test will verify that the voltage applied to designated Class 1E loads is within the required operating range for that equipment. This verification will be performed on equipment that has been identified by an engineering review as potential voltage-drop problem cases.

<u>Acceptance Criteria</u>

1. Each battery will demonstrate a capacity equal to or greater than that required during the 2-hr service discharge test evidenced by the terminal voltage remaining above 105 V in accordance with Section 8.3.2.1.2.

2. Each battery charger is capable of supplying the combined demands of steady-state loads while recharging its associated battery to a full-charge condition within 24 hr from the minimum charge state.

3. Ground detection indication and annunciation for Batteries 2A, 2B, and 2C function as described in Section 8.3.2.1.2.

4. Dc bus undervoltage relays and associated alarms function as described in Section 8.3.2.1.2.

5. Battery capacities are ≥90 percent of the manufacturer's rated capacity, as demonstrated by the surveillance test for each individual battery in accordance with IEEE-450-1980.

6. Specified equipment operates with a system low bus voltage.

TABLE 14.2-102
(Sheet 1 of 1)

STATION EMERGENCY LIGHTING SYSTEM

System 75

Test Objectives

1. To demonstrate the operation of the Station emergency lighting system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electrical power are available.

Test Procedure

1. The emergency lighting system is verified to provide adequate illumination in areas required for operating the safety-related equipment during emergency conditions.

2. The essential lighting system is checked to ensure adequate illumination is provided for certain critical areas of the Station, such as the control room.

3. The egress lighting system is verified to provide adequate illumination for all egress signs and egress routes.

Acceptance Criteria

1. All Station emergency lighting systems will be shown to provide adequate lighting in accordance with Table 9.5-2.

2. The system functions as described in Section 9.5.3.

TABLE 14.2-103
(Sheet 1 of 2)

PLANT COMMUNICATION SYSTEM

System 76

Test Objectives

1. To demonstrate the operation of the plant communication systems and components.

2. To ensure the system is properly designed and constructed.

3. To verify that the plant communication systems can provide proper intraplant and plant-to-offsite communications.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system is turned over to NMPC.

2. All applicable power sources to supply electric power are available.

Test Procedure

1. The test will verify the proper operation of the plant PP/PA communication system.

2. The system's emergency evacuation alarm and other emergency alarms will be verified.

3. The test will verify that plant communication systems provide communications indoors, outdoors, and offsite.

4. Verification of power supplies for communication equipment will be performed.

TABLE 14.2-103
(Sheet 2 of 2)

PLANT COMMUNICATION SYSTEM

System 76

Acceptance Criteria

1. The system's emergency evacuation alarm and other emergency alarms function and provide audible alarm signals throughout the plant.

2. The plant-to-offsite communications operate as described in the Site Emergency Plan.

3. The in-plant communication systems function in accordance with Section 9.5.2.

TABLE 14.2-104
(Sheet 1 of 2)

REMOTE SHUTDOWN

System 78

Test Objective

1. To demonstrate the operation of RSS system.
2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.
2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.
3. All support systems needed for this preoperational test are available for test use.

Test Procedure

1. The test procedure will verify that the RSS system is capable of properly operating the required shutdown systems and their components.
2. System interlocks, controls and instrumentation will be verified for proper response.
3. It will be demonstrated that no systems can be operated from the RSP unless the specific transfer switch is placed in the emergency position.
4. Control functions transferred to the RSP from the normal control panel in the control room can only be operated from the RSP.
5. All applicable alarms will be verified for proper operation in conjunction with various tests performed.

TABLE 14.2-104
(Sheet 2 of 2)

REMOTE SHUTDOWN

System 78

Acceptance Criteria

1. The RSS system transfer switches override controls from the main control room and transfer controls to the RSP.

2. All shutdown panel control switches demonstrate proper control over appropriate equipment.

3. The system functions as described in Section 7.4.1.4.

TABLE 14.2-105
(Sheet 1 of 2)

AREA, PROCESS AIRBORNE AND GASEOUS RADIATION MONITORING SYSTEM

System 80A

Test Objectives

1. To demonstrate the operation of the digital and nondigital RMS system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system is turned over to the NMPC.

2. All applicable power sources to supply electric power to control circuits and instrumentation are available.

3. Valve lineups are completed.

4. Calibration of detectors and monitors using specific samples and/or sources has been completed.

Test Procedure

1. Annunciators, alarms, and trip functions for the digital and nondigital RMS systems are verified to ensure that monitors provide warning of increasing radiation levels, power failures, or component malfunction.

2. Alarms, setpoints, and indications are verified by simulated signals or parameter variation (samples of sources).

3. System isolations which are initiated by the process RMS system will be demonstrated in those system's applicable preoperational tests.

TABLE 14.2-105
(Sheet 2 of 2)

AREA, PROCESS AIRBORNE AND GASEOUS RADIATION MONITORING SYSTEM

System 80A

Acceptance Criteria

1. The process radiation systems provide continuous indication of selected radiation levels.

2. Alarms function on increasing radiation levels.

3. All automatic actions initiated by the process RMS systems function as described in Section 11.5.

4. The systems function as described in Sections 11.5 and 12.3.4.

TABLE 14.2-106
(Sheet 1 of 1)

MAIN STEAM LINE RADIATION MONITORING SYSTEM

System 80B

Test Objectives

1. To demonstrate the operation of the main steam line RMS system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system is turned over to NMPC.

2. All applicable power sources to supply electric power to control circuits and instrumentation are available.

Test Procedure

1. System alarms, detectors, indicators, and annunciators are checked to ensure they detect and measure gamma radiation levels at the main steam lines.

2. Alarms and setpoints are initiated to verify that the system provides indication and annunciation in the main control room of main steam line radiation levels.

Acceptance Criteria

1. The system functions as designed in accordance with Section 11.5.2.2.1.

2. All applicable alarms and annunciators function as described in Section 11.5.2.2.1.

TABLE 14.2-107
(Sheet 1 of 1)

CONTAINMENT LEAKAGE MONITORING

System 81

Test Objectives

1. To demonstrate the operation of the containment leakage monitoring system and components.
2. To ensure the systems are properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.
2. All applicable power sources to supply electric power to control circuits and instrumentation are available.
3. No primary containment isolation signals present.

Test Procedure

1. The drywell and suppression chamber manometer isolation valves are tested.
2. All drywell electrical penetrations are pressure tested.
3. Associated annunciators and computer alarms will be verified by simulated signals or actual parameter variation in conjunction with tests performed.

Acceptance Criteria

1. Each leakage monitoring valve must be operable from the individual switches and isolated in pairs from their respective isolation switches.
2. The isolation valves must isolate on a containment isolation signal, as described in Section 5.2.5.2.1.
3. All electrical penetrations must maintain pressure and associate annunciators and computer alarms function when a low pressure condition exists.

TABLE 14.2-108
(Sheet 1 of 2)

CONTAINMENT ATMOSPHERE MONITORING

System 82

Test Objectives

1. To demonstrate the operation of the containment atmosphere monitoring systems and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to control circuits and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. The test procedure will ensure that the containment monitoring system will provide indication of atmospheric conditions in the drywell and suppression chamber.

2. Hydrogen, oxygen, and humidity analyzers; drywell radiation monitors, suppression pool water level elements, and drywell and suppression pool temperature and pressure elements will be checked for proper operation.

3. Alarms, annunciators, control instrumentation, and interlocks will be tested for correct response for each test condition.

4. The test will simulate abnormal operating conditions to test the isolation features of the system.

TABLE 14.2-108
(Sheet 2 of 2)

CONTAINMENT ATMOSPHERE MONITORING

System 82

<u>Acceptance Criteria</u> 1. The containment monitoring system measures the containment atmospheric conditions and provides the information to the main control room regarding containment atmospheric conditions during normal operation. 2. Control room instrumentation responds correctly to parameter variations. 3. All applicable alarms and annunciators function as designed in accordance with Section 6.2.1.7.

TABLE 14.2-109
(Sheet 1 of 1)

PRIMARY CONTAINMENT ISOLATION SYSTEM
(NSSS)

System 83

Test Objectives

1. To demonstrate the operation of the primary containment isolation system and components.
2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.
2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.
3. Valve lineups are completed.

Test Procedure

1. The test procedure ensures that the system automatically isolates appropriate lines penetrating the primary containment when predetermined plant limits are reached.
2. All applicable setpoints, alarms, and annunciators related to this system will be tested in conjunction with tests performed.

Acceptance Criteria

1. The system functions to isolate the containment in accordance with Section 6.2.4.
2. All primary containment isolation valves operate in response to an isolation signal, as described in Section 6.2.4.2.

TABLE 14.2-110
(Sheet 1 of 2)

REACTOR BUILDING - POLAR CRANE

System 84

Test Objectives

1. To demonstrate the operation of the RBPC and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Dynamic and static load tests, at 100 percent and 125 percent of rated load, have been performed satisfactorily.

Test Procedure

1. The radio controls are verified for proper operation.

2. The operation of all locking and safety devices is verified.

3. The restrictive path operation is verified.

4. Nondestructive and functional testing of the special lifting devices for reactor vessel internals will be performed.

TABLE 14.2-110
(Sheet 2 of 2)

REACTOR BUILDING - POLAR CRANE

System 84

Acceptance Criteria 1. All limit switches, interlocks, and locking and safety devices function, as described in Section 9.1.4.2.2. 2. The polar crane responds correctly to all radio remote control functions. 3. The testing of the special lifting devices has been satisfactorily completed in accordance with ANSI N14.6-1978.

TABLE 14.2-111

THIS TABLE HAS BEEN DELETED

TABLE 14.2-112
(Sheet 1 of 2)

REACTOR COOLANT AND ECCS LEAK DETECTION SYSTEM

System 85

Test Objectives

1. To demonstrate the operation of the reactor coolant and ECCS leak detection system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Alarm setpoints are set according to design requirements.

Test Procedure

Valve, sensor, and logic tests are performed to determine proper operation on the following systems:

1. Area leak detection systems and equipment.

2. Leak detection for drywell floor and equipment drain sumps.

3. Leak detection for reactor building equipment and floor drain sumps.

4. Flow leak detection for RWCU system.

5. Safety system for RCIC turbine exhaust.

TABLE 14.2-112
(Sheet 2 of 2)

REACTOR COOLANT AND ECCS LEAK DETECTION SYSTEM

System 85

6. Head seal leak detection.

7. Drywell and reactor vessel head vent line leak detection.

8. Drywell air cooler temperature monitoring.

9. Main steam line relief and safety valve leakoff.

10. RCIC and main steam line high flow detection and RCIC low pressure detection.

11. RHR/RCIC steam line high flow detection.

12. Fission products monitoring subsystem.

Acceptance Criteria

The system operates as described in Section 5.2.5.

TABLE 14.2-113
(Sheet 1 of 1)

LOOSE PARTS MONITORING SYSTEM

System 86

Test Objectives

1. To demonstrate the system's ability to monitor structural stability of the reactor vessel internal components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to control circuits and instrumentation are available.

Test Procedure

The LPMS will be tested to ensure proper response to induced vibration signals.

Acceptance Criteria

The system responds to signals/noise levels and provides remote alarm and indication as described in Section 4.4.6.1.2.

TABLE 14.2-114
(Sheet 1 of 2)

CONTAINMENT INERTING SYSTEM

System 88

Test Objectives

1. To demonstrate the operation of the containment nitrogen and inerting system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. The test procedure ensures system controls, interlocks, and valves are verified for proper operation.

2. Alarm and instrumentation are verified in conjunction with tests performed.

3. The test procedure will verify the system's ability to inert the containment and maintain the oxygen concentration at or below 4 percent.

TABLE 14.2-114
(Sheet 2 of 2)

CONTAINMENT INERTING SYSTEM

System 88

Acceptance Criteria
1. The system supplies instrument nitrogen gas to the instrument and control system inside the primary containment, as described in Sections 9.3.1.5.3 and 9.3.1.5.5.
2. System interlocks and controls operate as described in Section 9.3.1.5.5.
3. The system is capable of supplying nitrogen gas for inerting the primary containment when required and maintaining an inert atmosphere in the containment during normal operations in accordance with Sections 9.3.1.5.2 and 6.2.5.2.3.

TABLE 14.2-115
(Sheet 1 of 1)

SEISMIC MONITORING SYSTEM

System 90

<u>Test Objectives</u>

1. To demonstrate the operation of the seismic monitoring system and components.

2. To ensure the system is properly designed and constructed.

<u>Safety Precaution</u>

Follow NMPC safety rules and proper procedures during testing.

<u>Prerequisites</u>

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to control circuits and instrumentation are available.

<u>Test Procedure</u>

1. The test verifies proper operation of the system alarms.

2. The test verifies the seismic monitoring system's ability to monitor and record seismic motion.

<u>Acceptance Criteria</u>

1. The system detects, records, and provides immediate information for seismic events at the plant site.

2. The system functions as described in Section 3.7A.4.

TABLE 14.2-116
(Sheet 1 of 1)

PROCESS COMPUTER

System 91

Test Objectives

1. To demonstrate the operation of the process computer and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power are available.

Test Procedure

1. The test will verify that the process computer can properly process analog input signals from various sensors, initiate annunciators when transients occur, and generate a printout of system parameters of the monitored event.

2. The test will verify that all sensors or signal device digital input signals initiate annunciators and generate printouts of monitored events.

3. The test will verify proper operation of system features provided for display/printout of plant parameters.

4. The test will verify by use of test cases proper operation of NSSS calculations and BOP performance calculations.

Acceptance Criteria

The computer is capable of receiving and processing digital and analog signals and providing outputs representative of these signals, as described in Section 7.7.1.6.

TABLE 14.2-117
(Sheet 1 of 2)

NEUTRON MONITORING SYSTEM

System 92

Test Objective

1. To demonstrate the operation of the NMS systems and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

Test Procedure

Verification of the NMS capability will be demonstrated by the proper integrated operation of the following:

1. SRM and IRM detectors and their respective insert and retract mechanisms and cables.

2. SRM and IRM channels, including recorders, trip logic, bypass logic, system interlocks, power supplies, and annunciators.

3. All LPRM detectors and their respective input signals to corresponding APRMs.

4. All APRM channels, including trips, bypasses, recorders, interlocks, and annunciators.

5. Recirculation flow bias signals input to the NMS.

TABLE 14.2-117
(Sheet 2 of 2)

NEUTRON MONITORING SYSTEM

System 92

Acceptance Criteria 1. The SRM system functions as described in Section 7.7.1.7.2.2. 2. The NMS provides trip signals to the RPS, as described in Section 7.2.1.2.1. 3. The IRMs, LPRMs, and APRMs and associated controls function as described in Section 7.6.1.4.

TABLE 14.2-118
(Sheet 1 of 1)

ROD BLOCK MONITORING SYSTEM

System 93

<u>Test Objectives</u>

1. To demonstrate the operation of the RBM system and components.

2. To ensure the system is properly designed and constructed.

<u>Safety Precaution</u>

Follow NMPC safety rules and proper procedures during testing.

<u>Prerequisites</u>

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

<u>Test Procedure</u>

1. The test will verify that each LPRM input signal for a selected control rod will be displayed in the correct meter group.

2. Verification will be made for the various trip modes using simulated signals for different operating conditions.

3. The test will verify independent Bus A and B power supplies to corresponding RBM channels.

4. All associated annunciators, recorders, control instrumentation, and system interlocks will be tested for proper operation according to design specifications for the RBM system.

<u>Acceptance Criteria</u>

The system functions as described in Section 7.7.1.7.3.2.

TABLE 14.2-119
(Sheet 1 of 2)

TRAVERSING IN-CORE PROBE SYSTEM

System 94

Test Objectives

1. To demonstrate the operation of the TIP system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Drive mechanism and indexer purge system is operating.

4. Flux probing monitors are calibrated and amplifiers have correct setting.

Test Procedure

1. Cross-calibration interlocks are verified.

2. All shear valve monitor lamps function correctly and squib current is monitored accurately.

3. The manual operation mode is verified.

4. The automatic operation mode is verified.

5. The manual override is checked for proper operation.

TABLE 14.2-119
(Sheet 2 of 2)

TRAVERSING IN-CORE PROBE SYSTEM

System 94

6. The automatic stop is checked for proper operation.

7. The automatic detector withdrawal is verified on containment isolation, loss of 125 V dc, or loss of the shear valve monitor signal.

8. The containment secure lamp circuits are checked for correct operation.

9. The manual scan, manual ball valve, and low speed control operations are verified.

Acceptance Criteria

The system functions as described in Section 7.7.1.7.1.

TABLE 14.2-120
(Sheet 1 of 1)

ROD WORTH MINIMIZER SYSTEM

System 95A

<u>Test Objectives</u>

1. To demonstrate the operation of the RWM system and components.

2. To ensure the system is properly designed and constructed.

<u>Safety Precaution</u>

Follow NMPC safety rules and proper procedures during testing.

<u>Prerequisites</u>

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to control circuits and instrumentation are available.

3. All auxiliary systems required for the test will be available for test use.

<u>Test Procedure</u>

1. The test will verify for power ascension and normal operating modes the ability for the RWM to restrict, monitor, and initiate error signals for rod movement and selection.

2. Proper operation will be verified for computer inputs, associated annunciators, control instrumentation, and system interlocks of the RWM system.

<u>Acceptance Criteria</u>

The system operates as described in Section 7.7.1.1.2.

TABLE 14.2-121
(Sheet 1 of 1)

ROD SEQUENCE CONTROL SYSTEM

System 95B

Test Objectives

1. To demonstrate the operation of the RSCS and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to control circuits and instrumentation are available.

3. The RPI system, RMCS, and the CRD system are available to support this test.

Test Procedure

1. The logic for each RSCS* status and resultant displays, annunciators, and setpoints is verified.

2. The performance of the rod pattern controller is verified.

3. Supply of continuously updated rod position data from the RPI system to the RSCS* is verified.

4. Provision for single rod bypass is checked.

5. Rod sequences are verified with respective control rod group assignments.

6. Constraints of rod movement are verified.

Acceptance Criteria

1. The RSCS is capable of receiving and processing the informational inputs described in Section 7.7.1.1.5.

2. The system operates and provides output signals and controls as described in Section 7.7.1.1.5.

*Note: RSCS function removed in RFO14 with ECP-13-000084.

TABLE 14.2-122
(Sheet 1 of 1)

REACTOR MANUAL CONTROL AND ROD POSITION INDICATION

System 96

Test Objectives

1. To demonstrate the operation of the RMCS and RPI system and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to control circuits and instrumentation are available.

3. The cooling fans in the control room panel for rod display are operable.

Test Procedure

1. All rod blocks, alarms, and interlocks for all modes of the reactor mode switch are verified.

2. A test simulator will supply rod position information to verify the proper operation of the displays and alarms associated with the RPIs.

3. The rod drift alarm is tested for proper operation.

4. All control modes are utilized to verify the proper functioning of the manual control system, the proper energization sequence, and the proper timing of the CRD directional control valves and stabilizing valves.

Acceptance Criteria

This system operates as described in Section 7.7.1.

TABLE 14.2-123
(Sheet 1 of 2)

REACTOR PROTECTION SYSTEM

System 97

Test Objectives

1. To demonstrate the operation of the RPS and components.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. The following CRD hydraulic system components are installed and available: backup scram valves, scram pilot valves, the discharge volume isolation pilot valves, the scram valves, and discharge header drain and vent valves, and scram valve position lights.

4. The RPS power supplies (UPSs and MG sets) and the electrical protection circuitry are available.

5. RPS MG set performance and full load tests are completed.

Test Procedure

1. All valve, sensor, and logic tests are performed to demonstrate system operability.

2. The sensor to actuator relay test is performed to verify system interconnections and proper actuation of relay logic associated with system sensors.

TABLE 14.2-123
(Sheet 2 of 2)

REACTOR PROTECTION SYSTEM

System 97

3. Response time measurements are performed to ensure that system is operating according to design requirements.

4. The mode switch is checked in each of its modes of operation to verify that all functions are operating properly.

5. The scram trip system is tested to demonstrate its operability.

6. Associated annunciator and computer alarms are checked for proper response in conjunction with the tests performed.

7. The trip system power independence and fail-safe feature is verified.

<u>Acceptance Criteria</u>

1. The system functions as described in Section 7.2.1.2.

2. Response times shall be within parameters specified in Technical Specifications.

TABLE 14.2-124

THE INFORMATION ON THIS PAGE HAS BEEN DELETED

TABLE 14.2-125
(Sheet 1 of 3)

STANDBY DIESEL GENERATOR

System 100A

Test Objectives

1. To demonstrate the operation of the standby diesel generator system.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. Service water system is available to support testing.

5. No. 2 diesel fuel oil is available from the diesel oil change tanks.

Test Procedure

1. The air compressors are checked to verify that they deliver air at design pressure to the air receivers and all controls are tested to verify that air receiver pressure is maintained within design limits.

2. The engine-driven and motor-driven circulating water pumps are verified to function as designed and verified that the jacket water system can maintain engine temperature within design limits.

TABLE 14.2-125
(Sheet 2 of 3)

STANDBY DIESEL GENERATOR

System 100A

3. The diesel generator lubrication oil system is tested to demonstrate its ability to deliver lubrication oil to required engine components and maintain the oil temperature within design limits.

4. The test will demonstrate proper operation of the diesel generators during loading, including a complete loss of load, with verification of voltage requirements and overspeed limits.

5. The ability to synchronize the diesel generator, while under load, with offsite power sources will be demonstrated.

6. Applicable alarms and annunciators will be verified for proper operation in conjunction with the tests performed.

7. Full load-carrying capability will be demonstrated during a 24-hr test run, 22 hr of which will be at the load equivalent of the continuous rating and 2 hr at the 2-hr rating of the diesel generator.

8. The manual and automatic features for each standby diesel generator fuel oil transfer pump are tested for proper operation.

<u>Acceptance Criteria</u>

1. Each diesel generator starts, accelerates to rated speed, voltage, and frequency, and is ready for loading sequence within 10 sec of receipt of the start signal.

2. Diesel generator voltage requirements are maintained, and overspeed limits are not exceeded during a complete loss of load.

3. With the generator connected to the emergency or equivalent larger load, it can be synchronized and the load transferred to the offsite power source.

TABLE 14.2-125
(Sheet 3 of 3)

STANDBY DIESEL GENERATOR

System 100A

4. The engine jacket water system functions to maintain engine temperatures within design limits in both standby and operating conditions.

5. The diesel generator lubrication oil system functions to lubricate engine bearings and other moving parts with the generator in operation and maintains oil temperature with design limits when engine is in a standby condition.

6. The diesel generator fuel oil transfer pumps start automatically when a day tank low level occurs and stop automatically when a day tank high level occurs.

7. Each air compressor is capable of recharging the air receivers from minimum to maximum operating pressure in 45 min or less.

8. The starting air supply is capable of starting the diesel generators 5 times from maximum operating pressure without recharging.

9. The diesel generators can maintain full rated load at normal operating voltage and frequency without exceeding any operational limits.

10. The diesel generators can maintain operating voltage and frequency during an overload condition equivalent to its 2 hr rating for 2 hr.

TABLE 14.2-126
(Sheet 1 of 3)

HPCS DIESEL GENERATOR

System 100B

Test Objectives

1. To demonstrate the operation of the HPCS diesel generator and supporting fuel and starting oil systems.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the system turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are completed.

4. Service water system is available to support testing.

5. No. 2 fuel oil is available from the diesel oil storage tanks.

Test Procedure

1. The air compressors are checked to verify that they deliver air at design pressure to the air receivers and all controls are tested to verify that air receiver pressure is maintained within design limits.

2. The engine jacket water system is verified to function as designed and verified that it maintains engine temperature within design limits.

TABLE 14.2-126
(Sheet 2 of 3)

HPCS DIESEL GENERATOR

System 100B

3. The HPCS diesel generator lubrication oil systems will be tested to verify their ability to supply oil to necessary engine components and maintain the engine in a warm prelubricated standby condition.

4. The test will demonstrate the operation of the diesel generator during loading, including complete loss of load, with verification of voltage requirements and overspeed limits.

5. The ability to synchronize the generator, while under load, with offsite power sources will be demonstrated.

6. The test will demonstrate proper operation of the diesel generator under full rated load and overload conditions.

7. All applicable alarms and annunciators will be verified for proper operation in conjunction with the tests performed.

8. The manual and automatic features for each standby diesel generator fuel oil transfer pump are tested for proper operation.

Acceptance Criteria

1. The HPCS diesel generator starts, accelerates to rated speed, voltage, and frequency within 13 sec of receipt of a start signal.

2. Diesel generator voltage requirements are maintained, and overspeed limits are not exceeded during a complete loss of load.

3. With the generator connected to the emergency or equivalent load, it can be synchronized and load transferred to the offsite power source.

TABLE 14.2-126
(Sheet 3 of 3)

HPCS DIESEL GENERATOR

System 100B

4. The engine jacket water system functions as designed to maintain engine temperature within design limits in both standby and operating conditions.

5. The diesel generator lubrication oil system functions to lubricate engine bearings and other moving parts and maintain the engine in a warm prelubricated standby condition.

6. The diesel generator fuel oil transfer pumps start automatically when a day tank low level occurs and stop automatically when a day tank high level occurs.

7. Each air compressor is capable of recharging the receivers from minimum to maximum operating pressure in 30 min or less.

8. The starting air supply is capable of starting the diesel generators five times from maximum operating pressure without recharging.

9. The diesel generator can maintain full rated load at normal operating voltage and frequency without exceeding any operational limits.

10. The diesel generator can maintain operating voltage and frequency during an overload condition equivalent to its 2-hr rating for 2 hr.

TABLE 14.2-127

THE INFORMATION ON THIS PAGE HAS BEEN DELETED

TABLE 14.2-128
(Sheet 1 of 1)

REDUNDANT REACTIVITY CONTROL SYSTEM

System 106

Test Objectives

1. To demonstrate the operation of the RRCS, its components, and interconnecting systems that perform the RRCS function.

2. To ensure the system is properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed for the RRCS and all interconnecting systems; i.e., CRD, reactor recirculation, feedwater, SLC, nuclear boiler, RWCU, and NMS.

2. The system is turned over to NMPC.

Test Procedure

1. The test procedures ensure that all components, controls, logic, and interlocks are checked for proper operation.

2. All applicable alarms are verified in conjunction with the tests performed.

3. All automatic signals and actuations are verified by simulated signal or actual parameter variation.

4. All system interfaces and interactions are verified.

Acceptance Criteria

1. All applicable interlocks and trips function as described in Section 7.6.1.8.

2. All automatic actuations function as described in Sections 7.6.1.8 and 15.8.3.1.

TABLE 14.2-129
(Sheet 1 of 3)

LOSS OF POWER/ECCS FUNCTIONAL TEST

Test Objectives

1. To demonstrate the onsite electrical distribution systems in conjunction with the ECCS system during simulated emergency.

2. To ensure the systems are properly designed and constructed.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests of the electrical system are complete and the system turned over to NMPC.

2. Valve lineups are completed.

3. The following systems must be available on a normal operational mode to support testing: service water, diesel generators, diesel generator HVAC, RHR, RCIC, HPCS, LPCS, process computer, control building HVAC, RPS, reactor recirculation, and reactor building HVAC, standby gas treatment, and their preoperational tests complete.

4. Reliability testing of the standby and HPCS diesel generators is complete.

Test Procedure

1. The test will demonstrate proper normal, emergency, and standby power system response to a loss of the 115-kV distribution system, independently and simultaneously, both with and without LOCA/containment isolation signals.

2. The test will verify that there is no voltage present at selected nonenergized buses.

TABLE 14.2-129
(Sheet 2 of 3)

LOSS OF POWER/ECCS FUNCTIONAL TEST

3. Redundancy and independence of the emergency distribution systems will be demonstrated by simulating losses of redundant divisions and verifying the correct operation of the operable division and nonoperation of the de-energized buses/equipment.

   5. The test will verify the capability of the diesel generator to:

   a. Start and assume the design loads for a LOCA/containment isolation and/or LOOP in the specific sequential loading times from cold (normal/standby) temperatures. At least one sequence will be performed from hot (normal operating) temperatures.

   b. Maintain voltage and frequency during loading.

   c. Reject the largest single load any time after the design loading sequence is complete.

5. The test will verify that the emergency loads can operate with the minimum and maximum design ac voltages available.

6. Temperature rise on all large power transformers will be verified under maximum available load.*

7. Voltage drops will be verified between load centers and MCCs at maximum available load* and extrapolated to rated load conditions.

8. Voltage drops between MCCs and selected motor loads, representative of the most severe set of load and cable sizes and cable length, will be verified to be within acceptable limits.

____

* Maximum loads available in-plant not exceeding the rating of the equipment.

TABLE 14.2-129
(Sheet 3 of 3)

LOSS OF POWER/ECCS FUNCTIONAL TEST

9. The test will demonstrate that the normal ac power system can provide sufficient power to start, accelerate, and run the ECCS and selected normal plant loads* during simulated LOCA conditions.

Acceptance Criteria

1. Systems required to operate during LOCA and/or LOOP conditions operate within time and load requirements of their design, in accordance with Section 8.3.

2. In the event one diesel generator becomes unavailable, the remaining two diesels will be capable of feeding the loads necessary for safe plant shutdown in accordance with Section 8.3.

3. The failure of any one electrical division does not affect the operation of the others or their LOCA/containment isolation functions.

4. The diesel generators can start and assume their LOCA/containment isolation and/or loss of power loads in the specified times and sequence, while maintaining voltage and frequency within specified limits from both cold (normal standby) and hot (operating) temperatures.

5. On a loss of the largest single load, the increase in the diesel generator speed does not exceed 75 percent of the difference between the nominal speed and the overspeed trip setpoint or 15 percent of the nominal, whichever is less.

6. The design emergency loads can start and run properly under minimum and maximum ac voltage conditions.

7. The temperatures on the larger power transformers do not exceed the transformer's maximum rated temperature while carrying maximum available load.

8. Voltage drops from load centers to MCCs and MCCs to motor loads shall be within design requirements.

9. The ECCS loads can be started, accelerated, and run while being supplied from normal offsite or standby ac power systems.

TABLE 14.2-130

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TABLE 14.2-131
(Sheet 1 of 1)

STRUCTURAL INTEGRITY
INTEGRATED LEAK RATE TEST

Test Objectives

1. To verify the overall structural integrity of the primary containment.

2. To determine primary containment leakage rates with the containment at test pressure.

Safety Precaution

Follow NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and the primary containment turned over to NMPC.

2. All applicable power sources to supply electric power to control circuits and instrumentation are available.

3. Valve lineups are completed.

Test Procedure

1. The test verifies the primary containment integrity by pressurizing it to test pressure and conducting integrated leak rate measurements on the primary containment.

2. The primary containment leakage monitoring system will be used to monitor containment pressure during the test.

Acceptance Criteria

1. All leak rates from penetrations, valves, and overall containment are demonstrated to be within design limits.

2. Test pressures and allowable leakage rates are within limits of Table 6.2-60.

TABLE 14.2-132
(Sheet 1 of 1)

SECONDARY CONTAINMENT LEAKAGE TEST

Test Objectives

To verify overall secondary containment integrity by subjecting the reactor building to a specified negative pressure and ensuring that the in-leakage is within design limits.

Safety Precautions

Follow all NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are complete and the structures turned over to NMPC.

2. All applicable power sources to supply electric power to motors, control circuits, and instrumentation are available.

3. Valve lineups are complete.

4. Reactor building ventilation and SGTSs are available.

5. Reactor building airlocks are installed and can be operated to support the test.

6. Reactor building conduit, pipe, and other structural penetrations are sealed.

Test Procedure

With the SGTS operating at a specific capacity to maintain the reactor building internal structure at a specified negative pressure, the resultant in-leakage will be verified.

Acceptance Criteria

The reactor building leakage rate is not greater than 3,190 scfm, as described in Section 6.2.3.1.

TABLE 14.2-201
(Sheet 1 of 2)

CHEMICAL AND RADIOCHEMICAL

Startup Test (SUT-1)

Test Objectives

1. To secure information on the chemistry and radiochemistry of the reactor coolant.

2. To verify that the sampling equipment, procedures, and analytic techniques are adequate to demonstrate that the chemistry of all parts of the entire reactor system meets 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 OFG system, and calibration of certain process instrumentation. Data for these purposes are secured from a variety of sources: plant operating records, regular routine coolant analysis, radiochemical measurements of specific nuclides, and special chemical tests.

Prerequisites

The preoperational tests have been completed, the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

Prior to fuel loading, a complete set of chemical and radiochemical samples are 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 are taken and measurements are made to determine the chemical and

TABLE 14.2-201
(Sheet 2 of 2)

CHEMICAL AND RADIOCHEMICAL

Startup Test (SUT-1)

radiochemical quality of reactor water and reactor feedwater, amount of radiolytic gas in the steam, gaseous activities leaving the air ejectors, delay times in the offgas lines, and performance of filters and demineralizers.

Calibrations are made of monitors in the stack, liquid waste system, and liquid process lines.

The following tests are performed:

Action	Test Conditions
1. Reactor water chemistry and radiochemistry	a. Prior to fuel loading
2. Gaseous and liquid effluents activity monitor	b. During heatup
	c. Subsequent to major changes in power level

Acceptance Criteria

Level 1:

1. Chemical factors defined in the Technical Specifications and fuel warranty are maintained within the limits specified.

2. The activity of gaseous and liquid effluents conforms to license limitations.

3. Water quality is known at all times and remains within the guidelines of the water quality specifications.

Level 2:

Not applicable.

TABLE 14.2-202
(Sheet 1 of 2)

RADIATION MEASUREMENT

Startup Test (SUT-2)

Test Objectives

1. To determine the background radiation levels in the plant environs prior to operation for base data on activity buildup.

2. To monitor radiation at selected power levels to assure the protection of personnel during plant operation.

Prerequisites

The appropriate preoperational tests have been completed; the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

A survey of natural background radiation throughout the plant site is made prior to fuel loading. Subsequent to fuel loading, during reactor heatup and at power levels of approximately 25, 60, and 100 percent of rated power, gamma radiation level measurements and, where appropriate, neutron dose rate measurements are made at specific locations throughout the plant. All potentially high radiation areas are surveyed.

The following tests are performed:

Action	Test Conditions
1. Background radiation	a. Prior to fuel loading level survey b. After fuel loading but prior to initial criticality
2. Monitor radiation level periodically during the startup	a. Reactor heatup b. Steady-state operation at approximately 25, 60, and 100 percent of rated power

TABLE 14.2-202
(Sheet 2 of 2)

RADIATION MEASUREMENT

Startup Test (SUT-2)

Acceptance Criteria

Level 1:

The radiation doses of plant origin and the occupancy times of personnel in radiation zones are controlled consistent with the requirements of the standards for protection against radiation outlined in 10CFR20.

Level 2:

Not applicable.

TABLE 14.2-203
(Sheet 1 of 2)

FUEL LOADING

Startup Test (SUT-3)

Test Objective

To load fuel safely and efficiently to the full core size.

Prerequisites

Prerequisites to fuel loading are established in Section 14.2.10 and the tests required thereby are implied in those prerequisites. Also, the SORC has approved fuel loading and the following additional prerequisites have been met to assure that fuel loading is performed in a safe manner:

1. All systems required for fuel loading have undergone preoperational testing.

2. Fuel and control rod inspections are complete. Control rods are installed and tested.

3. SRMs are calibrated and operable. IRMs and APRMs have been preoperationally tested and are operable.

4. SRMs are source checked with a neutron source prior to loading and periodically will be functionally checked and source checked.

5. The status of the reactor building is specified and established.

6. Reactor vessel status is specified relative to internal component placement and this placement established to make the vessel ready to receive fuel.

7. Reactor vessel water level is established and minimum level prescribed.

8. The SLCS is operable.

TABLE 14.2-203
(Sheet 2 of 2)

FUEL LOADING

Startup Test (SUT-3)

Test Procedure

1. Prior to fuel loading, control rods and neutron sources and detectors are installed and tested. Fuel loading will begin near a SRM location. Loading will spiral outward from this location to the fully loaded configuration. A shutdown margin demonstration on the partially loaded core is performed during the loading.

Acceptance Criteria

Level 1:

The partially loaded core shutdown margin demonstration verifies that the configuration is subcritical by at least 0.38-percent $\Delta K/K$ with the analytically determined strongest rod fully withdrawn.

Level 2:

Not applicable.

TABLE 14.2-204
(Sheet 1 of 2)

FULL CORE SHUTDOWN MARGIN

Startup Test (SUT-4)

Test Objectives

The purpose of this test is to demonstrate that the reactor can be made subcritical with the required margin at any point throughout the fuel cycle with the strongest worth control rod fully withdrawn and all other control rods fully inserted.

Prerequisites

The appropriate preoperational tests have been completed, and the SORC has reviewed and approved the test procedures and initiation of testing.

Test Procedure

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. The approach to criticality will be performed cautiously to prevent achieving criticality within a period shorter than 30 sec. If the highest worth rod will not be withdrawn in sequence, other rods may be withdrawn providing the reactivity worth is equivalent. The difference between the measured K_{eff} and the calculated K_{eff} for the in-sequence critical will be applied to the calculated value to obtain the true shutdown margin.

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 percent $\Delta k/k$ with the analytically strongest rod (or its reactivity equivalent) withdrawn. If the shutdown margin is measured at some time during the cycle other

TABLE 14.2-204
(Sheet 2 of 2)

FULL CORE SHUTDOWN MARGIN

Startup Test (SUT-4)

than the most reactive time, compliance with the above criterion is shown by demonstrating that the shutdown margin is 0.38 percent $\Delta k/k$ plus an exposure-dependent increment which adjusts the shutdown margin at that time to the minimum shutdown margin.

Level 2:

Criticality should occur within ± 1.0 percent $\Delta k/k$ of the predicted criticality in accordance with the Technical Specifications. Criticality prediction shall be included in the test procedure.

TABLE 14.2-205

THE INFORMATION ON THIS TABLE HAS BEEN DELETED

TABLE 14.2-206
(Sheet 1 of 4)

CONTROL ROD DRIVE SYSTEM

Startup Test (SUT-5)

Test Objectives

1. To demonstrate that the CRD system operates properly over the full range of primary coolant temperatures and pressures from ambient to operating.

2. To determine the initial operating characteristics of the entire CRD system.

Prerequisites

The appropriate preoperational tests have been completed. The SORC has reviewed and approved the test procedures and initiation of testing. The CRD manual control system preoperational testing must be completed on CRDs being tested. The reactor vessel, closed loop cooling water system, condensate supply system, and instrument air system must be operational to the extent required to conduct the test.

Test Procedure

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 CRDs operate properly when installed, they are tested periodically during heatup to assure that there is no significant binding caused by thermal expansion of the core components. A list of all CRD tests to be performed during startup testing is as follows:

TABLE 14.2-206
(Sheet 2 of 4)

CONTROL ROD DRIVE SYSTEM

Startup Test (SUT-5)

CONTROL ROD DRIVE SYSTEM TESTS

		Test Conditions Reactor Pressure with Core Loaded psig (kg/cm^2)			
Action	Accumulator Pressure	0	600 (42.2)	800 (56.2)	Rated
Position Indication		All			
Normal Stroke Times Insert/ Withdraw		All			4*
Coupling		All***			
Friction		All			4*
Scram	Normal	All	4*	4*	All
Scram	Minimum	4*			
Scram	Zero				4*
Scram	Normal				4**

* Refers to four CRDs selected for continuous monitoring based on slow normal accumulator pressure scram times or unusual operating characteristics, at zero reactor pressure or rated reactor pressure when this data is available. The four selected CRDs must be compatible with the rod worth minimizer, RSCS system, and CRD sequence requirements.

TABLE 14.2-206
(Sheet 3 of 4)

CONTROL ROD DRIVE SYSTEM

Startup Test (SUT-5)

NOTE: RSCS function removed in RFO14 with ECP-13-000084.

** Scram times of the four slowest CRDs (based on scram data at rated pressure) will be determined at test conditions 1, 2, and 6 during planned reactor scrams.

*** Establish that this check is normal operating procedure.

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

Criteria

Level 1:

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

2. The mean scram time of all operable CRDs must not exceed the following times: (Scram time is measured from the time the pilot scram valve solenoids are de-energized.)

Position Inserted from Fully Withdrawn	Scram Time (Seconds)
45	0.43
39	0.86
25	1.93
05	3.49

3. The mean scram time of the three fastest CRDs in a two-by-two array must not exceed the following times: (Scram time is measured from the time the pilot scram valve solenoids are de-energized.)

TABLE 14.2-206
(Sheet 4 of 4)

CONTROL ROD DRIVE SYSTEM

Startup Test (SUT-5)

Position Inserted from Fully Withdrawn	Scram Time (Seconds)
45	0.45
39	0.92
25	2.05
05	3.70

4. The maximum scram insertion time of each control rod from the fully withdrawn position to notch position 5, based on de-energization of the scram pilot solenoids as time zero, shall not exceed 7.0 sec.

Level 2:

1. Each CRD must have a normal insert or withdraw speed of 3.0 ± 0.6 ips (7.62 ± 1.52 cm/sec), indicated by a full 12-ft stroke in 40 to 60 sec.

2. With respect to the CRD friction tests, if the differential pressure variation exceeds 15 psid (1.1 kg/cm^2) 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 (2.1 kg/cm^2), nor should it vary by more than 10 psid (0.7 kg/cm^2) over a full stroke.

TABLE 14.2-207
(Sheet 1 of 2)

SOURCE RANGE MONITOR PERFORMANCE

Startup Test (SUT-6)

Test Objective

To demonstrate that the operational sources, SRM instrumentation, and rod withdrawal sequences provide adequate information to achieve criticality and increase power in a safe and efficient manner.

Prerequisites

The preoperational tests have been completed, and the SORC has reviewed and approved the test procedure and the initiation of testing. The CRD system must be operational.

Test Procedure

Prior to fuel load commencement SRM operability will be demonstrated as part of Startup Test 3 and the Technical Specifications. Prior to rod withdrawal to initial criticality this test will also demonstrate that SRM signal-to-noise and minimum count rate are in accordance with Technical Specification requirements. During rod withdrawal to initial criticality, SRM response will be monitored and used to determine the proximity to criticality. This rod withdrawal sequence shall specify all control rod withdrawals from all-rods-in to rated power. Once the reactor is critical, proper overlap of the SRMs with the IRMs will be demonstrated.

The following test is performed:

Action	Test Conditions
1. Rod withdrawal in prescribed sequence	a. After fuel loading b. Operational neutron sources installed c. SRM minimum signal-to-noise count ratio and minimum count rate criteria satisfied

TABLE 14.2-207
(Sheet 2 of 2)

SOURCE RANGE MONITOR PERFORMANCE

Startup Test (SUT-6)

2. Verify SRM-IRM overlap	Flux level sufficient for IRM response

Acceptance Criteria

Level 1:

1. There must be a minimum count rate of 3 cps (with a neutron signal count to noise count ratio of at least 2:1) or a minimum count rate of 0.7 cps (with a neutron signal count to noise count ratio of at least 20:1) on all of the required operable SRMs in accordance with the Technical Specifications.

2. Each required operable IRM channel must be on scale before the required operable SRMs exceed their rod block setpoint.

Level 2:

Not applicable.

TABLE 14.2-208

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TABLE 14.2-209
(Sheet 1 of 2)

INTERMEDIATE RANGE MONITOR PERFORMANCE

Startup Test (SUT-10)

Test Objective

To adjust the IRM system to obtain an optimum overlap with the SRM and APRM systems.

Prerequisites

The preoperational tests have been completed. The SORC has reviewed and approved the test procedures and the initiation of testing. All SRMs and pulse preamplifiers, IRMs and voltage preamplifiers, and APRMs have been calibrated in accordance with vendor's instructions.

Test Procedure

Initially the IRM system is set to maximum gain. After the APRM calibration, the IRM gains are adjusted to optimize the IRM overlap with the SRMs and APRMs.

The following tests are performed:

Action	Test Conditions
1. Verify IRM response to neutron flux	Flux level sufficient for IRM response
2. Adjust IRM gain, if necessary, for proper IRM-APRM overlap	During first APRM calibration based on a heat balance

Acceptance Criteria

Level 1:

1. Each APRM must be on scale before the IRMs exceed their upscale rod block setpoint.
2. The IRMs produce a scram as specified in the Technical Specifications with the reactor mode switch in startup.

TABLE 14.2-209
(Sheet 2 of 2)

INTERMEDIATE RANGE MONITOR PERFORMANCE

Startup Test (SUT-10)

Level 2: Each IRM channel must be adjusted so that at least a half-decade overlap with the SRMs and a one-decade overlap with the APRMs is assured.

TABLE 14.2-210
(Sheet 1 of 1)

LPRM CALIBRATION

Startup Test (SUT-11)

Test Objective

To calibrate the LPRM system.

Prerequisites

The appropriate preoperational tests have been completed, the SORC has reviewed and approved the test procedures and the initiation of testing. Instrumentation for calibration has been checked and installed.

Test Procedure

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

The following tests are performed:

Action	Test Conditions
1. Verify LPRM flux response. This test may be done in conjunction with rated pressure scram testing (SUT-5)	a. Hot standby or TC-1
2. Take data and calibrate LPRM system	a. TC-2, 3, and TC-6 b. All systems in NORM mode

Acceptance Criteria

Level 1:

Not applicable.

Level 2:

Each LPRM reading is within 10 percent of its calculated value.

TABLE 14.2-211
(Sheet 1 of 2)

APRM CALIBRATION

Startup Test (SUT-12)

Test Objective

To calibrate the APRM system.

Prerequisites

The preoperational tests have been completed, and the SORC has reviewed and approved the test procedures and the initiation of testing. Instrumentation for calibration has been checked and installed.

Test Procedure

A heat balance is performed daily and after each major power level change. Each APRM channel reading is adjusted to be consistent with the core thermal power as determined from the heat balance in accordance with the Technical Specifications. During heatup a preliminary calibration is 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 are recalibrated in the power range by a heat balance as soon as adequate feedwater indication is available.

Recalibration of the APRM system is in accordance with the Technical Specifications.

The following tests are performed:

Action	Test Conditions
1. Calibrate APRM system based on heat balance data	Constant rate of heatup below rated pressure
2. Calibrate APRM system based on steady-state heat balance data	Above approximately 25 percent power at TC-2, 3, 5, and 6 and repeated as necessary

TABLE 14.2-211
(Sheet 2 of 2)

APRM CALIBRATION

Startup Test (SUT-12)

Acceptance Criteria

Level 1:

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

2. APRM upscale scram and rod block trip setpoints do not exceed the allowable values specified in the Technical Specifications.

3. In the startup mode, all APRM channels produce a scram at less than or equal to 15 percent 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, MLHGR, and fraction of rated power to within (+2, -0) percent of rated power.

TABLE 14.2-212
(Sheet 1 of 3)

NSSS PROCESS COMPUTER

Startup Test (SUT-13)

Test Objective

To verify the performance of the NSSS process computer under plant operating conditions.

Prerequisites

The preoperational tests have been completed and the SORC has reviewed and approved the test procedures and initiation of testing. Computer diagnostic test is completed. Construction and construction testing on each input instrument and its cabling are completed.

Test Procedure

Computer system program verification and calculational program validations at static and at simulated dynamic input conditions are preoperationally tested at the computer supplier's site and following delivery to the plant site. Following fuel loading, during plant heatup and the ascension to rated power, the NSSS and the BOP system process variables sensed by the computer as digital or analog signals become available. Verify that the computer is receiving correct values of sensed process variables and that the results of performance calculations of the NSSS and the BOP are correct. At steady-state power conditions the dynamic system test case is performed.

As discussed in Core Performance Tests (SUT-19), the BUCLE offline computation system will be used to evaluate core performance until the process computer performance is verified. A manual computation method is available at the site if either the process computer or BUCLE is not available.

The following tests are performed:

Action	Test Conditions
1. Computer/TIP interface	Items 1 and 2 do not require reactor operation

TABLE 14.2-212
(Sheet 2 of 3)

NSSS PROCESS COMPUTER

Startup Test (SUT-13)

Action	Test Conditions
2. Simulated dynamic input test	
3. Dynamic system test case	To be completed between TC-1 and TC-3
4. Obtain data for transmittal to San Jose	a. Reactor power greater than 80% of rated b. Core flow at 100 percent of rated c. A full core LPRM calibration (OD1) must be completed immediately prior to data taking or the most recent P1 log contains no "Base Crit Codes" d. Scheduled control rod pattern

Acceptance Criteria

Level 1:

Not applicable.

Level 2:

Programs OD-1, P1, and OD-6 are considered operational when:

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

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

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NSSS PROCESS COMPUTER

Startup Test (SUT-13)

b. For the case in which the MCPR calculated by the process computer is in a different assembly than that calculated by BUCLE, for each assembly, the MCPR and CPR calculated by the two methods agree within 2 percent.

2. The maximum linear heat generation rates (LHGRs) calculated by BUCLE and the process computer either:

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

   b. For the case in which the maximum LHGR calculated by the process computer is in a different assembly than that calculated by BUCLE, for each assembly, the maximum LHGR and LHGR calculated by the two methods agree within 2 percent.

3. The maximum average planar LHGRs (MAPLHGR) calculated by BUCLE and the process computer either:

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

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

4. The LPRM gain adjustment factors calculated by BUCLE and the process computer agree within 2 percent.

NOTE: The remaining programs are considered operational upon successful completion of the static and dynamic testing.

TABLE 14.2-213
(Sheet 1 of 4)

RCIC SYSTEM

Startup Test (SUT-14)

Test Objectives

1. To verify the proper operation of the RCIC system over its expected operating pressure and flow ranges.

2. To demonstrate reliability in automatic starting from cold standby when the reactor is at power conditions.

Prerequisites

The appropriate preoperational tests have been completed and the SORC has reviewed and approved the test procedures and the initiation of testing. Initial turbine operation (uncoupled) must be performed to verify satisfactory operation and overspeed trip. The auxiliary steam system is available to supply turbine steam. Instrumentation has been installed and calibrated, and sufficient water is available to meet specified purity requirements. The following systems must be operational to the extent necessary to conduct the test: reactor vessel, suppression pool, condensate supply system, and instrument air.

Test Procedure

The RCIC system is designed to be tested in two ways: flow injection into a test line leading to the condensate storage tank (CST) and flow injection directly into the reactor vessel. The first set of CST injections consists of manual and automatic starts at 150 psig and near rated reactor pressure. The pump discharge pressure during these tests is throttled to $\geq$100 psi above reactor pressure to simulate the largest expected pipeline pressure drop. This CST testing is done to demonstrate general system operability and for making most controller adjustments.

Reactor vessel injection tests follow to complete the controller adjustments and to demonstrate automatic starting from a cold (ambient temperature for RCIC operation) standby condition. Cold is defined as a minimum 72 hrs without any kind of RCIC operation.

TABLE 14.2-213
(Sheet 2 of 4)

RCIC SYSTEM

Startup Test (SUT-14)

After all final controller and system adjustments have been determined, a defined set of demonstration tests must be performed with that one set of adjustments. Two consecutive reactor vessel injections starting from cold conditions in the automatic mode must satisfactorily be performed to demonstrate system reliability. Following these tests, a set of CST injections are done to provide a benchmark for comparison with future surveillance tests.

After the auto start portion of certain of the above tests is completed, and while the system is still operating, small step disturbances in speed and flow command are input (in manual and automatic mode, respectively) to demonstrate satisfactory stability. This is done at both low (above minimum turbine speed) and near rated flow initial conditions to span the RCIC operating range.

A demonstration of expanded operation of up to 2 hr (or until pump and turbine oil temperature are stabilized) of continuous running at rated flow is scheduled at a convenient time during the test program.

Differential pressures measured during rated steam flow will be used to establish appropriate high steam flow setpoints.

The following tests are performed:

Action	Test Conditions
1. CST injection first phase manual start	a. For all RCIC testing; recirculation in POS mode and all other controllers in NORM mode b. Demonstration at 150 psig reactor pressure c. Rated reactor pressure RCIC discharge ≥100 psi above RPV
2. CST injection, step changes in flow for controller adjustments	Immediately after 1c with RCIC discharge to CST. Manual and automatic control modes

TABLE 14.2-213
(Sheet 3 of 4)

RCIC SYSTEM

Startup Test (SUT-14)

3. CST injection, extended operation demonstration	In conjunction with 2.
Action	**Test Conditions**
4. CST injection, second phase. Hot quick stability demonstration	a. Rated reactor pressure, RCIC discharge ≥100 psi start followed by above RPV b. 150 psig reactor pressure, RCIC discharge ≥100 psi above RPV
5. Reactor vessel injection, manual start, step changes for controller adjustments	Rated reactor pressure, manual and automatic modes
6. Reactor vessel injection hot quick start	Rated reactor pressure, automatic mode
7. Reactor vessel injection, hot or cold quick start followed by stability demonstration	150 psig reactor pressure, manual and automatic modes
8. Confirmatory reactor vessel injection, cold quick start	Rated reactor pressure, final RCIC controller settings
9. Second consecutive confirmatory reactor vessel injection, cold quick start	Same as 8
10. Condensate storage tank injection for surveillance test base data, cold quick start	a. Rated reactor pressure, final controller settings, RCIC discharge ≥100 psi above RPV b. 150 psig reactor pressure, final controller settings, RCIC discharge ≥100 psi above RPV

TABLE 14.2-213
(Sheet 4 of 4)

RCIC SYSTEM

Startup Test (SUT-14)

Acceptance Criteria Level 1: 1. The average pump discharge flow is equal to or greater than the 100-percent rated value after 30 sec have elapsed from automatic initiation at any reactor pressure between 150 psig and rated. 2. The RCIC turbine does not trip on overspeed during auto or manual starts. If any Level 1 criteria are not met, the reactor is only allowed to operate up to a restricted power level defined by Figure 14.2-213-1 until the problem is resolved. Also, consult the plant Technical Specifications for actions to be taken. Level 2: 1. In order to provide an overspeed trip avoidance margin, the transient start first and subsequent speed peaks must not exceed 5 percent above the rated RCIC turbine speed. 2. The speed and flow control loops are adjusted so that the decay ratio of any RCIC system-related variable is not greater than 0.25. 3. The turbine gland seal condenser system is capable of preventing steam leakage to the atmosphere. 4. The ΔP switch for the RCIC steam supply line high-flow isolation trip is calibrated to actuate at less than or equal to 300 percent and greater than 272 percent of the maximum required steady-state flow.

TABLE 14.2-214
(Sheet 1 of 2)

SELECTED PROCESS TEMPERATURES

Startup Test (SUT-16A)

Test Objective

The purposes of this test are:

1. To ensure 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 plant personnel with temperature differential limitations of the reactor system.

Prerequisites

The preoperational tests have been completed, and the SORC has reviewed and approved the test procedures and initiation of testing. System and test instrumentation have been calibrated.

Test Procedure

The adequacy of bottom drain line temperature sensors will be determined by comparison with recirculation loop coolant temperature when core flow is 100 percent 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. The effects of cleanup flow on vessel temperature stratification will be investigated as operational limits allow. Utilizing this data, it can be

TABLE 14.2-214
(Sheet 2 of 2)

SELECTED PROCESS TEMPERATURES

Startup Test (SUT-16A)

determined whether coolant temperature stratification occurs when the recirculation pumps are on and, if so, what minimum recirculation flow will prevent it.

Monitoring the preceding 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.

The following test is performed:

Action	Test Conditions
Monitor vessel temperatures	1. During heatup 2. At 100 percent core flow (TC-3) 3. After recirculation pump trips (natural circulation)

Acceptance Criteria

Level 1:

1. The reactor recirculation pumps shall not be started, flow increased, nor power increased unless the coolant temperatures between the steam dome and bottom head drain are within 145°F.

2. 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 idle loop suction temperature is within 50°F of the active loop suction temperature and the active loop flow rate is less than or

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SELECTED PROCESS TEMPERATURES

Startup Test (SUT-16A)

equal to 50 percent of rated loop flow. 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 coolant temperature as measured by the bottom drain line thermocouple is within 30°F of the recirculation loop temperature.

TABLE 14.2-215
(Sheet 1 of 2)

WATER LEVEL REFERENCE AND VARIABLE LEG TEMPERATURES

Startup Test (SUT-16B)

Test Objective

To measure the reference and variable leg temperatures and recalibrate the instruments if the measured temperatures are different from the values assumed during the initial calibration.

Prerequisites

The preoperational tests have been completed, the SORC has reviewed and approved the test procedures and initiation of testing. System and test instrumentation have been calibrated.

Test Procedures

To monitor the reactor vessel water level, five level instrument systems are provided. These systems and their functions are:

1. Shutdown range - water level measurement in cold, shutdown condition.

2. Narrow range - feedwater flow and water level control functions.

3. Wide range - safety functions.

4. Fuel range - post-accident indication.

5. Upset range - water level measurement during transient conditions.

The test for the narrow range, wide range, and upset range level instruments will be done during steady-state conditions at rated temperature and pressure. The test for the shutdown range level instrument will be done during cold ambient conditions with the reactor shut down. No test is possible for

TABLE 14.2-215
(Sheet 2 of 2)

WATER LEVEL REFERENCE AND VARIABLE LEG TEMPERATURES

Startup Test (SUT-16B)

the fuel zone water level instrument by virtue of its calibration conditions (i.e., LOCA conditions). The testing will verify that the reference and variable leg temperatures of the instrument are the values assumed during calibration. If not, the instruments will be recalibrated using the measured reference and variable leg temperatures.

Action	Test Conditions
Monitor drywell temperature	Hot standby with steady drywell temperatures

Acceptance Criteria

Level 1:

Not applicable.

Level 2:

The difference between the actual reference and variable leg temperature(s) and the value(s) assumed during initial calibration shall be less than that amount which will result in a scale end point error of 1 percent of the instrument span for each range.

TABLE 14.2-216
(Sheet 1 of 2)

SYSTEM EXPANSION

Startup Test (SUT-17)

Test Objectives

To demonstrate that:

1. The piping system during system heatup and cooldown is free to expand and move without unplanned obstruction or restraint.

2. The piping does shake down after a few thermal expansion cycles.

3. The measured values of displacement are within the limits specified by the responsible piping design engineer.

Prerequisites

The appropriate preoperational tests have been completed, and the SORC has reviewed and approved the test procedures and initiation of testing.

Test Procedure

During initial heatup, a visual inspection is made at an intermediate reactor water temperature to ensure that components are free to move as designed. Corrections are made as necessary. Devices for continuously measuring pipe displacement are mounted on the recirculation lines, and motion during heatup is compared with calculated values. Final sensor locations are determined at the site and based on generic recommendations. After receipt of the installed transducer locations, the plant piping design subsection will supply to the startup engineer the expected thermal displacements (Level 2 limits) and the allowable thermal displacements (Level 1 limits) for the above piping and related conditions. These displacements will be specific to each transducer for each coordinate direction.

TABLE 14.2-216
(Sheet 2 of 2)

SYSTEM EXPANSION

Startup Test (SUT-17)

Action	Test Conditions
1. Visual inspection	a. All control systems in NORM mode b. Approximately 275°F at accessible locations c. At ambient and rated temperature
2. Record displacement sensor readings	a. At approximately 275°F b. At approximately 400 to 450°F c. At approximately rated recirculation temperature d. Repeat c for approximately two to four heatup and cooldown cycles

Acceptance Criteria

Level 1:

1. There shall be no obstructions which will interfere with the thermal expansion of the recirculation piping systems.

2. The displacements at the established transducer locations shall not exceed the allowable values provided by the plant piping design subsection. The allowable values of displacement shall be based on not exceeding ASME Section III Code stress allowables.

Level 2:

The displacements at the established transducer locations shall not exceed the expected values provided by the plant piping design subsection.

TABLE 14.2-216A

THE INFORMATION ON THIS PAGE HAS BEEN DELETED

TABLE 14.2-217
(Sheet 1 of 2)

TIP UNCERTAINTY

Startup Test (SUT-18)

Test Objective

To determine the reproducibility of the TIP system readings.

Prerequisites

System installation has been completed and preoperational tests completed and verified. The SORC has reviewed and approved the test procedure and initiation of testing. The TIP detector, ball valve time delay, core top and bottom limits, clutch, x-y recorder, and purge system are operational. Instrumentation has been calibrated and installed.

Test Procedure

TIP reproducibility consists of a random noise component and a geometric component. The geometric component is due to a variation in the water gap geometry and TIP tube orientation from TIP location to location. Measurement of these components is obtained by taking repetitive TIP readings at a single TIP location, and by analyzing pairs of TIP readings taken at TIP locations that are symmetrical about the core diagonal of fuel loading symmetry.

TIP data is taken at greater than 70-percent rated thermal power. The TIP data are taken with the reactor operating with an octant symmetric rod pattern and at steady-state conditions.

The total TIP reproducibility is obtained by dividing the standard deviation of the symmetric TIP pair nodal ratios by $\sqrt{2}$. The nodal TIP ratio is defined as the nodal BASE value of the TIP in the lower right half of the core divided by its symmetric counterpart in the upper left half. The total TIP reproducibility value that is compared with the test criterion is the average value of the data sets taken.

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TIP UNCERTAINTY

Startup Test (SUT-18)

The random noise uncertainty is obtained from successive TIP runs made at the common hole, with each of the TIP machines making six runs. The standard deviation of the random noise is derived by taking the square root of the average of the variances at nodal levels 5 through 22, where the nodal variance is obtained from the fractional deviations of the successive TIP values about their nodal mean value.

The geometric component of TIP reproducibility is obtained by statistically subtracting the random noise component from the total TIP reproducibility.

The following test is performed:

Action	Test Conditions
TIP overall uncertainty	a. Octant symmetric control rod pattern b. At steady state c. Greater than 70 percent rated thermal power

Acceptance Criteria

Level 1:

Not applicable.

Level 2:

The total TIP uncertainty (including random noise and geometrical uncertainties) obtained by averaging the uncertainties for all data sets shall be less than 6.0 percent.

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(Sheet 1 of 2)

CORE PERFORMANCE

Startup Test (SUT-19)

Test Objectives

1. To evaluate the core thermal power and flow.

2. To evaluate whether the following core performance parameters are within limits:

    a. MLHGR.

    b. MCPR.

    c. MAPLHGR.

Prerequisites

The preoperational tests have been completed and the SORC has reviewed and approved the test procedure and initiation of testing. System instrumentation has been installed and calibrated and test instrumentation calibrated.

Test Procedure

Core performance evaluation is employed to determine the principal thermal and hydraulic parameters associated with core behavior. These parameters are:

1. Core flow rate.

2. Core thermal power level.

3. MLHGR.

4. MAPLHGR.

5. MCPR.

These core performance parameters are evaluated by manual calculation techniques 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 proven that it agrees with BUCLE within 2 percent on all thermal parameters (SUT-13).

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CORE PERFORMANCE

Startup Test (SUT-19)

If neither BUCLE nor the process computer is available the manual calculation techniques can be used for the core performance evaluation.

The following test is performed:

Action	Test Conditions
Evaluate core thermal power, flow, and compute the thermal and hydraulic parameters associated with core behavior. Use plant process computer, offline computer system, or manual calculations	a. TC-1, 2, 3, 5*, and 6 are necessary for documentation

Acceptance Criteria

Level 1:

1. The MLHGR of any rod during steady-state conditions does not exceed the limit specified by the plant Technical Specifications.

2. The steady-state MCPR does not exceed the limits specified by the Technical Specifications.

3. The MAPLHGR does not exceed the limits specified by the Technical Specifications.

4. Steady-state reactor power is limited to rated core thermal power and values on or below the rated power flow control line. Core flow does not exceed its rated value.

Level 2:

Not Applicable.

* At midpower range and natural circulation.

TABLE 14.2-219
(Sheet 1 of 2)

STEAM PRODUCTION

Startup Test (SUT-20)

Test Objective

To demonstrate that the NSSS provides steam sufficient to satisfy all appropriate warranties as defined in the contract.

Prerequisites

Test Procedure

Warranty demonstration consists of recording sufficient data under steady-state conditions to determine the reactor power level, the pressure and quality of the steam, and the steam flow rate from the reactor.

These measurements include the temperature, pressure, and flow rate of feedwater entering the reactor, the energy added to the reactor water by the recirculation drive pumps, the flow rate through and temperature entering and leaving the reactor cleanup system, the flow rate and temperature of the CRD cooling water, the carryover of reactor water into the steam lines, and the steam pressure outside the drywell near the MSIVs.

Each set of measurements is taken at frequent intervals, every 5 or 10 min as appropriate, for a total test run duration of 4 hr. The average measured quantity, suitably corrected for all calibration factors, is used to determine the NSSS output during the test run. Where the contract requires a 100-hr demonstration, two test runs are made, one in the first 50 hr and one in the second 50 hr. The demonstrated output is the average of the values from the two test runs. During the balance of the 100-hr demonstration, the NSSS output is held constant within ±5 percent of the nominal steam flow rate as indicated by the installed plant feedwater instrumentation.

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(Sheet 2 of 2)

STEAM PRODUCTION

Startup Test (SUT-20)

Should the 100-hr warranty run be interrupted once for any reason and a subsequent time for any reason not due to the fault of the customer, subject to the provisions of the contract, it will be repeated. If the test is interrupted a second or subsequent time for any reason due to the fault of the customer or the power grid to which the Station is connected, it will be resumed upon coming to full power and continued until the desired test period is accumulated, provided that the minimum continuous period full-power operation has been 24 hr.

The following test is performed:

Action	Test Conditions
Demonstrate steam quality and flow under steady conditions	a. At conditions prescribed in the nuclear steam system warranty (TC-6) b. Operate continuously for 100 hr

Acceptance Criteria

Level 1:

The NSSS parameters as determined by using normal operating procedures are within the appropriate license restrictions.

Level 2:

The NSSS is 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 MSIVs. 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 the test.

TABLE 14.2-220

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(Sheet 1 of 3)

PRESSURE REGULATOR

Startup Test (SUT-22)

Test Objectives

1. To determine the optimum settings for the pressure control loop by analysis of the transients induced in the reactor pressure control system by means of the pressure regulators.

2. To demonstrate the takeover capability of the backup pressure regulator upon failure of the controlling pressure regulator and to set spacing between the setpoints at an appropriate value.

3. To demonstrate smooth pressure control transition between the control valves and bypass valves when reactor steam generation exceeds steam used by the turbine.

4. To demonstrate that other affected parameters are within acceptable limits during pressure regulator-induced transient maneuvers.

Prerequisites

The preoperational tests have been completed, and the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

The pressure setpoint is decreased rapidly and then increased rapidly by about 10 psi, and the response of the system is measured in each case. It is desirable to accomplish the setpoint change in less than 1 sec. At specified test conditions, the load limit setpoint is set so that the transient is handled by control valves, bypass valves, or both. The backup regulator is tested by simulating a failure of the operating pressure regulator so that the backup regulator takes over control. The response of the system is measured and evaluated, and regulator settings are optimized. At certain conditions, the test results will provide valuable core stability data in the midfrequency range (i.e., 0.1 to 3.0 Hz).

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(Sheet 2 of 3)

PRESSURE REGULATOR

Startup Test (SUT-22)

Test No. 22 - Pressure Regulator

Action		Test Condition				
Operating Mode	Input	1	2	3	5	6
CV	Setpoint	No	Yes	Yes	Yes	Yes
CV	Fail to backup[3]	No	Yes	Yes	No	Yes
BPV	Setpoint	Yes	Yes	No	Yes	Yes
BPV	Fail to backup[3]	Yes	Yes	No	No	Yes
BPV-IN[2]	Setpoint	No	No	Yes	No	No
	Recirculation modes	MAN	MAN	MAN and FLX	MAN	MAN[1] and FLX

Acceptance Criteria

Level 1:

The transient response of any pressure control system-related variable to any test input must not diverge.

[1] Either POS or FLO.
[2] Bypass valve incipient opening test, MAN mode only.
[3] Failure to backup regulator, MAN mode only.

TABLE 14.2-221
(Sheet 3 of 3)

PRESSURE REGULATOR

Startup Test (SUT-22)

Level 2:

1. 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. (This criterion does not apply to tests involving simulated failure of one regulator with the backup regulator taking over.)

2. The pressure response time from initiation of pressure setpoint change to the turbine inlet pressure peak is ≤10 sec.

3. Pressure control system deadband, delay, etc., is small enough that steady-state limit cycles (if any) produce steam flow variations no larger than ±0.5 percent of rated steam flow.

4. For all pressure regulator transients, the peak neutron flux and/or peak vessel pressure shall remain below the scram settings by 7.5 percent and 10 psi, respectively. (Maintain a plot of power versus the peak variable values along the 100-percent rod line.)

5. 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:

Steam Flow Obtained With Valves Wide Open (Percent)	Variation
0 to 85	≤4:1
85 to 97	≤2:1
85 to 99	≤5:1

TABLE 14.2-222
(Sheet 1 of 2)

WATER LEVEL SETPOINT,
MANUAL FEEDWATER FLOW CHANGES

Startup Test (SUT-23A)

Test Objective

To verify that the feedwater control system has been adjusted to provide acceptable reactor water level control.

Prerequisites

The preoperational tests have been completed; the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

Reactor water level setpoint changes of approximately 3 to 6 in are used to evaluate (and adjust if necessary) the feedwater control system settings for all power and feedwater flow control valve modes. The level setpoint changes will also demonstrate core stability to subcooling changes.

The following tests are performed:

Action		Test Condition				
Operating Mode	Input	1	2	3	5	6
3-element	Setpoint	No	Yes	Yes	Yes	Yes
1-element	Setpoint	No	Yes	Yes	Yes	Yes
NORM	Manual flow steps*	No	Yes	Yes	No	No
	Recirculation modes**	MAN	MAN	MAN	MAN	MAN

* Manual flow steps to be done on each flow control valve only when two pumps or more are on, with one or more in automatic mode and the valve to be tested in manual mode.

** Either POS or FLO.

TABLE 14.2-222
(Sheet 1 of 2)

WATER LEVEL SETPOINT,
MANUAL FEEDWATER FLOW CHANGES

Startup Test (SUT-23A)

Acceptance Criteria

Level 1:

The transient response of any level control system-related variable to any test input must not diverge.

Level 2:

1. Level 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.

2. The open loop dynamic response of each feedwater actuator (control valve) to small (<10 percent NBR) step disturbances shall be:

   a. Maximum time to 10 percent of a step disturbance — ≤1.2 sec

   b. Maximum time from 10 percent to 90 percent of a step disturbance — ≤2.1 sec

   c. Peak overshoot (percent of step disturbance) — ≤15 percent

   d. Settling time (100 percent ±5 percent of step distribution) — ≤14.0 sec

3. The average rate of response of the feedwater actuator to large (>10 percent of NBR) step disturbances shall be between 10 and 25 percent nuclear boiler rated feedwater flow/second. This average response rate will be assessed by determining the time required to pass linearly through the 10 percent and 90 percent response points.

4. At steady-state operation for the 3/1 element systems, input scaling to the mismatch gains should be adjusted such that the level error due to biased mismatch gain output should be within ±1 in.

TABLE 14.2-223
(Sheet 1 of 2)

LOSS OF FEEDWATER HEATING

Startup Test (SUT-23B)

Test Objective

To demonstrate adequate response to a feedwater temperature loss.

Prerequisites

The appropriate preoperational tests have been completed; the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

The condensate/feedwater system is studied to determine the single failure that causes the largest loss in feedwater heating. This event is then performed at between 70- and 90-percent power with the recirculation flow near its rated value.

The following test is performed:

Action	Test Condition
Single event that causes largest decrease in feedwater temperature.	During TC-6 reduce power to between about 70- and 90-percent thermal power, and near 100-percent core flow.

Acceptance Criteria

Level 1:

1. For the feedwater heater loss test, the maximum feedwater temperature decrease due to a single-failure case must be ≤100°F. The resultant MCPR must be greater than the fuel thermal safety limit.

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(Sheet 2 of 2)

LOSS OF FEEDWATER HEATING

Startup Test (SUT-23B)

2. The increase in simulated heat flux does not exceed the predicted Level 2 value by more than 2 percent. The predicted value is based on the actual test values of feedwater temperature change and initial power level.

Level 2:

The increase in simulated heat flux does not exceed the predicted value referenced to the actual feedwater temperature change and initial power level.

TABLE 14.2-224
(Sheet 1 of 2)

FEEDWATER PUMP TRIP

Startup Test (SUT-23C)

Test Objective

To demonstrate the capability of the automatic core flow runback feature to prevent low water level scram following the trip of one feedwater pump.

Prerequisites

The preoperational tests have been completed and the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

One of the two operating feedwater pumps is tripped and the automatic recirculation runback circuit acts to drop the power to within the capacity of the remaining feedwater pump. Prior to the test, a simulation of the feedwater pump trip is done to verify the runback capability of the recirculation system.

The recirculation runback is initiated by the pump trip detection equipment and the low water level signal.

The following test is performed:

Action	Test Conditions
Trip feedwater pump to demonstrate recirculation system runback scram avoidance. (The Maximum Feedwater Runout Capability test, SUT-23D, and the Recirculation Pump Runback test, SUT-30D, must have already been done.)	a. TC6 b. All systems in NORM mode.

TABLE 14.2-224
(Sheet 2 of 2)

FEEDWATER PUMP TRIP

Startup Test (SUT-23C)

Acceptance Criteria Level 1: Not applicable. Level 2: The reactor shall avoid low-water-level scram by a 3-in margin from an initial water level halfway between the high- and low-level alarm setpoints.

TABLE 14.2-225
(Sheet 1 of 2)

MAXIMUM FEEDWATER RUNOUT CAPABILITY

Startup Test (SUT-23D)

Test Objective

To determine that the maximum feedwater runout capability is compatible with licensing assumptions.

Prerequisites

The appropriate preoperational tests have been completed; the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

The test is divided into two parts: 1) the initial calibration of the valve controllers, and 2) verification of calibration by measured data, which includes a verification that the maximum feedwater flows do not exceed the flows (different flows at different vessel pressures) in Section 15.1.2.3.2.

1. The valve controller calibration is done by first obtaining vendor pump and valve performance curves. The pump and valve performance curves are then used to determine the valve position corresponding to the maximum allowable flow at rated vessel pressure specified by the FSAR. The high-pressure, high-flow valve leakage will be measured prior to startup and verified to be less than 5 percent NBR. Additionally, for good level control system performance, it is desirable to be able to reach 115.5 percent NBR flow at 1,071 psia and 68 percent NBR flow at 1,021 psia in the one-pump-tripped condition. Adjustable equipment (i.e., valve control loops, feedwater control system function generators, etc.) are set to prevent the feedwater pumps from exceeding their maximum allowed output, and yet allow the desirable performance.

2. During the data collection and verification of calibration portion of the test, pressure, flow, and controller data will be collected between 60 and 100 percent power. Measured data will be compared against expected values to ensure proper calibration. The measured maximum flow will be adjusted to the FSAR pressures using the measured data. The maximum flows stated in the FSAR are used as licensing assumptions; therefore, the FSAR maximum flows should not be exceeded. If, however, the FSAR maximum flows are exceeded, there exist two options. The system can be

TABLE 14.2-225
(Sheet 2 of 2)

MAXIMUM FEEDWATER RUNOUT CAPABILITY

Startup Test (SUT-23D)

adjusted so that the licensing assumption is not exceeded, or an additional penalty can be applied to the ΔCPR. This penalty will be calculated by the appropriate engineering component, and operating limits will be modified, where necessary.

Action	Test Conditions
1. Record master controller output, feedwater pump suction, discharge and reactor pressures, feedwater flow rate and flow control valve positions.	a. Four equally-spaced feedwater flow points. This can be done at TC-3 or any high-power point achieved prior to commercial operation. b. All systems in NORM mode. c. Maximum number of condensate and feedwater pumps normally operated at 100 percent power shall be running.

Acceptance Criteria

Level 1:

Maximum valve position attained shall not exceed the position which will give the following flows with the normal complement of pumps operating.

1. 145 percent NBR at 1060 psig.
2. 155 percent NBR at 1010 psig.

Level 2:

The maximum valve position must be greater than the calculated position required to supply:

1. With rated complement of pumps - 115.5 percent NBR at 1,071 psia.
2. One feedwater pump tripped condition - 68 percent NBR at 1,021 psia.

TABLE 14.2-226
(Sheet 1 of 2)

TURBINE VALVE SURVEILLANCE

Startup Test (SUT-24)

Test Objective

To demonstrate the acceptable procedures and maximum power levels for surveillance testing of the main turbine control and stop valves without producing a reactor scram.

Prerequisites

The appropriate preoperational tests have been completed; the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

Individual main turbine control and stop valves are tested routinely during plant operation as required for turbine surveillance testing. At several test points the response of the reactor is observed, and although it is not required, it is recommended that the maximum possible power level for performance of these tests along the 100-percent load line be established. First actuation should be between 45 and 65 percent power, and used to extrapolate to the next test point between 75 and 90 percent power, and ultimately to the maximum power test condition with ample margin to scram. Note the proximity to APRM flow bias scram point and preconditioning cladding interim operating management recommendation (PCIOMR) envelope. The turbine valves are tested manually and reset. The rate of valve stroking and timing of the close-open sequence are such that the minimum practical disturbance is introduced and that PCIOMR limits are not exceeded.

The following tests are performed:

Action	Test Conditions
1. Individually close turbine stop valves.	a. Between 45 and 65 percent power, and again between 75 and 90 percent power, perform third test at chosen maximum power level for all subsequent surveillance tests along the 100-percent rod line (nonequilibrium xenon).

TABLE 14.2-226
(Sheet 2 of 2)

TURBINE VALVE SURVEILLANCE

Startup Test (SUT-24)

Action	Test Conditions
	b. Mode of recirculation system to be determined by testing (to minimize flux peak, it is recommended that FLX mode be utilized); all others in NORM mode.
2. Individually close turbine control valves.	Perform the same 3-step power optimization procedure as in the above stop valve test.

Acceptance Criteria

Level 1:

Not applicable.

Level 2:

1. Peak neutron flux is at least 7.5 percent below the scram trip setting. Peak vessel pressure remains at least 10 psi below the high-pressure scram setting. Peak heat flux must remain at least 5 percent below its scram trip point.

2. Peak steam flow in each line remains 10 percent below the high flow isolation trip setting.

TABLE 14.2-227
(Sheet 1 of 2)

MAIN STEAM ISOLATION VALVES
FUNCTIONAL TESTS

Startup Test (SUT-25A)

Test Objectives

1. To functionally check the MSIVs for proper operation at selected power levels.

2. To determine isolation valve closure time at rated temperature and pressure.

Prerequisites

The preoperational tests have been completed, and the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

During initial heatup at rated temperature and at a greater power level, 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: 1) t_{sol} the time from de-energizing the solenoids until the valve is completely closed, and 2) the time from when the valve starts to move from full open until it is completely closed (t_s), and is based on the interval from 10-percent to 90-percent closure, assuming linear valve travel from 0-percent to 100-percent closure.

The following tests are performed:

Action	Test Conditions
1. Individually close each MSIV, fast mode.	a. Heatup and between TC-1 and -3, close each MSIV to measure valve timing only. b. Recirculation system in POS mode; other systems in NORM mode.

TABLE 14.2-227
(Sheet 2 of 2)

MAIN STEAM ISOLATION VALVES
FUNCTIONAL TESTS

Startup Test (SUT-25A)

Acceptance Criteria Level 1: 1. The MSIV stroke time, t_s, shall be not less than 3.0 sec. 2. For any MSIV, t_{sol} shall not be greater than 5.0 sec. Level 2: Not applicable.

TABLE 14.2-228
(Sheet 1 of 2)

FULL REACTOR ISOLATION

Startup Test (SUT-25B)

Test Objective

To determine the reactor transient behavior that results from the simultaneous full closure of all MSIVs.

Prerequisites

The preoperational tests have been completed; the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

A test of the simultaneous full closure of all MSIVs is performed at ≥95 percent of rated thermal power. Correct performance of the RCIC, HPCS, and relief valves is shown. Reactor process variables are monitored to determine the transient behavior of the system during and following main steam line isolation.

The following test is performed:

Action	Test Conditions
Close all MSIVs (SUT-77 and SUT-5 are to be done in conjunction with this test).	a. Perform at TC-6. b. All systems in NORM mode.

Acceptance Criteria

Level 1:

1. Reactor must scram to limit the severity of the neutron flux and simulated fuel surface heat flux transient.

2. Feedwater system settings must prevent flooding of the steam lines.

TABLE 14.2-228
(Sheet 2 of 2)

FULL REACTOR ISOLATION

Startup Test (SUT-25B)

3. The recorded MSIV full closure times must meet the previously stated timing specifications (SUT-25A).

4. The positive change in vessel dome pressure occurring within the first 30 sec 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 percent of the rated value.

Level 2:

1. The positive change in vessel dome pressure and simulated flux occurring within the first 30 sec after the closure of all MSIV valves must not exceed the BOL predicted values. Predicted values will be referenced to actual test conditions of initial power level and dome pressure and will use BOL nuclear data.

2. Initial action of the RCIC and HPCS are automatic when Level 2 is reached, and system performance is within specifications.

3. Recirculation pump trip shall be initiated if low water level (L2) is reached. Recirculation pump power will shift to the low-frequency motor generators if low water level (L3) is reached.

TABLE 14.2-229

THIS TABLE HAS BEEN DELETED

TABLE 14.2-230
(Sheet 1 of 2)

RELIEF VALVES

Startup Test (SUT-26)

Test Objectives

1. To verify that the relief valves function properly (can be opened and closed manually).

2. To verify that the relief valves reseat properly after operation.

3. To verify that there are no major blockages in the relief valve discharge piping.

Prerequisites

The preoperational tests have been completed, the SORC has reviewed and approved the test procedures and initiation of testing, and instrumentation has been checked or calibrated as appropriate.

Test Procedure

A functional test of each SRV is made as early in the startup program as practical. This is normally the first time the plant reaches 950 psig with steam flow greater than the individual relief valve capacity. Bypass valve or electrical output response is monitored during the test. The test duration is about 10 sec to allow turbine valves and tailpipe sensors to reach a steady state.

The tailpipe sensor responses are used to detect the opening and subsequent closure of each SRV. The BPV or power level (MWe) responses are analyzed for anomalies indicating a restriction in a SRV tailpipe. In addition, lead BWR plants measure SRV tailpipe backpressure on the longest and shortest tailpipes.

Valve capacity is based on certification by ASME Code stamp and the applicable documentation being available in the onsite records. The nameplate capacity/pressure rating assumes that

TABLE 14.2-230
(Sheet 2 of 2)

RELIEF VALVES

Startup Test (SUT-26)

the flow is sonic. This is true if the backpressure is not excessive. A minor blockage of the line may prevent sonic flow and it should be determined that no major blockage exists through the BPV or MWe response signatures.

The following tests are performed:

Action	Test Conditions
1. Manual opening for plant response and valve reseating checks. SUT-77, Drywell Piping Vibration, is to be done in conjunction with this test.	a. At ≥950 psig (TC-1), if any valve is readjusted, repeat test. b. Recirculation system in MAN mode. Other systems in NORM mode.

Acceptance Criteria

Level 1:

There is positive indication of steam discharge during the manual actuation of each valve.

Level 2:

1. Pressure control system-related variables may contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response is less than or equal to 0.25.

2. The temperature measured by thermocouples on the discharge side of the valves returns to within 10°F of the temperature recorded before the valve was opened. If pressure sensors are available, they return to their initial states upon valve closure.

3. During the test the steam flow through each relief valve shall not be less than 90 percent of the average relief valve steam flow, as measured by bypass valve position, or the steam flow through each relief valve, as measured by MWe, shall not be lower than the average valve response by more than 0.5 percent of rated MWe.

TABLE 14.2-231
(Sheet 1 of 4)

TURBINE TRIP AND GENERATOR LOAD REJECTION

Startup Test (SUT-27)

Test Objective

To demonstrate the response of the reactor and its control systems to protective trips in the turbine and generator.

Prerequisites

The appropriate preoperational tests have been completed; the SORC has reviewed and approved the test procedures and initiation of testing. All controls and interlocks are checked and instrumentation calibrated.

Test Procedure

1. Turbine trip (closure of the main turbine stop valves within 0.1 sec) and generator trip (closure of the main turbine control valves within 0.3 sec) is performed at selected power levels during the startup test program. At low power levels, reactor protection following the trip is provided by high neutron flux and vessel high-pressure scrams. For the protective trips occurring at intermediate and higher power levels, the reactor scrams by relays, actuated by stop/control valve motion.

2. A turbine trip is performed at low power level in such a way that nuclear boiler steam generation is just within the bypass valve capacity to demonstrate scram avoidance.

3. Above 30-percent power, the recirculation pump circuit breakers are both automatically tripped and subsequent transient pressure rise is limited by the opening of the bypass valves initially, and the SRVs if necessary.

4. For the turbine trip, the main generator breakers remain loaded for a time so there is no rise in turbine generator speed, whereas in the generator trip, the main generator breaker opens and the residual turbine steam causes a momentary rise in the generator speed.

TABLE 14.2-231
(Sheet 2 of 4)

TURBINE TRIP AND GENERATOR LOAD REJECTION

Startup Test (SUT-27)

The following tests are performed:

Action	Test Conditions
1. Main turbine trip. (SUT-77, BOP Piping Vibration, is to be done in conjunction with this test.)	a. At TC-1 or -2, just within bypass system capacity. b. Recirculation system in POS mode; other systems in NORM mode. c. Manual intervention permissible to prevent high or low water level trip.
2. Generator trip scram. (SUT-33, Drywell Piping Vibration, and SUT-77 are to be done in conjunction with this test.)	a. Will be done at TC-6. b. All systems in NORM mode.

Previous experience demonstrates that reactor responses to a turbine trip and a generator load rejection at full power are similar for plants like Unit 2, which have steam bypass capacities equivalent to approximately 25 percent of rated power. The load rejection trip is performed at full power to test the turbine overspeed protection system.

Acceptance Criteria

Level 1:

1. For turbine and generator trips at power levels greater than 50 percent NBR, there is a delay of less than 0.1 sec following the beginning of control or stop valve closure before the beginning of bypass valve opening. The bypass valves are opened to a point corresponding to greater than or equal to 80 percent of their capacity within 0.3 sec from the beginning of control or stop valve closure motion.

TABLE 14.2-231
(Sheet 3 of 4)

TURBINE TRIP AND GENERATOR LOAD REJECTION

Startup Test (SUT-27)

2. Feedwater system settings must prevent flooding of the steam line following these transients.

3. The two pump drive flow coastdown transients during the first 3 sec, excluding the first 0.25 sec, must be bounded by the criteria that are specified in SUT-30B.

4. The positive change in vessel dome pressure occurring within 30 sec after either generator or turbine trip must not exceed the Level 2 criteria by more than 25 psi.

5. The positive change in simulated heat flux must not exceed the Level 2 criteria by more than 2 percent of rated value.

6. The total time delay from start of turbine stop valve motion, or from start of turbine control valve motion, to the complete suppression of electrical arc between the fully-open contacts of the RPT circuit breakers shall be less than 190 milliseconds.

Level 2:

1. There shall be no MSIV closure during the first 3 min of the transient and Operator action must not be required during that period to avoid the MSIV trip. (The Operator may take action as he desires after the first 3 min, including switching out of run mode. The Operator may also switch out of run mode in the first 3 min if he confirms from measured data that this action did not prevent MSIV closure.)

2. The positive change in vessel dome pressure and in simulated heat flux, which occurs within the first 30 sec after the initiation of either generator or turbine trip, must not exceed the predicted values.

TABLE 14.2-231
(Sheet 4 of 4)

TURBINE TRIP AND GENERATOR LOAD REJECTION

Startup Test (SUT-27)

The predicted values are those specified in the Transient Safety Analysis and Design Report. The predicted values should be corrected for actual plant parameters measured during the Startup Test Program.

3. For the turbine trip within the bypass valve capacity, the reactor must not scram for initial thermal power values within that bypass valve capacity and below the power level of which trip scram is inhibited. The measured bypass capacity (in percent of rated power) is equal to or greater than that used for FSAR analysis.

4. Low-level initiation of total recirculation trip, HPCS, and RCIC must not occur.

5. Recirculation LFMG sets must take over after the initiation of RPT, and adequate vessel temperature difference must be maintained.

6. Feedwater level control must avoid loss of feedwater due to possible high level (L8) trip during the event.

TABLE 14.2-232
(Sheet 1 of 2)

SHUTDOWN FROM OUTSIDE THE MAIN CONTROL ROOM

Startup Test (SUT-28)

Test Objective

To demonstrate that the reactor can be brought from a normal initial steady-state power level down to the point where cooldown is initiated and is under control with reactor vessel pressure and water level controlled from outside the main control room.

Prerequisites

The appropriate preoperational tests have been completed; the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

The test will be performed at a low power level and will consist of demonstrating the capability to scram and initiate controlled cooling from outside the control room. The reactor is scrammed and isolated from outside the control room after a simulated control room evacuation. Reactor pressure and water level will be controlled using SRVs and RCIC. The cooldown will continue until RHR shutdown cooling mode is placed in service from outside the control room with cooling water supplied from the ultimate heat sink. Alternatively, verification of satisfactory operation of the RHR shutdown cooling mode from outside the control room may be done at some other, more convenient time during the startup program. Coolant temperature must be lowered at least 50°F while in the shutdown cooling mode, at a rate that would not exceed the limits of the Technical Specifications. All other Operator actions not directly related to vessel water level and pressure will be performed in the main control room. The plant will be maintained in hot standby condition for at least 30 min during the performance of this test.

TABLE 14.2-232
(Sheet 2 of 2)

SHUTDOWN FROM OUTSIDE THE MAIN CONTROL ROOM

Startup Test (SUT-28)

The following tests are performed:

Action	Test Conditions
1. Functionally check use of remote shutdown panels (RSP) to shut down reactor.	a. Steady-state power operation (10-25%). b. Reactor initially critical with MSIVs open. c. T-G online.
2. Functionally check use of RSP to cool down reactor.	
3. Functionally check use of RSP to place shutdown cooling systems in operation.	

Acceptance Criteria

Level 1:

Not applicable.

Level 2:

During a simulated control room evacuation, the reactor must be brought to the point where cooldown is initiated and under control, and the reactor vessel pressure and water level are controlled using equipment and controls outside the control room.

TABLE 14.2-233
(Sheet 1 of 3)

RECIRCULATION FLOW CONTROL VALVE POSITION CONTROL

Startup Test (SUT-29A)

Test Objective

To demonstrate the recirculation flow control system's capability, while in the valve position (POS) mode.

Prerequisites

The appropriate preoperational tests have been completed; the SORC has reviewed and approved the test procedures and initiation of testing. All controls are checked and instrumentation calibrated.

Test Procedure

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. Preliminary component and valve position loop tests are run when the plant is in cold shutdown, in order to visually observe the hydraulic cylinder response. While operating at low power with the pumps using the low-frequency power supply, small step changes are input into the position controller and the responses recorded.

The following test is performed:

Action	Test Conditions
1. Small and large step changes input into position controller.	a. Prior to plant heatup, reactor shutdown, recirculation pumps off. (Preoperational testing results may be used to satisfy this testing requirement.)

TABLE 14.2-233
(Sheet 2 of 3)

RECIRCULATION FLOW CONTROL VALVE POSITION CONTROL

Startup Test (SUT-29A)

Action	Test Conditions
2. Small step changes input into position controller.	a. Before or at TC-1 with pumps using low-frequency power supply; at TC-3; and 6. b. Recirculation system in POS mode; other systems in NORM mode.

Acceptance Criteria

Level 1:

The transient response of any recirculation system-related variables to any test input must not diverge.

Level 2:

1. 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.

2. Maximum rate of change of valve position shall be 5 $\pm$ 1, -0.5 percent/sec.

   During TC-3 and TC-6, while operating on the high-speed (60 Hz) source, gains and limiters shall be set to obtain the following response.

3. Delay time for position demand step shall be:

   For step inputs of 0.5 percent to 5 percent — $\leq$0.22 sec

   For step inputs of 0.2 percent to 0.5 percent — (see Figure 14.2-233-1)

TABLE 14.2-233
(Sheet 3 of 3)

RECIRCULATION FLOW CONTROL VALVE POSITION CONTROL

Startup Test (SUT-29A)

4. Response time for position demand step shall be:	
For step inputs of 0.5 percent to 5 percent	$\leq$1.05 sec
For step inputs of 0.2 percent to 0.5 percent	(see Figure 14.2-233-1)
5. Overshoot after a small position demand input (1 to 5 percent) step shall be <10 percent of magnitude of input.	

TABLE 14.2-234
(Sheet 1 of 5)

RECIRCULATION FLOW LOOP CONTROL

Startup Test (SUT-29B)

Test Objectives

1. To demonstrate the core flow system's control capability over the entire flow control range, including core flow, neutron flux.

2. To determine that all electrical compensators and controllers are set for desired system performance and stability.

Prerequisites

The preoperational tests have been completed; the SORC has reviewed and approved the test procedures and initiation of testing. All controls are checked and instrumentation calibrated.

Test Procedure

Following the initial position mode tests of Part 1, the final adjustment of the position loop gains, flow loop gains, and preliminary values of the flux loop adjustments are made on the midpower line. This will demonstrate stable operation of the recirculation control system. The core power distribution is adjusted by control rods to permit a broad range of maneuverability with respect to PCIOMR. In general, the controller dials and gains are raised to meet the maneuvering performance objectives. Thus, the system is set to be the slowest that will perform satisfactorily, in order to maximize stability margins and minimize equipment wear by minimizing actuator motion.

Because of PCIOMR power maneuvering rate restrictions, the fast flow maneuvering adjustments are performed along a midpower rod line, and an extrapolation is made to the expected results along the 100-percent rod line.

The following tests are performed:

TABLE 14.2-234
(Sheet 2 of 5)

RECIRCULATION FLOW LOOP CONTROL

Startup Test (SUT-29B)

Action	Test Conditions
1. Step and ramp inputs.	a. Between TC-2 and 3. b. Recirculation system in FLO and FLX modes; other systems in NORM mode. c. Normal power sources to be used as applicable.
2. Step changes to demonstrate satisfactory response.	a. At TC-6. b. Recirculation system in FLO and FLX modes; other systems in NORM mode.

Acceptance Criteria

Flow Loops Criteria

Level 1:

The transient response of any recirculation system-related variable to any test input must not diverge.

Level 2:

1. The decay ratio of the flow loop response to any test inputs must be less than or equal to 0.25.

2. 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 about 20 ± 5 sec.

TABLE 14.2-234
(Sheet 3 of 5)

RECIRCULATION FLOW LOOP CONTROL

Startup Test (SUT-29B)

3. The delay time for flow demand step (≤5 percent) must be 0.75 sec or less.

4. The response time for flow demand step (≤5 percent) must be 1.8 sec or less.

5. The maximum allowable flow overshoot for step demand of ≤5 percent of rated must be 2 percent of rated.

6. The flow demand step settling time must be ≤25 sec.

Flux Loop Criteria

Level 1:

The flux loop response to test inputs must not diverge.

Level 2:

1. Flux overshoot to a flux demand step must not exceed 2 percent of rated for a step demand of ≤20 percent of rated.

2. The delay time for flux response to a flux demand step ≤20 percent of rated must be ≤5.0 sec.

3. The response time for flux demand step ≤20 percent of rated must be ≤30.0 sec.

4. The flux settling time must be ≤60 sec for a flux demand step ≤20 percent of rated.

5. The flow control system shall be adjusted to limit the maximum core flow to 102.5 percent of rated by limiting the flow control valve opening position.

TABLE 14.2-234
(Sheet 4 of 5)

RECIRCULATION FLOW LOOP CONTROL

Startup Test (SUT-29B)

Scram Avoidance and General Criteria

Level 1:

Not applicable.

Level 2:

For any one of the above loops' test maneuvers, the trip avoidance margins must be at least the following:

1. For APRM ≥7.5 percent.

2. For simulated heat flux ≥5.0 percent.

Flux Estimator Test Criteria

Level 1:

Not applicable.

Level 2:

1. Switching between estimated and sensed flux should not exceed 5 times/5 min at steady state.

2. During flux step transient there should be no switching to sensed flux, or if switching does occur, it should switch back to estimated flux within 20 sec of the start of the transient.

Flow Control Valve Duty Test Criteria

Level 1:

Not applicable.

TABLE 14.2-234
(Sheet 5 of 5)

RECIRCULATION FLOW LOOP CONTROL

Startup Test (SUT-29B)

Level 2: The flow control valve duty cycle in any operating mode must not exceed 0.2 percent - Hz. Flow control valve duty cycle is defined as: $$\frac{\text{Integrated valve movement in percent (\% Hz)}}{\text{2 x span (in sec)}}$$

TABLE 14.2-235
(Sheet 1 of 3)

RECIRCULATION SYSTEM, ONE-PUMP TRIP

Startup Test (SUT-30A)

Test Objectives

1. To obtain recirculation system performance data during the pump trip, flow coastdown, and pump restart.

2. To verify that the feedwater control system can satisfactorily control water level without a resulting turbine trip/scram.

Prerequisites

The appropriate preoperational tests have been completed and the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

The reactor coolant recirculation system consists of the reactor vessel and two piping loops. Each loop contains a constant speed centrifugal recirculation pump, a flow control valve, two isolation valves located in the drywell, and 10 jet pumps in parallel, situated in the reactor downcomer. Each recirculation pump takes suction from the reactor downcomer and discharges through a manifold system to the nozzles of the 10 jet pumps. Here the flow is augmented by suction flow from the downcomer and delivered to the reactor inlet plenum.

A potential threat to 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 prove that the water level will not rise enough to threaten a high-level trip of the main turbine or the feedwater pumps.

The following tests are performed:

TABLE 14.2-235
(Sheet 2 of 3)

RECIRCULATION SYSTEM, ONE-PUMP TRIP

Startup Test (SUT-30A)

Action	Test Conditions
1. Trip one pump. (Drywell piping vibration test [SUT-33] can be done in conjunction with this test.)	a. At TC-3 with core flow ≥95% of rated. b. All systems in NORM mode.
2. Restart pump.	a. Between TC-2 and 3 (with as high a control rod line as possible). b. All systems in NORM mode.
3. Trip other pump. (Drywell piping vibration test [SUT-33] can be done in conjunction with this test.)	a. At TC-6. b. All systems in NORM mode.
4. Restart pump using procedures developed during earlier low power restart (Item 2).	a. On 100% load line. b. All systems in NORM mode.

Acceptance Criteria

Level 1:

The reactor shall not scram during the one-pump trip recovery.

Level 2:

1. The reactor water level margin to avoid a high-level trip is greater than or equal to 3.0 in during the one-pump trip.

TABLE 14.2-235
(Sheet 3 of 3)

RECIRCULATION SYSTEM, ONE-PUMP TRIP

Startup Test (SUT-30A)

NOTE: Margin to trip is defined as:

$$\text{Margin} = L8 - (1/2\ (L4 + L7) + \Delta L)$$

where:

ΔL = magnitude of the level swell during the one-pump trip event

L8 = high-water level trip setting

L4 = low-water level alarm setting

L7 = high-water level alarm setting

2. The simulated heat flux margin to avoid a scram is greater than or equal to 5.0 percent during the one-pump trip and during pump trip recovery.

3. The APRM margin to avoid a scram is greater than or equal to 7.5 percent during the one-pump trip recovery.

TABLE 14.2-236
(Sheet 1 of 2)

RECIRCULATION SYSTEM, TWO-PUMP TRIP

Startup Test (SUT-30B)

Test Objective

To record and verify acceptable performance of the recirculation two-pump circuit trip system.

Prerequisites

The appropriate preoperational tests have been completed, and the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

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 flux in such events. This two-pump transfer or trip test verifies that this flow coastdown is satisfactory prior to the high-power turbine generator trip tests and subsequent operation (in TC-6).

The following test is performed:

Action	Test Conditions
Simulate TG-initiated RPT to trip all four RPT breakers simultaneously. (SUT-33, Drywell Piping Vibration, can be done in conjunction with this test.)	a. At TC-3 above 50 percent rated power and at 95 percent or more of rated core flow. b. All systems in NORM mode. Water level may be lowered to avoid possible turbine trip scram.

TABLE 14.2-236
(Sheet 2 of 2)

RECIRCULATION SYSTEM, TWO-PUMP TRIP

Startup Test (SUT-30B)

Acceptance Criteria

Level 1:

The two-pump drive flow coastdown transient during the first 3 sec, excluding the first 0.25 sec, must be bounded by limiting curves. These curves are site specific and will be supplied by GE-San Jose prior to startup.*

Level 2:

Not applicable.

* The limiting curves will be determined based upon measurement of the recirculation elbow flow meters transmitter time delay.

TABLE 14.2-237
(Sheet 1 of 1)

RECIRCULATION SYSTEM PERFORMANCE

Startup Test (SUT-30C)

Test Objective

To record recirculation system parameters during the power test program.

Prerequisites

The preoperational tests are complete. The SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

Recirculation system parameters are recorded at several power-flow conditions and in conjunction with single-pump trip recoveries.

The following test is performed:

Action	Test Conditions
Record steady-state operating data.	a. At TC-2, 3, 5*, and 6. b. During recovery from single-pump trips of SUT-30A.

Acceptance Criteria

Level 1:

Not applicable.

Level 2:

The measured core plate ΔP shall not be >3.0 psi above prediction.

* At natural circulation.

TABLE 14.2-238
(Sheet 1 of 1)

RECIRCULATION PUMP RUNBACK

Startup Test (SUT-30D)

Test Objective

To verify the adequacy of the recirculation runback to prevent a scram on loss of one feedwater pump and subsequent Level 4.

Prerequisites

The appropriate preoperational tests have been completed. The SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

While operating at near rated recirculation flow, a loss of a feedwater pump is simulated. The transient and final condition are studied to determine the adequacy of the system in preventing a scram during the scheduled loss of a single feedwater pump trip test (SUT-23C).

The following test is performed:

Action	Test Conditions
Simulate loss of feedwater pump to initiate recirculation runback mode.	a. At TC-3 with core flow $\geq$95% of rated. b. All systems in NORM mode.

Acceptance Criteria

Level 1:

Not applicable.

Level 2:

The recirculation flow control valves shall run back to 45-percent drive flow upon a trip of the runback circuit.

TABLE 14.2-239
(Sheet 1 of 2)

RECIRCULATION SYSTEM CAVITATION

Startup Test (SUT-30E)

Test Objective

To verify that no recirculation system cavitation occurs in the operable region of the power flow map.

Prerequisites

The appropriate preoperational tests have been completed. The SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

Both the jet pumps 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 run back upon sensing a decrease in subcooling (as measured by the difference between the steam dome and recirculation loop temperature) to lower the reactor power. 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 a low feedwater flow). This limit will be verified to ensure that operation is prevented where flow control valve cavitation may occur.

In both of these cases, flow runback is accomplished 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 frequency may not be required during this test as long as no sign of recirculation pump, jet pump, or flow control valve cavitation is evidenced.

TABLE 14.2-239
(Sheet 2 of 2)

RECIRCULATION SYSTEM CAVITATION

Startup Test (SUT-30E)

The following test is performed:

Action	Test Conditions
Insert control rods until cavitation occurs or until a cavitation interlock signal initiates, whichever occurs first.	a. At TC-2 and 3. b. All systems in NORM mode.

Acceptance Criteria

Level 1:

Not applicable.

Level 2:

Runback logic settings are adequate to prevent operation in areas of potential cavitation.

TABLE 14.2-240
(Sheet 1 of 2)

LOSS OF TURBINE GENERATOR AND OFFSITE POWER

Startup Test (SUT-31)

Test Objective

To determine the electrical equipment and reactor transient performance during the loss of auxiliary power.

Prerequisites

The appropriate preoperational tests have been completed, and the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

The loss of auxiliary power test is performed at 20 to 30 percent of rated power. The proper response of reactor plant equipment, automatic switching equipment, and the proper sequencing of the diesel generator load are checked. Appropriate reactor parameters are recorded during the resultant transient. The loss of power will be maintained long enough for plant conditions to stabilize (≥30 min). Systems which do not affect vessel level and pressure may be manually started and operated, as necessary.

The following test is performed:

Action	Test Conditions
After transferring auxiliary loads to the unit auxiliary transformer and starting main turbine dc oil pump, use the trip relay or turbine manual trip mechanism to trip the main turbine generator (SUT-77 and 5 can be done in conjunction with this test.)	a. At TC-2. b. Recirculation system in POS mode. All other systems in NORM mode.

TABLE 14.2-240
(Sheet 2 of 2)

LOSS OF TURBINE GENERATOR AND OFFSITE POWER

Startup Test (SUT-31)

Acceptance Criteria Level 1: All safety systems such as the RPS, 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 the LPCS, LPCI, ADS, and MSIV closure. Diesel generators shall start automatically. Level 2: Proper instrument display to the Reactor Operator shall be demonstrated, including power monitors, pressure, water level, control rod position, suppression pool temperature, and reactor cooling system status. Displays shall not be dependent on specially installed instrumentation.

TABLE 14.2-241
(Sheet 1 of 3)

DRYWELL PIPING VIBRATION

Startup Test (SUT-33)

Test Objectives

1. To verify that the vibration of the reactor recirculation is within acceptable limits.

2. To verify that stresses are within code limits during operating transient loads.

Prerequisites

The appropriate preoperational tests have been completed, and the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

This test is an extension of the system expansion test (SUT-17). Consult the specification of SUT-17 for piping considered to be within the scope of testing.

Because of limited access due to high radiation levels, no visual observation is required during the startup phase of the testing. Remote measurements of piping vibrations are made during the following steady-state conditions:

1. Recirculation at minimum flow.

2. Recirculation at 50 percent ±5 percent of rated flow and operating temperature.

3. Recirculation at 75 percent ±5 percent of rated flow and operating temperature.

4. Recirculation at 100 percent of rated flow.

During the operating transient load testing, the amplitude of the piping displacement is measured and the displacements compared with acceptance criteria. Remote deflection measurements are taken during the following transients:

1. Recirculation pump start.

2. Recirculation pump trip at 100 percent of rated flow.

TABLE 14.2-241
(Sheet 2 of 3)

DRYWELL PIPING VIBRATION

Startup Test (SUT-33)

The locations to be monitored and predicted displacements for the monitored locations in each plant will be provided by the GE Piping Response Measurement Data Sheet 22A5405AV.

The following tests are performed:

Action	Test Conditions
Record recirculation loop vibration	a. Recirculation at minimum flow at TC-1. b. At 50, 75, and at approximately 100% of rated recirculation flow on 100% load line. c. In conjunction with recirculation pumps starts and transfers or trips (Tests 30A and B) at TC-3 and 6. d. In conjunction with Test 71 startup, shutdown, and while at 100% of rated RHR flow in the shutdown cooling mode.

Acceptance Criteria

Level 1:

1. Operating transients: Level 1 limits on piping displacements are prescribed in GE Piping Response Measurement Startup Test Specification Data Sheet 22A5405AV. 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 is placed on hold.

2. Operating vibration: Level 1 limits on piping displacement are prescribed in GE Piping Response Measurement Startup Test Specification Data Sheet 22A5405AV. 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 is placed on hold.

TABLE 14.2-241
(Sheet 3 of 3)

DRYWELL PIPING VIBRATION

Startup Test (SUT-33)

Level 2:

1. 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. GE Piping Response Measurement Startup Test Specification Data Sheet 22A5405AV tabulates allowable movements or movement tolerances for each transducer.

2. Operating vibration: Acceptable levels of operating vibration are prescribed in GE Piping Response Measurement Startup Test Specification Data Sheet 22A5405AV. The limits have been set based on consideration of analysis, operating experience, and protection of pipe-mounted components.

TABLE 14.2-242
(Sheet 1 of 2)

RECIRCULATION SYSTEM FLOW CALIBRATION

Startup Test (SUT-35)

Test Objective

To perform complete calibration of the installed recirculation system flow instrumentation.

Prerequisites

The appropriate preoperational tests have been completed and the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

During the testing program, at operating conditions that allow the recirculation system to be operated at rated flow at power, the jet pump flow instrumentation is adjusted to provide correct flow indication based on jet pump flow. After the relationship between drive flow and core flow is established, the flow-biased APRM/RBM (rod block monitor) system is adjusted to match this relationship.

The following test is performed:

Action	Test Conditions
Take recirculation system data and recalibrate instrumentation.	a. At TC-3. b. At TC-6.

Acceptance Criteria

Level 1:

Not applicable.

TABLE 14.2-242
(Sheet 2 of 2)

RECIRCULATION SYSTEM FLOW CALIBRATION

Startup Test (SUT-35)

Level 2: 1. Jet pump flow instrumentation is adjusted in such a way that the jet pump total flow recorder provides a correct core flow indication at rated conditions 2. The APRM/RBM flow-bias instrumentation is adjusted to function properly at rated conditions. 3. The calculated jet pump M-ratio shall not be <0.2 points below prediction. 4. The nozzle and riser plugging criteria shall not be exceeded.

TABLE 14.2-243
(Sheet 1 of 2)

REACTOR WATER CLEANUP SYSTEM

Startup Test (SUT-70)

Test Objective

To demonstrate specific aspects of the mechanical ability of the RWCU. (This test, performed at rated reactor pressure and temperature, is actually the completion of the preoperational testing that could not be done without nuclear heating.)

Prerequisites

The preoperational tests have been completed, and the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

With the reactor at rated temperature and pressure, process variables are recorded during steady-state operation. The RWCU system sample station is tested at hot process conditions as part of SUT-1.

The following test is performed:

Action	Test Conditions
Record process data.	a. Reactor at rated temperature and pressure with the cleanup system operating in a reactor startup alignment (i.e., flow rejection) and in a normal operating alignment.

Acceptance Criteria

Level 1:

Not applicable.

TABLE 14.2-243
(Sheet 2 of 2)

REACTOR WATER CLEANUP SYSTEM

Startup Test (SUT-70)

Level 2:

1. The temperature at the tube side of the nonregenerative heat exchangers does not exceed 130°F in the hot standby mode or 120°F in the normal mode.

2. The pump available NPSH at least 13 ft during the hot standby mode is as defined in the process diagrams.*

3. The cooling water supplied to the nonregenerative heat exchangers shall be less than 6 percent above the flow corresponding to the heat exchanger capacity (as determined from the process diagram). The outlet temperature shall not exceed 180°F.

4. Pump vibration shall be less than or equal to 2 mils peak-to-peak (in any direction) as measured on the bearing housing, and 2 mils peak-to-peak shaft vibration.

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* If measurements and calculations made during the system preoperational test show that NPSH requirements for this mode can be met, then this requirement need not be addressed during startup testing.

TABLE 14.2-244
(Sheet 1 of 3)

RESIDUAL HEAT REMOVAL SYSTEM

Startup Test (SUT-71)

NOTE: Steam-condensing mode of RHR is abandoned in place. Reference to steam condensing is for historical information only.

Test Objective

To demonstrate the ability of the RHR system to:

1. Remove heat from the reactor system so that the refueling and nuclear system servicing can be performed.
2. Condense steam from the reactor.

Prerequisites

The appropriate preoperational tests have been completed, and the SORC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

Test Procedure

With the reactor at a convenient thermal power, the steam condensing mode of the RHR system is tuned and demonstrated. Condensing heat exchanger performance characteristics are demonstrated. During the first suitable reactor cooldown, the shutdown cooling mode of the RHR system is 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, or during the first shutdown after the test program after accumulating significant core exposure, this demonstration would more adequately demonstrate the heat exchanger capacity. The RHR heat exchangers will also be tested in the suppression pool cooling mode.

The following tests are performed:

TABLE 14.2-244
(Sheet 2 of 3)

RESIDUAL HEAT REMOVAL SYSTEM

Startup Test (SUT-71)

Action	Test Conditions
1. Controller adjustment based on subsystem perturbations	a. Reactor not isolated above 10% rated power but ≤25% rated power. b. RHR system in steam condensing mode. c. RCIC flow to CST or RPV.
2. Take heat exchanger capacity data.	a. RHR in shutdown cooling mode. b. After trip or cooldown from TC-6 or during the first shutdown after the test program in order to provide sufficient decay heat. c. RHR in suppression pool cooling mode.

Acceptance Criteria

Level 1:

The transient response of any system-related variable to any test input must not diverge.

Level 2:

1. The RHR system must be capable of operating in the steam condensing, suppression pool cooling, and shutdown cooling modes (with one or both heat exchangers) at heat removal rate equivalent to or greater than the values indicated on the process diagrams. For the steam condensing mode, a steam condensing rate, equivalent to or greater than the one derived from the process diagram with the temperature of the heat exchanger discharge less than 140°F, can be considered to satisfy this Level 2 criterion.

TABLE 14.2-244
(Sheet 3 of 3)

RESIDUAL HEAT REMOVAL SYSTEM

Startup Test (SUT-71)

2. 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.

NOTE: If decay heat is not sufficient to demonstrate shutdown cooling mode heat rejection capacity, then heat exchanger capacity may be inferred from data taken in the suppression pool cooling mode, provided that the data were taken with the system as close as possible to the process diagram flows and temperatures.

TABLE 14.2-245
(Sheet 1 of 3)

OFFGAS SYSTEM

Startup Test (SUT-74)

Test Objective

The purpose of this test is to verify the proper operation of the offgas system over its expected operating range.

Prerequisites

The appropriate preoperational tests have been completed. The SORC has reviewed and approved the test procedure and the initiation of testing. Instrumentation has been checked and calibrated as appropriate. The following systems must be operable to the extent required to support testing:

- Condenser air removal.
- Auxiliary steam.
- Turbine building closed loop cooling.
- Service air.
- Radiation monitoring.

Test Procedure

The following offgas system tests will be conducted at various power levels throughout plant startup while at steady-state conditions:

1. Hydrogen analyzer - Check that the hydrogen analyzer is functioning and record the level of hydrogen in the recombiner effluent.
2. Dew point - Check that the dew point in the offgas system complies with design temperatures.
3. Temperature - Monitor the temperature of the charcoal absorbers, active and standby catalytic recombiner, and freeze-out dryer discharge to see that the specified limits are met.

TABLE 14.2-245
(Sheet 2 of 3)

OFFGAS SYSTEM

Startup Test (SUT-74)

4. Recombiner performance - As the recombiner performance is least efficient in the lower power range, it will be inspected closely in this range for correct initial operation.

5. Recombiner feed - A hydrogen concentration measurement of the offgas flow is taken downstream of the recombiner condenser. This concentration must be less than 0.5% by volume to ensure that the hydrogen concentration entering the recombiner is less than 4% by volume.

6. Radionuclide residence times - Provided that reasonable and sufficient fission gasses are present in the offgas, measurements will be made of at least one radionuclide to determine the decontamination factor(s) across one or several charcoal beds.

7. HEPA filters - If sufficient particulate fission gas daughter products are present, measurements of decontamination factors across the filters will be made. This is to confirm that the filters are operating properly during normal operating conditions.

8. Radiolytic gas production - Calculate the radiolytic gas production rate based on recombiner differential temperatures and verify that the production rate is within the design value.

9. Freeze-out dryer performance - Monitor the effluent dew point of the freeze-out dryer during its operating cycles to verify that discharge limits are met.

Acceptance Criteria

Level 1:

The release of radioactive gaseous and particulate effluents must not exceed the limits specified in the site Technical Specifications.

TABLE 14.2-245
(Sheet 3 of 3)

OFFGAS SYSTEM

Startup Test (SUT-74)

Level 2:

1. The system flow, pressure, temperature, and dew point shall comply with the process data sheets supplied to the site.

2. The catalytic recombiner, hydrogen analyzer, freeze-out dryers, activated carbon beds, and filters shall be working properly during operation, i.e., there shall be no gross malfunctioning of these components.

TABLE 14.2-301
(Sheet 1 of 2)

DRYWELL COOLING SYSTEM

Startup Test (SUT-75)

Test Objective

To demonstrate the capability of the drywell cooling system to maintain peak and average drywell temperatures within the maximum design limits during power operation at rated temperature and pressure.

Prerequisites

The appropriate preoperational tests have been completed. The SORC has reviewed and approved the test procedures and the initiation of testing. Instrumentation has been checked and calibrated as appropriate. The service water and closed loop cooling systems are operational to the extent required to conduct the test.

Test Procedure

The following data will be recorded and evaluated at the test conditions listed.

Action	Test Conditions
1. Record temperature and flow data to perform a heat balance across the coolers, check average Space temperature, and Check suspected hot Spot temperatures.	a. During heatup to rated temperature and pressure, TC-2 and TC-6.
2. Check suspected hot spot temperatures as well as average space temperature, during both normal and post-scram conditions.	a. TC-2 and TC-6.

TABLE 14.2-301
(Sheet 2 of 2)

DRYWELL COOLING SYSTEM

Startup Test (SUT-75)

Acceptance Criteria

Level 1:

Drywell average air space temperature shall not exceed the limit specified in plant Technical Specifications.

Level 2:

1. The maximum temperature measured in any area of the drywell shall not exceed the design limits specified in Table 9.4-1.

2. Reactor pressure vessel skirt area temperature shall not be less than the minimum design value specified in Table 9.4-1, and shall be greater than or equal to 100°F with the vessel exterior surface temperature at normal operating conditions (528°F-544°F).

TABLE 14.2-302
(Sheet 1 of 1)

ESF AREA COOLING

Startup Test (SUT-76)

Test Objective

The purpose of this test is to verify that the unit coolers serving the RCIC, RHR, LPCS, HPCS, SGTS, auxiliary building MCC, service water bay, and standby diesel generator control rooms can maintain the equipment room temperature below the maximum design limits under postulated accident conditions.

Prerequisites

The appropriate preoperational tests have been completed. The SORC has reviewed and approved the test procedures and the initiation of testing. Instrumentation has been checked and calibrated as appropriate. The service water system is operational to the extent required to conduct the test.

Test Procedure

The ESF areas listed above will be isolated from the normal ventilation system and major equipment in the area run in the mode providing the maximum practical heat load. Numerous temperature measurements will be made in the area. Adequate temperature and flow data will be collected to perform a heat balance across the area coolers under test conditions.

Acceptance Criteria

Level 1:

All ESF area air space temperatures measured shall not exceed the design limits specified in Table 9.4-1.

Level 2:

Evaluation of test data shall demonstrate that all ESF area air space temperatures will remain below the design limits in Table 9.4-1 under design basis conditions.

TABLE 14.2-303
(Sheet 1 of 4)

BOP PIPING VIBRATION

Startup Test (SUT-77)

NOTE: Steam-condensing mode of RHR is abandoned in place. Reference to steam condensing is for historical information only.

Test Objective

1. To verify that steady-state and/or transient piping vibration for the main steam (including relief valve discharge), RHR feedwater, RCIC, and condensate systems is within acceptable limits.

2. To verify that steady-state vibrations for small bore piping and essential instrumentation lines on main steam, nuclear steam supply, feedwater, reactor plant sampling, RHR, and RCIC are within acceptable limits.

Prerequisites

The appropriate preoperational tests and generic pipe vibration tests have been completed, and the SORC has reviewed and approved the test procedures and the initiation of testing. Instrumentation has been checked and calibrated as appropriate.

Test Procedure

Due to the high radiation levels involved, no visual observations are performed in this test. Remote monitoring of piping vibration will be utilized. The locations to be monitored and the corresponding predicted displacements will be provided in the startup test procedure.

The following tests are performed:

Action	Test Conditions
1. Record vibration of RCIC lines.	a. In conjunction with RCIC pump start, rated pump flow, and RCIC pump trip (SUT-14 at HU and 1).

TABLE 14.2-303
(Sheet 2 of 4)

BOP PIPING VIBRATION

Startup Test (SUT-77)

Action		Test Conditions
2.	Record vibration of main steam lines.	a. At TC-2, 3, 5, and 6. b. In conjunction with pressure controller setpoint changes (SUT-22 at TC-2), MSIV closure (SUT-25 at TC-3 and 6), relief valve capacity checks (SUT-26 at TC-1), and turbine generator trip (SUT-27 at TC-2).
3.	Record vibration of main steam relief valve lines.	a. In conjunction with relief valve capacity checks (SUT-26 at TC-1).
4.	Record vibration of feedwater and condensate lines.	a. At TC-2, 3, 5, and 6. b. In conjunction with turbine generator trip (SUT-27 at TC-2 and 6) and feedwater system tests (SUT-23 at TC-1, 2, 5, and 6).
5.	Record vibration of RHR lines.	a. In conjunction with RHR steam condensing mode and shutdown cooling mode (SUT-71 at TC-6).
6.	Record vibration of recirculation system small bore lines.	a. At TC-2, 3, 5, and 6.

TABLE 14.2-303
(Sheet 3 of 4)

BOP PIPING VIBRATION

Startup Test (SUT-77)

7.	Record vibration of reactor vessel level indicator instrumentation (nuclear boiler instrumentation, ISC) lines.	a. At TC-2, 3, 5, and 6.
8.	Record vibration of main steam instrumentation lines.	a. At TC-2, 3, 5, and 6.
9.	Record vibration of selected nitrogen system lines.	a. In conjunction with containment inerting.

Acceptance Criteria[1]

Transient Vibration

Level 1:

The acceptance limits for Level 1 are based upon ASME B&PVC, Section III, Equation 9 for Class 1, 2, and 3 systems, or ANSI B31.1, Equation 12 for Class 4 systems. These acceptance limits restrict the bending stress due to deflection plus deadweight and pressure to a value less than the normal/upset allowable stress for occasional loads.

Level 2:

The acceptance limits for Level 2 are based on pipe stress and support loads that do not exceed design basis predictions.

(1) These criteria are technically equivalent to those described in Section 3.9.

TABLE 14.2-303
(Sheet 4 of 4)

BOP PIPING VIBRATION

Startup Test (SUT-77)

Steady-State Vibration Level 2: Acceptance criteria limits are based upon deflection equations given in ANSI/ASME OM-3 with either a limiting allowable stress of (0.8/1.3) S_{el} for carbon steel piping or, for stainless steel piping, an allowable stress of S_a at 10^{11} cycles using curve c from Figure I-9-2 of the 1983 ASME III Code, or curve B if detailed analysis is required.

TABLE 14.2-304
(Sheet 1 of 5)

BOP SYSTEM EXPANSION

Startup Test (SUT-78)

NOTE: Steam-condensing mode of RHR is abandoned in place. Reference to steam condensing is for historical information only.

Test Objective

To verify that BOP piping systems are free to expand and move without unplanned obstruction or restraint during system heatup and cooldown cycles, and to verify that the associated measured displacements are within specified limits.

Prerequisites

The appropriate preoperational tests have been completed and the SORC has reviewed and approved the test procedures and the initiation of testing. Instrumentation has been checked and calibrated as appropriate.

Test Procedure

Visual inspections will be performed, to the extent possible, to verify freedom of movement. In addition, scribers and remote sensors will be utilized to obtain displacement readings.

Action	Test Conditions
1. Visual inspection for: RWCU, HPCS, LPCS, RHR, RCIC and feedwater systems.	a. Prior to initial heatup at ambient conditions. b. At the reactor vessel temperature plateau of 300 $\pm$ 50°F. c. At the reactor vessel temperature plateau of 500 $\pm$ 50°F. d. At the end of the first heatup/cooldown cycle (near ambient conditions).

TABLE 14.2-304
(Sheet 2 of 5)

BOP SYSTEM EXPANSION

Startup Test (SUT-78)

Action	Test Conditions
2. Record remote sensor displacement readings for: RWCU, HPCS, LPCS, RHR, RCIC, main steam, and feedwater systems.	a. Prior to initial heatup at ambient conditions. b. At the reactor vessel temperature plateau of 300 ± 50°F. c. At the reactor vessel temperature plateau of 500 ± 50°F. d. At the end of the first heatup/cooldown cycle (near ambient conditions).
3. Record scriber displacement readings for: RWCU, RCIC, feedwater, main steam, and condensate systems.	a. At the end of the first heatup/cooldown cycle (near ambient conditions) following near rated conditions.
4. Record remote sensor displacements for feedwater system.	a. Upon feedwater system obtaining within ± 35°F of its rated temperature.
5. Record selected snubber and spring support deflections for main steam and RWCU systems.	a. Prior to initial heatup at ambient conditions. b. At the reactor vessel temperature plateau of 300 ± 50°F. c. At the reactor vessel temperature plateau of 500 ± 50°F. d. At the end of the first heatup/cooldown cycle (near ambient conditions).

TABLE 14.2-304
(Sheet 3 of 5)

BOP SYSTEM EXPANSION

Startup Test (SUT-78)

Action	Test Conditions
6. Record selected snubber and spring support deflections for feedwater, RCIC, and RHR (steam condensing and shutdown cooling modes) systems.	a. Prior to initial system heatup at ambient conditions. b. Upon achieving near rated conditions (where accessible). c. At the end of the first heatup/cooldown cycle (near ambient conditions) following near rated conditions.
7. Visual inspection for the condensate system.	a. Prior to initial system heatup at ambient conditions. b. At near rated conditions. c. At the end of the first system heatup/cooldown cycle (near ambient conditions) following near rated conditions.
8. Record remote sensor displacements for the main steam relief piping.	a. Prior to initial system heatup at ambient conditions. b. During SRV actuation at TC-1. c. Following SRV actuation at return to near ambient conditions.

TABLE 14.2-304
(Sheet 4 of 5)

BOP SYSTEM EXPANSION

Startup Test (SUT-78)

Action	Test Conditions
9. Record remote sensor displacements for RHR system (shutdown cooling mode). mode operation.	a. Prior to initial system heatup at ambient conditions. b. During shutdown cooling c. At the end of the first system heatup/cooldown cycle (near ambient conditions) following operation in the shutdown cooling mode.
10. Record displacements of piping at selected pipe whip restraint locations for feedwater, main steam, RCIC, RHR, and RWCU systems using local measuring devices.	a. Prior to initial system heatup at ambient conditions. b. At the return to near ambient following achieving near rated conditions for the system.
11. Record displacements and perform visual examinations of selected snubbers and spring supports (as defined by the Preservice Inspection Plan).	a. Prior to initial system heatup at ambient conditions. b. At the reactor vessel temperature plateau of 300 $\pm$ 50°F (where applicable to the system or portion thereof involved). c. At the reactor vessel temperature plateau of 500 $\pm$ 50°F (where applicable to the system or portion thereof involved).

TABLE 14.2-304
(Sheet 5 of 5)

BOP SYSTEM EXPANSION

Startup Test (SUT-78)

Action	Test Conditions
	d. At near rated conditions for systems outside the applicability of b. and c. above. e. At the return to near ambient conditions following achieving the applicable near rated conditions (conditions are specified in the test procedure) for the system.

Acceptance Criteria

Level 1:

1. There are no obstructions which will interfere with the thermal expansion of the above piping systems, including snubbers and spring supports attached to the piping systems.

2. The displacements at the established transducer, selected pipe support, and scriber locations shall not exceed the allowable values provided in the BOP thermal expansion procedure. The allowable values of displacement shall be based on not exceeding ASME Section III Code stress allowables.

3. Snubbers and spring supports examined shall be found operable as defined by criteria specified in the test procedure.

Level 2:

1. The displacements at established transducer, selected pipe supports, selected whip restraints and scriber locations shall not exceed the expected values as provided in the BOP system expansion procedure.

2. Selected snubber and spring support examinations shall be evaluated to acceptance criteria defined in the Preservice Inspection Plan for ASME Section IX VT-4 Examinations.

TABLE 14.2-305
(Sheet 1 of 2)
REACTOR INTERNALS VIBRATION

Startup Test (SUT-79)

Test Objective

To provide the data required to verify the similarity between the reactor internals design and the limited valid prototype with respect to flow-induced vibration. Testing is in accordance with RG 1.20 for the vibration measurement program for a non-prototype Category IV plant.

Prerequisites

The appropriate preoperational tests have been completed. The SORC has reviewed and approved the test procedure and the initiation of testing. Instrumentation has been checked and calibrated as appropriate.

Test Procedure

The testing is done at power utilizing measurements from resistance wire strain gauges and accelerometers. The vibration engineer will monitor and record vibration amplitudes and frequencies obtained from sensors mounted in the reactor. The data are then compared to acceptance criteria to ensure that all measured vibration amplitudes are within acceptable levels.

Action	Test Conditions
1. Record vibration measurements at steady-state conditions.	a. Four approximately equally spaced recirculation flow points on TC-3 load line.
2. Record vibration measurements during both transient and subsequent steady-state conditions.	b. At maximum flow (either operational or specification limit) trip one recirculation pump. This may be done in conjunction with Test 30A at TC-3 (at TC-6 trip the other pump).
	c. At maximum flow, transfer both recirculation pumps to slow speed. This may be done in conjunction with Test 30B at TC-3 and in

TABLE 14.2-305
(Sheet 2 of 2)
REACTOR INTERNALS VIBRATION

Startup Test (SUT-79)

Action	Test Conditions
	conjunction with Test 27 at TC-6. d. Steady-state unbalanced flow as defined from preceding tests. e. Repeat a., b., c., and d. on the TC-6 load line. f. All systems are to be in NORM mode, or if done in conjunction with another test, the latter's requirements govern.

Acceptance Criteria

Level 1:

The peak stress intensity may exceed 10,000 psi (single amplitude) when the component is deformed in a manner corresponding to one of its normal or natural modes, but the fatigue usage factor must not exceed 1.0.

Level 2:

The peak stress intensity shall not exceed 10,000 psi (single amplitude) when the component is deformed in a manner corresponding to one of its normal or natural modes. This is the low stress limit which is suitable for sustained vibration in the reactor environment for the design life of the reactor components.

TABLE 14.2-306
(Sheet 1 of 1)

EMERGENCY RECIRCULATION VENTILATION

Startup Test (SUT-80)

Test Objective

To verify that the emergency recirculation ventilation system can maintain the required reactor building area temperatures below the maximum design limits under postulated accident conditions.

Prerequisites

The appropriate preoperational tests have been completed. The SORC has reviewed and approved the test procedures and the initiation of testing. Instrumentation has been checked and calibrated as appropriate. The service water system is operable to the extent required to conduct the test.

Test Procedures

The standby gas treatment and emergency recirculation systems will be placed in operation and the normal reactor building HVAC system will be shut down during power operation. Temperature measurements will be made in various areas of the reactor building. Adequate temperature and flow data will be collected to perform a heat balance across the emergency recirculation coolers under the test conditions.

Acceptance Criteria

Level 1

All critical reactor building area temperatures measured shall not exceed the design limits specified in Table 9.4-1.

Level 2

Evaluation of test data shall demonstrate that critical reactor building area temperatures will remain below the design limit in Table 9.4-1 under design basis conditions.

TABLE 14.2-307
(Sheet 1 of 1)

DRYWELL HIGH ENERGY PENETRATIONS

Startup Test (SUT-81)

Test Objective

The purpose of this test is to demonstrate the capability of the drywell high energy penetrations to maintain the surrounding concrete below design temperature limits.

Prerequisites

The SORC has reviewed and approved the test procedure and the initiating of testing. Instrumentation has been checked and calibrated as appropriate.

Test Procedure

Selected thermally hot, high-energy penetrations to the primary containment will be tested at various power levels during plant startup while at steady-state conditions:

1. Temperature - Monitor the thermal rise of the process piping, flued head, and the liner insert sleeve.

2. The data will then be compared to values predicted for normal operation or for design conditions as required to verify compliance with the acceptance criteria.

Acceptance Criteria

Level 1:

1. The temperatures measured 4 in from the containment wall/penetration outer collar on the wall insert sleeve shall not exceed the values predicted to cause surrounding concrete temperatures to exceed 200°F.

TABLE 14.2-401

THIS TABLE HAS BEEN DELETED

TABLE 14.2-402

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TABLE 14.2-403
(Sheet 1 of 1)

QUALIFICATION OF GE PRINCIPAL TESTING PERSONNEL
DURING STARTUP TESTING

The GE Site Operations Manager meets the equivalent of ANSI N45.2.6, 1978, discussed for a Level III person. The Operations Manager is normally present for preoperational testing and will be SRO certified under the GE certification program.

The GE Operations Superintendent meets the equivalent of ANSI N45.2.6, 1978, discussed for a Level III person or a Level II person. The Operations Superintendent is normally present for preoperational testing and will be SRO certified under the GE certification program.

The GE STO Engineers meet the equivalent of ANSI N45.2.6, 1978, discussed for a Level II person. They will also be SRO certified under the GE certification program.

The GE Lead Startup Test Design and Analysis Engineer meets the equivalent of ANSI N45.2.6, 1978, discussed for a Level III person or a Level II person. He is qualified at the time of appointment to the position.

The GE Startup Test Design and Analysis Engineers meet the equivalent of ANSI N45.2.6, 1978, discussed for a Level II person.

The GE Startup Control and Instrumentation Engineers meet the equivalent of ANSI N45.2.6, 1978, discussed for a Level II person.

The GE Startup Chemist meets the equivalent of ANSI N45.2.6, 1978, discussed for a Level II person.

In addition, all GE personnel listed above will meet ANSI 3.1, 1978, Section 4.3.2 minimum qualifications.

14.3 INITIAL TEST PROGRAM FOR OPERATION AT POWER UPRATE CONDITIONS (3,467 MWt)

The startup test phase for power ascension to uprated power conditions commences with the receipt of an approved License Amendment for operation at the specified power level. Testing performed during this phase confirms the engineering evaluations supporting the uprate and provides the means for establishing necessary setpoint changes and other adjustments. The test program is based on Section 5.11.9 and Appendix L of Reference 1. It ensures continued acceptable operational performance of systems and/or components which have revised performance requirements, and closely monitors reactor and core conditions. Test procedures are based on the methods and criteria used during the original preoperational and startup test program.

14.3.1 Summary of Test Program and Objectives

14.3.1.1 Overview of Program

The Unit 2 Power Uprate Power Ascension Test Program included pre-refueling activities, refueling, heatup, and power ascension testing. The program tested the reactor, turbine generator, related auxiliary systems and balance of plant systems.

14.3.1.2 Test Conditions

The Power Uprate Power Ascension Test Program was divided into four test conditions. Test Condition D was further subdivided into two subsets.

Test Condition A - Covers all testing from pre-refueling up to and including operation at ≤≈ 90% uprate power (3120 - 3185 MWt).

Test Condition B - Covers all testing at the original rated power level of ≈96% uprate power (3297 - 3323 MWt).

Test Condition C - Covers all testing at 98% uprate power (3367 - 3395 MWt).

Test Condition D.1 - Covers all testing at 100% uprate power (3432 - 3467 MWt).

Test Condition D.2 - Covers all testing at 100% uprated power utilizing the leading edge flow meter (LEFM) correction for feedwater flow (3432 - 3467 MWt).

14.3.1.3 Test Objectives

The results of the power uprate power ascension tests were used to determine the acceptability of operating Unit 2 at the uprate power level.

14.3.2 Organization and Staffing

The Power Uprate Power Ascension Test Program was administered within the existing Unit 2 plant staff organization.

14.3.3 Conduct of Testing

14.3.3.1 Test Procedures

Power uprate power ascension test procedure preparation, procedure and results approval, procedural changes, test conduct, and test exceptions were governed by the Unit 2 administrative procedures.

14.3.3.2 Test Exceptions

Test exceptions (test results that do not meet acceptance criteria) were documented on a Test Exception form per PWM-PRO-0309 or GAP-SAT-03 as applicable.

14.3.3.3 Test Data

Data used in the evaluation of the individual power ascension tests were obtained from plant instrumentation (i.e., recorders, meters), the plant process computer, the General Electric Transient Analysis Recording System (GETARS), and special test equipment. All of these were used to obtain steady-state data. The 3D Monicore computer was utilized primarily for the evaluation of thermal power and thermal limits. The GETARS computer was employed mainly for system performance demonstrations and plant response to transients. All instrumentation used in the evaluation of acceptance criteria was calibrated to Unit 2 specifications.

14.3.3.4 Criteria for Testing

To assist in the evaluation of proper plant performance from the test results obtained, a set of criteria for each test was developed. These criteria are a result of a combination of factors such as safety analysis assumptions, engineering expectations, and contractual commitments. Level 1 criteria are based on safety considerations while Level 2 criteria are based on performance considerations. Definitions of these Level 1 and Level 2 criteria, and required actions in the event the criteria is not met, are as follows:

<u>Level 1 Acceptance Criteria</u>

If a Level 1 criterion is not satisfied, the plant is placed in a suitable hold condition that is judged to be satisfactory and safe based on prior testing. Plant operating or test procedures or the Technical Specifications may guide the decision on the direction taken. Tests compatible with this hold condition may be continued. Resolution of the problem is immediately pursued by appropriate equipment adjustments or through engineering analysis. Applicable test exceptions must be resolved to verify that the requirements of the Level 1 criterion are satisfied.

Level 2 Acceptance Criteria

If a Level 2 criterion is not satisfied, operating and testing plans are not necessarily altered. The limits stated in this category are usually associated with expectations of system performance whose characteristics can be improved by equipment adjustments. An investigation of the measurements and of the analytical techniques used for the predictions is initiated. Applicable test exceptions must be resolved to verify that the requirements of the Level 2 criterion are satisfied.

Acceptance Criteria Not Identified by Level

The Unit 2 surveillance and other test procedures do not identify acceptance criteria by level. Acceptance criteria that are not identified by a Level 1 or Level 2 designation are treated as Level 2 acceptance criteria.

14.3.3.5 Test Procedure Results Review and Approvals

Administrative hold points were instituted in order to assure that test results were reviewed and approved by the responsible senior manager prior to further increases in power level. Administrative hold points were placed at the following test conditions:

Hold Point	Senior Manager Review & Approval
Test Condition B	Test Condition A & B Results
Test Condition C	Test Condition C Results
Test Condition D	Test Condition D Results

14.3.3.6 Test Records

The power uprate power ascension test records were administered within the existing Unit 2 administrative procedures.

14.3.4 Conformance of Test Program with Regulatory Guidelines

The requirements for testing came from the Unit 2 power uprate licensing submittals, the NRC Safety Evaluation for License Amendment No. 66, Chapter 14 of the Updated Safety Analysis Report (USAR), the GE Power Uprate Power Ascension Test Specification, and the proposed Technical Specifications for power uprate. The results of these tests were used to determine the acceptability of operating the unit at the uprate power level. The Unit 2 Power Uprate Power Ascension Test Program was controlled under existing NMPC administrative procedures.

14.3.5 Summary of Test Results

A complete list of the power uprate power ascension tests can be found in Table 14.3-1. This table provides the test condition/% uprate power level at which each test was performed. This table also identifies what document, if any, specified the testing.

Each individual test performed during the Power Uprate Power Ascension Test Program is described in Table 14.3-2. This table provides an objective, acceptance criteria and discussion for each test performed. The discussion briefly describes the results in comparison with the acceptance criteria, and describes any test exceptions which may have been written while conducting the tests.

14.3.6 Reference

1. GE Nuclear Energy, "Generic Guidelines for General Electric Boiling Water Reactor Power Uprate," Licensing Topical Report NEDC-31897P-1, Class III (Proprietary), June 1991.

TABLE 14.3-1
(Sheet 1 of 2)

SUMMARY OF TESTING PERFORMED FOR THE POWER UPRATE
POWER ASCENSION TEST PROGRAM

USAR Chapter 14 Tests

SUT	POWER ASCENSION TESTS	Test Conditions/ % Uprated Power Levels				
			A	B	C	D
		P(1)	≤90	95	98	100
1	Chemical and Radiochemical			X		X
2	Radiation Measurement			X		X
3	Fuel Loading	X				
4	Full Core Shutdown Margin	X				
5	Control Rod Drive System	X				
6	Source Range Monitor Performance	X				
10	Intermediate Range Monitor System Performance		X			
11	LPRM Calibration		X			X
12	APRM Calibration		X	X	X	X
14	RCIC System		X			X
18	TIP Uncertainty					X
19	Core Performance		X	X	X	X
22	Pressure Regulator		X	X		
23A	Water Level Setpoint, Manual Feedwater Flow Changes	X		X		X
23D	Maximum Feedwater Runout Capability	X				
24	Turbine Valve Surveillance		X	X	X	X
33	Drywell Piping Vibration		X	X	X	X
35	Recirc System Flow Calibration					X
74	Offgas System			X		X
75	Drywell Cooling System			X	X	X
77	BOP Piping Vibration		X	X	X	X

GE Specified Tests

SUT	POWER ASCENSION TESTS	Test Conditions/ % Uprated Power Levels				
			A	B	C	D
		P(1)	≤90	95	98	100
95	HPCS	X				

TABLE 14.3-1
(Sheet 2 of 2)

SUMMARY OF TESTING PERFORMED FOR THE POWER UPRATE
POWER ASCENSION TEST PROGRAM

Additional Testing						
		Test Conditions/ % Uprated Power Levels				
			A	B	C	D
SUT	POWER ASCENSION TESTS	P[1]	≤90	95	98	100
100	Steady State Data Collection		X	X	X	X
101	Condensate and Feedwater Performance					X
102	Feedwater Heater Operational Performance			X		X
103	Recirculation Pump Vibration			X	X	X
121	Main Steam Line Rad Monitor					X
141	Jet Pump Operability					X

(1) Preoperational test performed prior to startup.

TABLE 14.3-2
(Sheet 1 of 23)

INDIVIDUAL POWER ASCENSION TESTS

TEST 1 - CHEMICAL AND RADIOCHEMICAL

Objective

To secure information on the chemistry and radiochemistry of the reactor coolant at uprate conditions.

Acceptance Criteria

Level 1

1. Chemical factors defined in the Technical Specifications and fuel warranty are maintained within the limits specified.

2. The activity of gaseous and liquid effluents conforms to license limitations.

3. Water quality is known at all times and remains within the guidelines of the water quality specifications.

Level 2

Fuel Reliability Indicator (FRI) shall be <100 μCi/sec.

Discussion

Samples were taken and measurements were made at the previous rated power condition and the uprated conditions to determine the chemical and radiochemical quality of reactor water and reactor feedwater, gaseous release, and reactor steam quality.

All acceptance criteria were satisfied.

TEST 2 - RADIATION MEASUREMENT

Objective

To monitor radiation at the uprate power conditions to assure that personnel exposures are maintained as low as reasonably achievable (ALARA).

Acceptance Criteria

Level 1

Not applicable.

TABLE 14.3-2
(Sheet 2 of 23)

INDIVIDUAL POWER ASCENSION TESTS

Level 2

Dose rates not >50% above the design shielding integrity acceptance criteria.

Discussion

Radiation levels at selected points throughout the plant at the previous rated power level and the uprate conditions were monitored.

Radiation measurements at predesignated locations for surveys were taken to identify and assess the impact of the Unit 2 uprate on actual plant area dose rates. USAR radiation zones were monitored for any required changes.

All points with the exception of one met the acceptance criteria. The one point (T4-3), a radiation base point in the counting room, failed the Level 2 acceptance criteria due to shine from the moisture separator reheaters. As a result, the area around the counting room door was changed from a Zone VI radiation zone to a Zone IV.

TEST 3 - FUEL LOADING

Objective

To load fuel safely and efficiently to the full core size.

Acceptance Criteria

Level 1

None.

Level 2

1. The reactor core is completely reloaded in accordance with the fuel movement instructions.

2. Fuel bundle serial numbers and locations agree with the post-refueling core map, fuel bundle orientation and seating are correct, and no abnormal conditions or foreign material are present.

TABLE 14.3-2
(Sheet 3 of 23)

INDIVIDUAL POWER ASCENSION TESTS

Discussion

Fuel was loaded safely and efficiently and proper loading was independently verified. All acceptance criteria were satisfied.

TEST 4 - FULL CORE SHUTDOWN MARGIN

Objective

To demonstrate that the reactor can be made subcritical with the required margin at any point throughout the fuel cycle with the strongest worth control rod fully withdrawn and all other control rods fully inserted.

Acceptance Criteria

Level 1

Shutdown margin $\geq 0.38\%\ \Delta k/k$.

Level 2

Actual number of control rod notches withdrawn to achieve criticality is within the upper limit and lower limit of allowable control rod removal.

Discussion

The core shutdown margin was demonstrated and the actual number of notches withdrawn at criticality were determined. All acceptance criteria were satisfied.

TEST 5 - CONTROL ROD DRIVE SYSTEM

Objective

To demonstrate that the CRD scram times were acceptable at the uprated pressure.

Acceptance Criteria

Level 1

1. The maximum scram insertion time of each control rod from fully withdrawn position to notch position 5, based on de-energization of the scram pilot valve solenoids as time zero, shall not exceed 7.0 sec.

TABLE 14.3-2
(Sheet 4 of 23)

INDIVIDUAL POWER ASCENSION TESTS

2. The average scram insertion time of all operable control rods from the fully withdrawn position, based on de-energization of the scram pilot valve solenoids as time zero, shall not exceed any of the following:

Position Inserted From Fully Withdrawn	Average Scram Insertion Time (sec)
45	0.43
39	0.86
25	1.93
5	3.49

Level 2

The position indication for each control rod tested shall function properly, the insert and withdraw times are to be between 42.0 and 57.6 sec, and each control rod is to be demonstrated to be coupled.

Discussion

Prior to startup, during the reactor pressure vessel (RPV) hydrostatic test, the flow control valves and CRD pumps were tested to ensure they are capable of operating within their acceptable range. CRD pump and flow control valve performance was satisfactory.

During the RPV hydro, with the RPV at 1020 psig, CRD scram testing was performed on 148 of the 185 CRDs. Twenty-six CRDs were tested during the RPV hydro with >950 psig pressure. The remaining 11 CRDs were tested during reactor operation with the vessel pressure at >960 psig.

CRD insert/withdraw timing was performed, each control rod position indication was verified, all CRD insert stroke times were measured, all CRD withdraw stroke times were measured, and each CRD was demonstrated to be coupled.

All acceptance criteria were satisfied.

TABLE 14.3-2
(Sheet 5 of 23)

INDIVIDUAL POWER ASCENSION TESTS

TEST 6 - SOURCE RANGE MONITOR PERFORMANCE <u>Objective</u> To ensure the source range monitors (SRM) were reading properly after initial fuel loading. <u>Discussion</u> Proper SRM response prior to startup was ensured.
TEST 10 - INTERMEDIATE RANGE MONITOR PERFORMANCE <u>Objective</u> To ensure adequate SRM/IRM overlap during the initial plant startup. <u>Discussion</u> Proper IRM response during startup was ensured.
TEST 11 - LOCAL POWER RANGE MONITOR <u>Objective</u> To calibrate the LPRM system. <u>Acceptance Criteria</u> <u>Level 1</u> None. <u>Level 2</u> 1. The gain adjustment factors (GAF) for all LPRMs which are not bypassed are between 0.90 and 1.10 inclusive. 2. The TIP system was normalized within 72 hr of LPRM calibration. 3. LPRM calibration currents for all unbypassed LPRMs are greater than or equal to the end-of-life calibration current.

TABLE 14.3-2
(Sheet 6 of 23)

INDIVIDUAL POWER ASCENSION TESTS

Discussion

The LPRM system was calibrated.

The LPRMs were calibrated at 75% power and 100% power. All acceptance criteria were satisfied.

TEST 12 - AVERAGE POWER RANGE MONITOR CALIBRATION

Objective

To calibrate the APRM system.

Acceptance Criteria

Level 1

1. If FPAPDR ≤1 or less than 25% power, the APRMs read ±2% of actual core thermal power and do not read >100% of rated thermal power.

2. If FPAPDR >1, the APRMs have been set to read CMFLPD*100 and the notice of APRM adjustment for P603 has been posted.

Discussion

The APRM system was calibrated at 90%, 95%, 98% and 100% power. All acceptance criteria were satisfied.

TEST 14 - REACTOR CORE ISOLATION COOLING SYSTEM

Objective

The RCIC system must meet the Technical Specification requirements of 600 gpm at 150 (+15, -0) psig reactor pressure, and the RCIC system must meet the Technical Specification requirements of 600 gpm at 1015 (+20, -80) psig reactor pressure, and at full uprated pressure.

Acceptance Criteria

Level 1

1. RCIC pump flow ≥600 gpm in the test flow path with system head corresponding to reactor vessel operating pressure when steam supply pressure is between 920 and 1020 psig.

TABLE 14.3-2
(Sheet 7 of 23)

INDIVIDUAL POWER ASCENSION TESTS

2. At 100% reactor rated pressure, the average RCIC pump discharge flow shall be equal to or greater than the 100% rated value within 30 sec of automatic initiation.

Level 2

The speed and flow control loops shall be adjusted so that the decay ratio of RCIC system variables is not greater than 0.25.

Discussion

The RCIC turbine mechanical overspeed trip at >60 psig reactor pressure was performed.

The RCIC was started and run at 610 gpm flow and 400 psig discharge pressure with the RPV at 160 psig. With the RCIC controller in AUTO, ±10% step changes were introduced. The controls responded as expected and no unusual occurrences were noted.

At 1015 (+20, -80) psig, a simulated cold quick start was satisfactorily performed. The system responded normally. With 600 gpm at 4250 rpm, CST to CST, ±10% step changes were introduced with good control response. Steady state was established in AUTO and the RCIC pump delivered 604.5 gpm/4225 rpm at a pump ΔP of 1112 psid, which was 117 psi above reactor pressure (995 psig). The test was completed satisfactorily as planned with no unusual occurrences.

At reactor rated conditions, a simulated CST to CST cold quick start resulted in 600 gpm flow in ≈18 sec.

TEST 18 - TIP UNCERTAINTY

Objective

To determine the uncertainty of the TIP readings according to N2-REP-14, TIP Uncertainty Calculation.

Acceptance Criteria

Level 1

None.

TABLE 14.3-2
(Sheet 8 of 23)

INDIVIDUAL POWER ASCENSION TESTS

Level 2

The total TIP uncertainty (including random noise and geometrical uncertainties) obtained by averaging the uncertainties for all data sets shall be <6.0%.

Discussion

This test was performed at 100% power and the results were within the acceptance criteria.

TEST 19 - CORE PERFORMANCE

Objective

To ensure that plant thermal limits are maintained during the ascension to uprate conditions.

Acceptance Criteria

Level 1

1. The core thermal limits MCPR, MLHGR, and maximum average planar linear heat generation rate (MAPLHGR) are within the Technical Specification limits.

2. Steady-state reactor power is limited to rated core thermal power and values on or below the rated power flow control line (109.6%). Core flow does not exceed its rated value.

Level 2

None.

Discussion

Steady-state core thermal (MWt) power measurements were made near 90% of uprated power and 100% of the old rated power (3323 MWt), and at increments of ≤3% power up to the new rating (3467 MWt). Fuel thermal margin was projected to the next test point to show acceptable margin, and was confirmed at each test point before advancing to the full uprate conditions.

Demonstration of fuel thermal margin was performed prior to and during power ascension to the uprated power level at each steady-state heat balance point discussed above.

TABLE 14.3-2
(Sheet 9 of 23)

INDIVIDUAL POWER ASCENSION TESTS

This demonstration and ongoing monitoring of core and fuel conditions were performed. Fuel thermal margin projections were made.
TEST 22 - PRESSURE REGULATOR <u>Objectives</u> 1. To confirm the continued adequacy of the settings for the pressure control loop by analysis of the transients induced in the reactor pressure control system by means of the pressure regulators. 2. To demonstrate the backup capability of the pressure regulators via simulated failure of the controlling pressure regulator. 3. To demonstrate that other affected parameters are within acceptable limits during pressure regulator induced transient maneuvers. <u>Acceptance Criteria</u> <u>Level 1</u> The transient response of any pressure control system related variable to any test input must not diverge. <u>Level 2</u> 1. Pressure control system related variables may contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response shall be $\leq$0.25. (This criterion does not apply to tests involving simulated failure of one regulator with the backup regulator taking over.) 2. The pressure response time from initiation of pressure setpoint change to the turbine inlet pressure peak shall be $\leq$10 sec. 4. Pressure control system deadband, delay, etc., shall be small enough that steady-state limit cycles (if any) produce steam flow variations no larger than $\pm$0.5% of rated steam flow (excluding bi-stable flow).

TABLE 14.3-2
(Sheet 10 of 23)

INDIVIDUAL POWER ASCENSION TESTS

4. The peak neutron flux and/or peak vessel pressure shall remain below the scram settings by at least 7.5% and 10 psi, respectively, for all pressure regulator transients.

5. 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 F_t	≤4:1
F_t to 97%	≤2:1
F_t to 99%	≤5:1

Where: F_t = Turbine steam flow at the control valve #4 crack point

6. Turbine control valves 1, 2, and 3 shall be full open when the fourth valve is modulating system pressure for reactor power levels from about 95% to 98% of nuclear boiler rated (NBR).

7. The turbine load limit shall be set between 102% and 103% of rated turbine load.

Discussion

At 64% and 96% of uprate power, pressure regulator step changes of approximately ±10 psi were input to the pressure regulators. A simulated failure of the operating regulator demonstrated transfer to the backup regulator.

During the simulated failure of the operating regulator ("A" to "B" failover), an apparent intermittent high resistance in the test switch resulted in the "B" regulator not going into saturation and taking control immediately. The only effect was a short delay. The "B" regulator then took control cleanly, and when the test switch was released, the "A" regulator retook control cleanly. All acceptance criteria were met.

No problems were experienced during the step changes at either power level.

TABLE 14.3-2
(Sheet 11 of 23)

INDIVIDUAL POWER ASCENSION TESTS

TEST 23A - WATER LEVEL SETPOINT, MANUAL FEEDWATER FLOW CHANGES

Objective

To verify that the feedwater system is adjusted to provide acceptable reactor water level control.

Acceptance Criteria

Level 1

The transient response of any level control system related variable to any test input shall not diverge.

Level 2

1. Level control system related variables may contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response must be ≤0.25.

2. At steady-state generation for the three element mode, the input scaling to the mismatch gain shall be adjusted such that level error due to biased mismatch gain output shall be within ±1 in.

Discussion

Setpoint changes were made in the three and single element modes at the previous rated power level and again at the uprate power level.

All acceptance criteria were satisfied.

TEST 23D - MAXIMUM FEEDWATER RUNOUT

Objective

To analytically determine runout capability based on feedwater system head loss characteristics.

Acceptance Criteria

Level 1

The maximum flow attained shall not exceed the following flows with the normal complement of pumps operating.

TABLE 14.3-2
(Sheet 12 of 23)

INDIVIDUAL POWER ASCENSION TESTS

1. 135% NBR* at pressure corresponding to uprate power.

2. 146% NBR* at 1025 psia.

Level 2

The maximum flow shall be greater than:

1. 105% NBR* at pressure corresponding to uprated power with rated complement of pumps.

2. 68% NBR* at 1009 psia with one feedwater pump tripped.

Discussion

An analysis was performed which determines the maximum feedwater flow runout at power uprate conditions with the reactor feedwater control valves full open. Calculation A10.2-A-080 was performed using plant data obtained during the original startup test SUT 23.6, which was then extrapolated to uprate conditions. The following results were calculated:

Level 1 Criteria	Result
≤135% NBR at 1035 psia	116.0% NBR
≤146% NBR at 1025 psia	116.2% NBR

Level 2 Criteria	Result
>105% NBR at 1035 psia	105.4%
>68% NBR at 1009 psia with one RFP tripped	65.2%

The 65.2% NBR flow with one RFP tripped fails the 68% Level 2 acceptance criteria. The 68% NBR flow is required for Unit 2 to survive a feedwater pump trip without Operator action. The failure to meet this criteria means that from high rod lines, Unit 2 would not be able to experience a reactor feedwater pump trip without Operator action to prevent a reactor scram. DER 2-95-0826 was written to address this issue.

* NBR is the feedwater flow that corresponds to 100% uprated power.

TABLE 14.3-2
(Sheet 13 of 23)

INDIVIDUAL POWER ASCENSION TESTS

TEST 24 - TURBINE VALVE SURVEILLANCE

Objective

To demonstrate the maximum power level for required periodic surveillance testing of the main turbine control valves without producing a reactor scram.

Acceptance Criteria

Level 1

Not applicable.

Level 2

1. 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.

2. Peak steam flow in each line must remain 10% below the high flow isolation trip setting.

Discussion

Individual main turbine stop and control valves are tested routinely during plant operation as required for turbine surveillance testing. At 88% and 90% of uprate power, the response of the reactor was observed and the maximum power level for performance of these tests along the maximum load line was extrapolated. Each valve test was manually initiated and reset. The rate of valve stroking and timing of the close-open sequence was such that the minimum practical disturbance was introduced.

During the testing, bypass valve actuation was observed at 90% power. While the bypass valve opening was minimal, and to ensure no adverse effects would occur, NMPC decided to eliminate higher power testing and to henceforth limit turbine valve surveillance testing to 88% power, where no bypass valve actuation will occur.

TABLE 14.3-2
(Sheet 14 of 23)

INDIVIDUAL POWER ASCENSION TESTS

TEST 33 - DRYWELL PIPING VIBRATION

Objectives

1. To verify that the vibration of the reactor recirculation piping is within acceptable limits.

2. To verify that stresses are within code limits during operating transient loads.

Acceptance Criteria

Level 1

The steady-state vibration levels shall result in stresses which are within acceptable code limits as determined by NMPC Engineering.

Level 2

None.

Discussion

To ensure that operation at uprate conditions does not significantly affect recirculation system vibration, vibration measurements were taken using the installed loose parts monitoring transducers and analyzed. Additionally, measurements were taken during the startup from Refueling Outage (RFO) 13 in 2012 using temporarily installed accelerometers on the RCS pumps A and B piping up to 105% core flow. All acceptance criteria were satisfied. Drywell feedwater piping vibration is discussed in Test 77.

TEST 35 - RECIRCULATION SYSTEM FLOW CALIBRATION

Objective

To perform a complete calibration of the installed core flow and recirculation pump flow instrumentation.

Acceptance Criteria

Level 1

None.

Level 2

1. Final GAFs for jet pump loop summers 2ISC-FY1602A/B are $\geq$0.99 and $\leq$1.01.

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2. GAFs for 2RCS-FY1652A/B are ≥0.99 and ≤1.01.

3. GAFs for flow units summer cards A, B, C and D are ≥0.99 and ≤1.01.

Discussion

Recirculation system data was taken and the jet pump and recirculation flow unit instrumentation recalibrated. All acceptance criteria were satisfied.

TEST 74 - OFFGAS SYSTEM

Objective

To demonstrate that the offgas system operates within the Technical Specifications at the uprate conditions.

Acceptance Criteria

Level 1

The release of radioactive gaseous and particulate effluents must not exceed the limits specified in the Unit 2 Technical Specifications.

Level 2

None.

Discussion

Offgas activity was monitored at the previous rated power level and at the uprate conditions. Test results satisfied the acceptance criteria.

TEST 75 - DRYWELL COOLING

Objective

To verify the ability of the drywell cooling system to maintain the drywell within Technical Specification limits.

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INDIVIDUAL POWER ASCENSION TESTS

<u>Acceptance Criteria</u>

<u>Level 1</u>

The drywell average air temperature shall not exceed 150°F per Technical Specification 3.6.1.6.

<u>Level 2</u>

The maximum temperature measured in any areas recorded on Table 7-1 of Attachment 7.0 of N2-OSP-LOG-D001 does not exceed 150°F.

<u>Discussion</u>

Measurements were taken to verify that the drywell temperatures remain below Technical Specification limits. All measurements met acceptance criteria.

TEST 77 - BALANCE OF PLANT PIPING VIBRATION

<u>Objective</u>

To verify that the steady-state vibration for the electro-hydraulic control (EHC) and feedwater systems is within acceptable limits.

<u>Acceptance Criteria</u>

<u>Level 1</u>

The steady-state vibration levels shall result in stresses which are within acceptable code limits as determined by NMPC Engineering.

<u>Level 2</u>

None.

<u>Discussion</u>

Vibration measurements were taken at points on the feedwater piping inside the drywell, EHC piping to turbine control valve #4, and on the feedwater pumps at 50%, 75%, 95%, 98%, and 100% power. With three exceptions, all acceptance criteria were satisfied.

One of the exceptions was high displacement readings due to the use of accelerometers to obtain displacements. At 50% power

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INDIVIDUAL POWER ASCENSION TESTS

level, the feedwater piping in the Z direction (perpendicular to the pipe run) exceeded the Level 2 criteria. Accelerometers installed on the feedwater piping are designed for noise monitoring and falsely introduce amplified displacements at low frequencies (<5 Hz) due to the double integration process. For recordings at 75% and higher power levels, acceleration responses ≤5 Hz were filtered.

The second and third exceptions were exceedance of administratively set vibration limits which trigger engineering evaluation. Limits were exceeded on the coupling bearing on the "B" feedwater pump at the 50% level and on the coupling bearing on the "C" feedwater pump at the 50% and 75% power levels. The exceedance was documented in DER 2-95-2113 for evaluation. Since these vibration levels only exceeded NMPC established administrative limits, and reduced to acceptable levels at greater than 75% power, there was no impact on power uprate.

Test 95 - HIGH-PRESSURE CORE SPRAY

Objective

To verify that HPCS can deliver the specified flow against the increased reactor pressure with power uprate (517 gpm @ 1200 psig).

Acceptance Criteria

Level 1

HPCS must be able to deliver 517 gpm flow against the increased reactor pressure with power uprate of 1200 psig.

Level 2

None.

Discussion

The requirements of this test were satisfied by a review of existing test data and the performance of a calculation to verify that HPCS can deliver 517 gpm against a discharge head of 1200 psig. Actual testing was not required.

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INDIVIDUAL POWER ASCENSION TESTS

TEST 100 - STEADY-STATE DATA COLLECTION

Objective

To monitor and extrapolate important plant parameters to uprate conditions.

Acceptance Criteria

Level 1

Parameter	Acceptance Criteria	Units
Core Thermal Power	≤3467	MWt
MFLCPR	≤1.0	-
MAPRAT	≤1.0	-
MFLPD	≤1.0	-
Reactor Feedwater Flow Inlet Temp	405-425	°F

Level 2

Parameter	Acceptance Criteria	Units
Main Steam Pressure	≤1020	psig
Turbine First-Stage Pressure	≤710	psia
Main Turbine Steam Flow	≤13.6	mlb/hr
Main Steam Flow	≤15.0	mlb/hr
Steam Dome Pressure	≤1020	psig
EHC Sensed Pressure	≤988	psig
EHC Pressure Setpoint	955-965	psig
Total Control Valve Position	≤85	%
Turbine Control Valve #1 Position	100	%
Turbine Control Valve #2 Position	100	%
Turbine Control Valve #3 Position	100	%
Turbine Control Valve #4 Position	≤30	%
Generator Power	≤1211	MWe
Feedwater Flow Loop A/B	≤8.0	mlb/hr
Total Feedwater Flow	≤15.0	mlb/hr

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INDIVIDUAL POWER ASCENSION TESTS

Discussion

Steady-state data of important plant parameters was taken at ≈ 90% power as a baseline for extrapolation. Plant power was increased to the old 100% power level of 3323 MWt (≈95.8% uprate power). Another set of plant steady-state data was taken and extrapolations were made to 98% uprate power. At 98% power, parameters were measured and extrapolations made to 100%. These power levels were determined based on feedwater flow measurements without the LEFM corrections being made. At full power, the LEFM corrections were made which showed actual power to be 99.6%. A mismatch between diverse feedwater flow monitoring instrumentation resulted in operation of the plant slightly below 100% in order to ensure conservative operation. This slight derate did not affect the completion of this test.

All Level 1 acceptance criteria were satisfied. Level 2 acceptance criteria failures were recorded on EHC pressure setpoint at all power levels, total control valve position at the 98% extrapolated power, control valve #4 at 100% power, and turbine first-stage bowl pressure at 100%.

At all power levels, the EHC pressure setpoints ('A'=974 psig, 'B'=975 psig) exceeded the 955-965 psig Level 2 acceptance criteria. This failure was resolved as "accept-as-is." The discrepancy is due to the non-linearity of the EHC pressure transmitters 2MSS-PT143/144 and a voltage offset in the EHC pressure regulator, introduced to ensure the pressure regulator will take control of pressure at 150 psig during plant startup. With these items taken into consideration, the recorded setpoints were as expected.

At the extrapolated 98% power level, the total control valve position was projected to be 93.3% which exceeded the 85% Level 2 acceptance criteria. This was due to the non-linearity of control valves 1-3 position versus steam flow between the 95% and 98% power levels. The conservative linear extrapolation overpredicted the total control valve position. This was accepted-as-is based on the agreement of each individual control valve position with its predicted position from the control valve flow curves. The actual position at 100% was 84.7% which was below the 85% acceptance criteria.

At 100% power, the position of control valve #4 was 36.1% which exceeded the Level 2 acceptance criteria of 30%. Operation with control valve #4 >30% is acceptable provided the EHC system is stable.

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INDIVIDUAL POWER ASCENSION TESTS

At 100% power, first-stage bowl pressure was 712.5 psia which exceeded the acceptance criteria of 710 psia. This condition was evaluated and found to be acceptable.

TEST 101 - CONDENSATE AND FEEDWATER PERFORMANCE

Objective

To ensure that motor amps are within nameplate rating and thus there is no significant impact on the lifetime of the motors with power uprate, and to ensure adequate margin to suction pressure trip setpoints for condensate, condensate booster and reactor feedwater pumps at runout flow rates.

Acceptance Criteria

Level 1

None.

Level 2

1. Condensate booster pump suction pressure >48 psig at 110% flow.

2. Reactor feedwater pump suction pressure >210 psig at 110% flow.

3. Condensate booster pump motor amps ≤112 amps.

4. Condensate pump motor amps ≤218 amps.

5. Reactor feedwater pump motor amps ≤499 amps.

6. Heater drain pump motor amps ≤190 amps.

Discussion

The condensate, condensate booster, feedwater, and heater drain pump motors were monitored during uprated power operation with 3-3-2,3 alignment to ensure that motor amps are within nameplate rating and thus there is no significant impact on the lifetime of the motors. Condensate booster and reactor feedwater pump flows and suction pressures were monitored and extrapolated to runout flow to ensure adequate margin to suction pressure trip setpoints for power uprate. Test results showed all acceptance criteria were satisfied.

TABLE 14.3-2
(Sheet 21 of 23)

INDIVIDUAL POWER ASCENSION TESTS

TEST 102 - FEEDWATER HEATER OPERATIONAL PERFORMANCE

Objective

To monitor operational performance of the feedwater heater regulating valves.

Acceptance Criteria

Level 1

None.

Level 2

The performance of the feedwater heater level control valves is stable and all normal level control valves are controlling feedwater heater levels within their normal level control bands.

Discussion

Operational performance of the feedwater heater regulating valves was monitored at 95% and 100% uprate power. All normal level control valves were operating satisfactorily within their normal level control band with sufficient margin to their full open position to accommodate transients. All emergency level dump valves were closed.

TEST 103 - RECIRCULATION PUMP VIBRATION

Objective

To monitor recirculation pump vibration at uprate conditions.

Acceptance Criteria

Level 1

None.

Level 2

1. Pump shaft displacement ≤13.9 mils.

2. Pump casing velocity ≤0.3 in/sec.

3. Motor frame displacement ≤3.4 mils; ≤0.305 in/sec.

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INDIVIDUAL POWER ASCENSION TESTS

Discussion

Recirculation pump shaft vibration was monitored using the permanently installed instrumentation during operation at 50%, 75%, 95%, 98% and 100% of uprated power. The requirements for this test were satisfied. Pump vibration was within the acceptance criteria at all power levels.

TEST 121 - MAIN STEAM LINE RADIATION MONITOR

Objective

To adjust the setpoint of the main steam line radiation monitors for the uprate conditions.

Acceptance Criteria

Level 1

None.

Level 2

The setpoints for the main steam line monitors have been recalculated for power uprate and the monitors have been recalibrated to the new setpoints.

Discussion

The setpoints of the main steam line radiation monitors were recalculated after power was increased to the uprated 100% power level.

TEST 141 - JET PUMP OPERABILITY (Technical Specification 3.4.3)

Objective

To measure the necessary parameters to create new Technical Specification jet pump operability curves.

Acceptance Criteria

Level 1

None.

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(Sheet 23 of 23)

INDIVIDUAL POWER ASCENSION TESTS

Level 2

The jet pump operability curve data has been taken and analyzed.

Discussion

Data for producing uprate jet pump operability curves was taken along the power/flow line near the 100% rod line. This includes recirculation loop flow, drive flow, jet pump flow and recirculation valve position. As of 1995, this testing was completed satisfactorily up to 102% core flow. Additional testing to 105% core flow was performed during the startup from RFO 13 in 2012 after jet pump mixer replacement. The testing was completed satisfactorily.

14.4 INITIAL TEST PROGRAM FOR OPERATION AT EXTENDED POWER UPRATE (EPU) CONDITIONS (3,988 MWt)

The startup test phase for power ascension to extended power conditions commences with the receipt of an approved License Amendment for operation at the specified EPU thermal power (EPUTP) level. Testing performed during this phase confirms the engineering evaluations supporting the uprate and provides the means for establishing necessary setpoint changes and other adjustments. The test program is based on References 1 and 2 (Attachment 7). It ensures continued acceptable operational performance of systems and/or components which have revised performance requirements, and closely monitors reactor and core conditions. Test procedures are based on the methods and criteria used during the original preoperational and startup test program.

14.4.1 Summary of Test Program and Objectives

14.4.1.1 Overview of Program

The Unit 2 EPU Power Ascension Test Program included pre-refueling activities, refueling, heatup, and power ascension testing. The program tested the reactor, turbine generator, related auxiliary systems and balance of plant systems.

14.4.1.2 Test Conditions

The EPU Power Ascension Test Program was divided into the following test conditions.

1. Mode 4 and 5 Test Condition - Mode 4 and 5 tests are performed prior to plant startup in accordance with the refueling outage schedule.
2. Startup to 3,467 MWt (86.9% EPUTP)
3. 3,467 MWt to 3,553 MWt (89.1% EPUTP)
4. 3,553 MWt to 3,640 MWt (91.3% EPUTP)
5. 3,640 MWt to 3,727 MWt (93.5% EPUTP)
6. 3,727 MWt to 3,813 MWt (95.6% EPUTP)
7. 3,813 MWt to 3,900 MWt (97.8% EPUTP)
8. 3,900 MWt to 3,988 MWt (100% EPUTP)

14.4.1.3 Test Objectives

The results of the EPU power ascension tests were used to determine the acceptability of operating Unit 2 at the uprate power level.

14.4.2 Organization and Staffing

The EPU Power Ascension Test Program was administered within the existing NMPNS plant staff organization.

14.4.3 Conduct of Testing

14.4.3.1 Test Procedures

EPU power ascension test procedure preparation, procedure and results approval, procedural changes, test conduct, and test exceptions were governed by the Unit 2 administrative procedures.

An administrative procedure, N2-EPUPA-MASTER, "EPU Master Test Procedure," is used to confirm and document acceptable plant performance following EPU-related changes performed in Refueling Outage N2R13 and for operation at EPU power level of 3,988 MWt per License Amendment No. 140. This test procedure establishes administrative controls for EPU test program implementation to track and verify station and NRC acceptance of test data and authorization to proceed through power ascension. This procedure implements EPU power ascension testing and documents successful completion of all the required procedures that establish power ascension test acceptance criteria to allow operation with reactor power above 3,467 MWt to 3,988 MWt.

14.4.3.2 Test Exceptions

Test exceptions (test results that do not meet acceptance criteria) are documented on a Test Exception form and a Condition Report in accordance with the corrective action program (CAP), as applicable.

14.4.3.3 Test Data

Data used in the evaluation of the individual power ascension tests were obtained from plant instrumentation (i.e., recorders, meters), the plant process computer, the Transient Analysis Recording System (TARS), and special test equipment. All of these were used to obtain steady-state data. The 3D Monicore computer was utilized primarily for the evaluation of thermal power and thermal limits. The TARS computer was employed mainly for system performance demonstrations and plant response to transients. All instrumentation used in the evaluation of acceptance criteria was calibrated to Unit 2 specifications.

14.4.3.4 Criteria for Testing

To assist in the evaluation of proper plant performance from the test results obtained, a set of criteria for each test was developed. These criteria are a result of a combination of factors such as safety analysis assumptions, engineering expectations, and contractual commitments. Level 1 criteria are based on safety considerations while Level 2 criteria are based on performance considerations. Definitions of these Level 1 and Level 2 criteria, and required actions in the event the criteria is not met, are as follows:

Level 1 Acceptance Criteria

If a Level 1 criterion is not satisfied, the test in progress is aborted and the plant is placed in a suitable hold condition that is judged to be satisfactory and safe based on prior testing. Plant operating or test procedures or the Technical Specifications may guide the decision on the direction taken. Resolution of the problem is immediately pursued by appropriate equipment adjustments or through engineering analysis. Applicable test exceptions must be resolved to verify that the requirements of the Level 1 criterion are satisfied.

Level 2 Acceptance Criteria

If a Level 2 criterion is not satisfied, the plant is placed in a suitable hold condition that is judged to be satisfactory and safe based on prior testing. The limits stated in this category are usually associated with expectations of system performance whose characteristics can be improved by equipment adjustments. An investigation of the measurements and of the analytical techniques used for the predictions is initiated. Applicable test exceptions must be resolved to verify that the requirements of the Level 2 criterion are satisfied.

Acceptance Criteria Not Identified by Level

The Unit 2 surveillance and other test procedures do not identify acceptance criteria by level. Acceptance criteria that are not identified by a Level 1 or Level 2 designation are treated as Level 2 acceptance criteria.

14.4.3.5 Test Procedure Results Review and Approvals

Administrative hold points were instituted in order to assure that test results were reviewed and approved by the responsible senior manager prior to further increases in power level.

Administrative hold points were placed at the completion of the following test conditions that required Plant Operating Review Committee (PORC) review and Plant General Manager approval of the testing results prior to further increases in power level.

1. Mode 4 and 5 Test Condition

2. Startup to 3,467 MWt (86.9% EPUTP)

3. 3,553 MWt to 3,640 MWt (91.3% EPUTP)

4. 3,727 MWt to 3,813 MWt (95.6% EPUTP)

5. 3,900 MWt to 3,988 MW t (100% EPUTP)

Regulatory hold points were required at 105% and 110% of 3,467 MWt for NRC review of test results for piping vibration and steam dryer performance.

14.4.3.6 Test Records

The EPU power ascension test records were administered and archived in accordance with the existing NMPNS administrative procedures.

14.4.4 Conformance of Test Program with Regulatory Guidelines

The requirements for testing came from the Unit 2 EPU licensing submittal (Reference 2), the NRC Safety Evaluation for License Amendment No. 140 (Reference 3), Chapter 14 of the Updated Safety Analysis Report (USAR), and the GE Extended Power Uprate Power Ascension Test Specification (Reference 1). Results of these tests were used to determine the acceptability of operating the unit at the uprate power level. The Unit 2 Extended Power Uprate Power Ascension Test Program was controlled under existing NMPNS administrative procedures and satisfied the requirements of 10CFR50, Appendix B, Criterion XI, “Test Control.”

14.4.5 Summary of Test Results

A list of the EPU power ascension tests can be found in Table 14.4-1. This table provides the EPU thermal power at which each test was performed. All activities in each of the Test Conditions were completed satisfactorily to allow continued operation at the full EPU licensed thermal power of 3,988 MWt.

The EPU Test number in Table 14.4-1 is in reference to the EPU Test Plan discussed in Reference 2, Attachment 7.

14.4.6 References

1. GE Hitachi Nuclear Energy EPU Task Report T1005, Startup Test Specifications, Revision 0, September 2008, Doc. No. 0000-0070-3271.

2. K. J. Polson (NMPNS) Letter to NRC, “License Amendment Request (LAR) Pursuant to 10CFR50.90: Extended Power Uprate,” May 27, 2009.

3. License Amendment No. 140 to Operating License No. NPF-69; Nine Mile Point Nuclear Station, Unit 2 – Extended Power Uprate.

Table 14.4-1
(Sheet 1 of 2)

Summary of Testing Performed for the Extended Power Uprate Power Ascension Test Program

EPU Test No.	Description	Procedure	Mode 4/5	Mode 4; OR <1595 MWt AND Pressure ≥800 psig	Mode 2 AND initial approach to criticality	Every 120 MWt following generator synch, to 100%	APRM >13% to <26%	APRM >23%	APRM >23%(when heat balance is valid, then when required	43.5% 1734 MWt	60% 2393 MWt	60.9% 2427 MWt	65.2% 2600 MWt	68% 2712 MWt	70% (2426 MWt) up to 85% (2497 MWt) as evaluated	73.9% 2947 MWt	78.2% 3120 MWt	82.6% 3294 MWt	85.2% 3397 MWt	86.9% 3467 MWt	89.1% 3553 MWt	91.3% 3640 MWt	93.5% 3727 MWt	95.6% 3813 MWt	97.8% 3900 MWt	100% 3988 MWt
3	Fuel loading and core verification performed per plant procedures	N2-FHP-13.2 N2-REP-008	X																	X						X
12,35	APRM calibration/functional test	N2-ISP-NMS-R001, LPRM/APRM Channel 1 Calibration N2-ISP-NMS-R002, LPRM/APRM Channel 2 Calibration N2-ISP-NMS-R003, LPRM/APRM Channel 3 Calibration N2-ISP-NMS-R004, LPRM/APRM Channel 4 Calibration	X																	X						
T/S 1	MSIV isolation on MSL flow - high allowable value	N2-ISP-MSS-Q002	X																							
T/S 2	SLC pump and relief valve surveillance test	N2-OSP-SLS-Q001	X																							
T/S 3	TSV/TCV closure scram bypass verification surveillance test and TSV/TCV closure EOC-RPT bypass verification surveillance test	N2-ISP-MSS-R105	X																							
5	Control rod speed testing/adjustment (scram timing). CRD dynamic friction determined to be within Technical Specification limits with acceptable scram times	N2-OSP-RMC-@001 N2-RESP-11 N2-RESP-8		X																						
4	Full core shutdown margin test	N2-RESP-10, Subcooled Critical Comparison			X																					
22B	Pressure regulator incremental regulation check	N2-EPUPA-22B				X																				X
22C	Scram/EOC-RPT bypass - first stage pressure	N2-MFT-302, High Pressure Turbine Power Ascension Monitoring, Attachment 8, Main Turbine First Stage Pressure SCRAM/EOC-RPT Bypass					X																			
12B	APRM gain adjustment	N2-OSP-NMS-@004					X	X	X																	
19	Core operating limits verification initial, then per N2-OP-101A	N2-RESP-001							X								X	X	X	X	X					
77, 100A	Piping vibration testing: MS, FW, and other key systems >100% CLTP: Data collection every 1% Data evaluation every 2.5%	N2-EPUPA-100A, Piping Vibration Test								X			X				X	X		X	X	X	X	X	X	X
100B	Steam dryer stress analysis >100% CLTP: Data collection every 1% Data evaluation every 2.5%	N2-EPUPA-100B, Steam Dryer Stress Analysis																		X	X	X	X	X	X	X
22A	Pressure regulator transient test pressure set "step testing" (X2 regulators)	N2-EPUPA-22A										X					X			X		X		X		X

Table 14.4-1
(Sheet 2 of 2)

Summary of Testing Performed for the Extended Power Uprate Power Ascension Test Program

EPU Test No.	Description	Procedure	Mode 4/5	Mode 4; OR <1595 MWt AND Pressure ≥800 psig	Mode 2 AND initial approach to criticality	Every 120 MWt following generator synch, to 100%	APRM >13% to <26%	APRM >23%	APRM >23%(when heat balance is valid, then when required	43.5% 1734 MWt	60% 2393 MWt	60.9% 2427 MWt	65.2% 2600 MWt	68% 2712 MWt	70% (2426 MWt) up to 85% (2497 MWt) as evaluated	73.9% 2947 MWt	78.2% 3120 MWt	82.6% 3294 MWt	85.2% 3397 MWt	86.9% 3467 MWt	89.1% 3553 MWt	91.3% 3640 MWt	93.5% 3727 MWt	95.6% 3813 MWt	97.8% 3900 MWt	100% 3988 MWt
24A	Turbine valve surveillance test power level determination Subsequent tests based on evaluation of previous tests	N2-EPUPA-24A									X			X	X											
11	LPRM calibration	N2-RESP-4									X	X	X													X
101, 75, 19	Key parameter monitoring	N2-EPUPA-101														X	X	X		X	X	X	X	X	X	X
12, 19	Core performance operating limits verification	N2-RESP-001, Power Distribution Limits Verification						X									X	X		X	X	X	X	X	X	X
74	Offgas system performance data collection	N2-CSP-OFG-S330															X			X		X		X		X
23C	Max feedwater runout data collection	N2, MFT-184, Feedwater Pump Min Flow Valve Testing																	X							
23A	FW Flow "Step Testing" Manual flow changes 1 element level changes 3 element level changes	N2-EPUPA-23A, Feedwater Control System Testing															X			X		X		X		X
102	Reactor recirculation system performance and jet pump monitoring and cleaning/maintenance determination	N2-OSP-RCS-R@001 GAI-REL-09																		X		X		X		X
12, 35	Recirc drive flow gain adjustment calibration	N2-REP-22																		X						X
1A, 74	Chemical and radiochemical water chemistry and gaseous effluent data collection	N2-CSP-GEN-D100 N2-CSP-2V N2-CSP-OFG-M333 N2-CSP-OFG-S330																		X		X		X		X
2	Radiation measurements Measure radiation levels at selected locations in the plant. Shield integrity checks, reference measurements and trending surveys	S-RPIP-10.9																		X		X		X		X
24B	MSIV surveillance test power level determination	N2-EPUPA-24B																		X	X	X		X		X
1B	Steam dryer/separator performance, moisture carryover	S-CAP-100, Steam Quality Analysis																		X	X	X	X	X	X	X
18	Tip probe uncertainty	N2-REP-14																								X
10	IRM overlap *First controlled shutdown after EPU implementation	N2-OP-101C, Plant Shutdown (if IRM adjustments are required, THEN N2-ISP-NMS-Q109, Intermediate Range Monitor Channel Calibration, is also included to perform channel functional testing)																								