14.0 INITIAL TEST PROGRAM

14.1 SPECIFIC INFORMATION TO BE INCLUDED IN PSAR

14.2 SPECIFIC INFORMATION TO BE INCLUDED IN FSAR

14.2.1 SUMMARY OF TEST PROGRAM AND OBJECTIVES

The Waterford 3 startup test program shall encompass testing activities commencing with the physical release of a system or component from construction and ending with a 100-hour warranty run at 100 percent power. The startup test program is primarily concerned with, but not limited to, the quality-related testing and evaluation of safety-related structures, components, and systems and will be in compliance with the basic intent of Regulatory Guide 1.68 (August 1978), Initial Test Programs for Water Cooled Nuclear Power Plants. The three basic objectives of the startup test program shall be to:

a) Provide assurance that the plant is properly designed and constructed and is ready to operate through the next phase of testing in a manner that will not endanger the health and safety of the public, plant personnel, and plant equipment.

b) Demonstrate and evaluate plant procedures required to meet the objective stated in a) above.

c) Assist in the training of the plant operating and maintenance staff and to provide them with hands-on experience in the operation and maintenance of plant equipment utilizing plant procedures.

Operating and Maintenance Procedures will be tested during the startup test program to the extent practical. To provide a systematic approach in conducting the startup test program, the program has been divided into three major test phases: Prerequisite (Phase I) Tests, Preoperational (Phase II) Tests, and Initial Startup (Phase III) Tests.

For verification of acceptability, LP&L QA shall perform a system review, including documentation, for each safety-related system prior to transfer of the system from Startup to Plant Operations.

14.2.1.1 Phase I - Prerequisite Testing

Phase I of the test program will generally begin as installation and/or construction of individual structures, components, and systems near completion. The prime objective of this phase is to verify that construction activities associated with the respective structure, components, and system have been completed. Another function is to verify that the components within the system can be put into operation safely. The testing requirements associated with this phase will verify installation integrity, component operability, and applicable system functional characteristics, and will ensure that the structures, components, and systems are ready for Preoperational Testing. If functional problems are discovered, they are reported and resolved according to written administrative procedures. Troubleshooting of equipment in accordance with written administrative procedures is authorized to assist in the solution of problems. After appropriate correction of problems, retests are conducted in accordance with written procedures to verify that the corrective action was successful in solving the problem.

Prerequisite tests are performed in accordance with approved written procedures. Data collected during the Prerequisite Testing phase, such as instrument calibration data and pump pressure versus flow data, may be used to satisfy prerequisites during Phase II, Preoperational Testing. Phase I testing as discussed further in Subsection 14.2.12.1.

14.2.1.2 Phase II - Preoperational Testing

Phase II of the test program will normally commence after Prerequisite Testing on respective structures, components, systems, and subsystems is completed. This phase of the test program will include the tests required to demonstrate that structures, components, and systems will perform satisfactorily in service and that they will support fuel loading and Phase III, Initial Startup Testing. The preoperational test is a test in accordance with Criterion XI of Appendix B of 10CFR50; it is performed in accordance with approved written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents. Phase II test procedures shall include provision for assuring that all pre-requisites for the test have been met, that adequate test instrumentation is specified and used, and that suitable environmental conditions if applicable, and initial conditions are specified. The Phase II test results will be documented and evaluated by the Joint Test Group (JTG) and the Plant Operations Review Committee (PORC) to assure that all requirements are met.

The preoperational test provides reasonable assurance that the system has been erected and functions in accordance with the design intent. A required prerequisite to the physical preoperational testing is a review of the applicable safety-related systems Quality Assurance (QA) records to determine that inspection, test, and operational status of the system are accurately defined and provides a basis for the decision to perform the preoperational test. After the test is undertaken, administrative measures are established to assure that the system retains the qualities for which it was tested. A surveillance program is undertaken periodically to ensure that the ability of components and systems to support fuel loading and Phase III testing is maintained.

The preoperational tests are directed by Waterford Startup Group (WSG) personnel who are qualified as detailed in Subsection 14.2.2.9. The WSG is independent of the plant design engineering and construction functions and has direct communication with LP&L management to report nonconformances in the design and construction of the plant found during testing.

The Hot Functional Test provides not only a verification of the integrated operation of the plant, which ensures that plant systems can safely support initial criticality and subsequent testing at power, but also provides a preliminary checkout of plant operating procedures and instructions to the extent practical. Phase II testing is discussed further in Subsection 14.2.12.2.

Prior to transfer of a system from startup to plant operations or prior to fuel load, LP&L QA will complete a review of construction records. In addition, LP&L QA will perform system audits of each safety-related system.

14.2.1.3 Phase III - Initial Startup Testing

Phase III of the test program will commence with the initial fuel load and will include the following areas of testing: precritical tests, initial criticality, low power physics tests, power ascension tests, and the NSSS warranty run. The purpose of precritical testing is to perform and/or resolve outstanding tests and deficiencies from the Phase II test program, and to complete the required post-fuel-load tests. The balance of the testing associated with this phase of the program is to demonstrate and/or verify that the plant was built and can operate in conformance with the FSAR and the operating license. Phase III testing is discussed further in Subsection 14.2.12.3. Phase III tests are directed by plant staff with assistance from the Startup Group, using test procedures and plant operating procedures approved by the Plant Manager.

14.2.2 ORGANIZATION AND STAFFING

The Senior Vice President-Nuclear Operations of Louisiana Power & Light Company has overall responsibility for the startup test program and the startup of Waterford 3. The Construction Manager is responsible for startup efforts until Hot Functional Testing (HFT) completion. After HFT, the Completion Manager will be responsible for Phase I and II startup activities. The Plant Manager-Nuclear will be responsible for all Phase III test activities. The Startup Manager who reports to the Completion Manager, has the authority necessary to conduct Phase I and II of the startup program in accordance with the Waterford 3 Startup Manual and related documents associated with accomplishing WSG objectives. The Startup Manager shall implement an organization to undertake the responsibilities assigned to the WSG. This organization is staffed with LP&L and contract personnel and comprises seven units.

a) Startup Administration Unit

b) Nuclear Steam Supply System (NSSS) Test Unit

c) Balance of Plant (BOP) Test Unit

d) Test Results/System Package Unit

e) Construction Startup Maintenance (CSM) Unit

f) Master Tracking System (MTS) Unit

g) Startup/Maintenance Interface Unit

The test units are managed by Unit Coordinators. Each of the seven startup units shall be staffed as the need and as the schedule dictate, as determined by the Startup Manager. The NSSS Test Unit, BOP Test Unit, Test Results/ System Package Unit, Construction Startup Maintenance Unit, Master Tracking System Unit, and Startup/Maintenance Interface Unit are directed by the Lead Startup Engineer, who reports to the Startup Manager.

Phase III testing will be directed by the Phase III Test Director, who reports to the Performance and Analysis Department Head. The Phase III Test Director has the authority necessary to conduct the Phase III test program and shall direct an organization in undertaking the responsibilities assigned to the Phase III Test Group. The Phase III Test Group will utilize the Startup Administration Unit to support Phase III testing.

These organizations will be staffed with LP&L personnel where possible but may be supplemented with personnel from the Middle South Services, Combustion Engineering, and other contract organizations.

Phase I and Phase II (Waterford Startup Group) organization is defined in Subsection 14.2.2.2. Phase III test organization is defined in Subsection 14.2.2.3.

14.2.2.1 Waterford 3 Organization

The LP&L plant staff will be utilized to the fullest extent practicable in the startup test program. It is intended that plant personnel will participate in startup activities during all phases of the test program.

The plant staff shall:

a) Operate permanently installed equipment.

b) Provide independent audit and review of the startup activities through Operations Quality Assurance.

c) Maintain test equipment and test equipment calibration records.

d) Provide supervision for testing of equipment

e) Provide craft support to test and maintain equipment, as applicable.

f) Maintain equipment data sheets.

14.2.2.2 Waterford 3 Startup Group (WSG)

The WSG, as shown on Figure 14.2-1, will coordinate and direct contributing groups having responsibilities for specific activities within the Phase I and Phase II test program.

The Startup Manager reports to the Construction Manager until completion of Precore Hot Functional Testing and to the Completion Manager after Hot Functional Testing and is responsible for directing the WSG and coordinating with other project groups as shown on Figure 14.2-2. The Startup Manager has the responsibility and the authority necessary for conducting the startup test program in accordance with the Waterford 3 Startup Manual.

14.2.2.2.1 Startup Manager

The Startup Manager's direct responsibilities shall be:

a) Develop and implement the Waterford 3 startup testing program in accordance with applicable regulatory requirements and other LP&L commitments, including the LP&L Quality Assurance Manual, and within the bounds of LP&L corporate policies and procedures.

b) Establish WSG objectives and provide goals, directions, and guidelines for the startup effort to ensure that the mission of the Startup Staff is defined and executed.

c) Effectively plan and schedule all significant activities for which the WSG is responsible to ensure earliest completion of startup testing and transfer of plant systems to Plant Staff.

d) Routinely monitor performance of the WSG against established objectives, goals, plans, schedules, and budgets and periodically report status to the Completion Manager.

e) Report startup problems to the Joint Test Group (JTG) and the Completion Manager in a timely manner.

f) Serve as alternate Chairman of the JTG.

g) Ensure that all test procedures are reviewed by qualified personnel in the WSG.

14.2.2.2.2 Staff Assistant(s)

The Staff Assistant(s) reports to the Startup Manager and will assist the Startup Manager in the administrative direction of the Waterford 3 Startup Group.

The Staff Assistant(s) shall:

a) Assist in identifying and resolving deficiencies and/or problems related to the startup test program.

b) Assist in conducting meetings with contributing groups as necessary to discuss test activities requiring special coordination or scheduling.

c) Assist in resolution of Quality Assurance audit items.

d) Review startup-related directives, instructions, and procedures to ensure conformance with the Startup Manual.

14.2.2.2.3 Lead Startup Engineer (LSE)

The LSE shall report to the Startup Manager in the conduct of the startup test program. The LSE shall supervise the Unit Coordinators for the Nuclear Steam Supply System Test, Balance of Plant Test, Construction Startup Maintenance, Master Tracking System, and Test Results/System Package units. Specifically, he shall:

a) Develop and implement the Waterford 3 startup test program in accordance with applicable regulatory requirements, Startup Manual, Quality Assurance Manual, and LP&L corporate policies and procedures.

b) Review and approve all Phase I procedures and test results. Approve Phase II procedures and recommend Phase II test results to Plant Manager.

c) Chair the JTG.

d) Implement the startup objective and goals to ensure that project commitments are achieved.

e) Ensure that the Waterford 3 startup organization is in conformance with the LP&L Quality Assurance Plan.

f) Ensure that startup procedures are adhered to by field and administrative personnel.

14.2.2.2.4 Unit Coordinator-Balance of Plant Testing (BOP)

The Unit Coordinator-BOP reports to the LSE in the conduct of the startup test program. The position responsibilities shall include:

a) Serving as a member of the JTG.

b) Implementing the Phase I (Prerequisite) and Phase II (Preoperational) test programs.

c) Preparing, reviewing, and implementing procedures and documents relevant to the unit.

d) Enforcing compliance with documents such as Startup Administration Procedures, Startup Technical Procedures, Plant Operating Manual, etc.

e) Advising the LSE of administrative problems which may impact the project schedule.

f) Maintaining unit systems status.

14.2.2.2.5 Unit Coordinator-Startup/Maintenance Interface

The Unit Coordinator-Startup/Maintenance Interface reports to the LSE. The position responsibilities shall include:

a) Effectively planning and scheduling all manpower activities between the WSG and the Maintenance Group.

b) Coordinating and establishing priorities for manpower requirements requested by test directors for NSSS and BOP, and ensuring that technicians are available to perform their tests.

c) Ensuring that shop supervisors in the Waterford Maintenance Group receive adequate direction to provide efficient and effective manpower support for the WSG.

14.2.2.2.6 Unit Coordinator-Construction Startup Maintenance (CSM)

The Unit Coordinator-Construction Startup Maintenance reports to the LSE. The position responsibilities shall include:

a) Preparing and reviewing CSM procedures and monitoring their implementation to ensure maximum effectiveness.

b) Verifying that the Condition Identification Work Authorization (CIWA) is actually required and filled out properly.

c) Issuing CIWA control numbers.

d) Undating the Master Tracking System (MTS) on CIWA initiation and closure.

e) Coordination of efforts of LP&L Startup and Plant Staff with Construction Startup and ESSE to track and report the accomplishment of corrective maintenance, design modifications, and other corrective actions.

f) Coordination of assigned Ebasco and Work Group CIWAs.

g) Implementation of vendor field representation procedure to ensure that all vendors have insurance before coming onsite and that required personnel are aware that the vendor is onsite.

h) Maintenance of CIWA active files.

14.2.2.2.7 Unit Coordinator-Startup Administration

The Unit Coordinator-Startup Administration reports to the Startup Manager. His responsibilities shall include:

a) Organization of the Startup Administration Unit as defined in the Startup Manual to undertake:

  1) Document production to accomplish the WSG objectives.

  2) Development of:

    a) Startup procedures and documents.

    b) Other startup-related documents.

  3) Text management of the above documentation and other necessary documents and forms.

  4) Cost and schedule control of startup.

  5) Startup personnel training.

b) Direction of personnel assigned to the Startup Administration Unit.

c) Liaison and coordination with other startup units.

d) Reporting to the Startup Manager the status of work activities assigned to the Startup Administration Unit.

14.2.2.2.8 Unit Coordinator-Test Results/System Packages

The Unit Coordinator-Test Results/System Packages reports to the LSE. The position responsibilities shall include:

a) Managing review of startup test procedures and retest results to ensure technical accuracy and administrative control compliance.

b) Managing system release/turnover documentation review and preparation of system transfer documentation.

c) Managing system scoping activities.

d) Providing direction for construction completion schedules to support system transfers.

e) Coordinating Communications and Security Systems testing.

14.2.2.2.9 Unit Coordinator-Master Tracking System (MTS)

The Unit Coordinator-Master Tracking System reports to the LSE. The position responsibilities shall include:

a) Data base management to ensure effective, efficient use of MTS for maximum benefit to site and for data retrievability.

b) Control of system security.

c) Dissemination of MTS information.

14.2.2.2.10 Unit Coordinator-Nuclear Steam Supply System Testing (NSSS)

The Unit Coordinator-NSSS reports to the LSE. The position responsibilities shall include:

a) Serving as a member of the JTG.

b) Implementing the Phase I (Prerequisite) and Phase II (Preoperational) test programs.

c) Preparing, reviewing, and implementing procedures and documents relevant to the unit.

d) Advising the LSE of administrative problems which may impact the project schedule.

e) Enforcing compliance with documents such as Startup Administration Procedures, Startup Technical Procedures, Plant Operating Manual, etc.

f) Maintaining unit systems status.

14.2.2.2.11 Test Directors

Test Directors report to their respective Unit Coordinators. Each Test Director is responsible for:

a) Ensuring that all procedures and documents are complete and satisfactory prior to performance of the test.

b) Following test problems and coordinating solutions. Utilizing the resources of test personnel to find solutions.

c) Being familiar with the system(s) under test and with the test procedure.

d) Covering overall planning and scheduling of testing. Establishing priorities using input from the Startup Schedules.

e) Coordinating manpower allocations with supervisors.

f) Coordinating with Operations to supply personnel to operate equipment when required.

g) Enforcing compliance with documents such as Startup Administration Procedures (SAPs), Startup Technical Procedures (STPs), Plant Operating Manual (POM) Procedures, etc.

h) Undertaking whatever assignments are delegated by their respective supervisors.

14.2.2.2.12 Startup Engineers

Startup Engineers assigned to WSG are assigned specific systems or areas of responsibility for which they will write applicable procedures. They will report to an assigned Unit Coordinator during the procedure production effort, the test performance, and the system transfer to plant staff. Generally, the responsibilities of the Startup Engineer are to:

a) Determine the nature and degree of testing required.

b) Develop testing activity milestones, target dates, and manpower requirements.

c) Follow construction progress to support the startup test program requirements.

d) Either prepare the required detailed initial startup test program procedures or ensure that these procedures are available for review and approval.

e) Identify and specify special temporary equipment or services needed to support testing.

f) Ensure that release tagging and safety tagging are implemented as necessary to support testing and/or release.

g) Direct all participating groups during the preparation for and execution of assigned tests.

h) Expedite testing progress as necessary to support the project schedule.

i) Identify and resolve deficiencies and problems found during the construction and/or testing of assigned systems and areas.

j) Review and evaluate test results and prepare test summaries.

k) Report status of required tests, release, and turnover dates of assigned systems and areas to startup scheduling.

l) Conduct all assigned testing activities in accordance with the Waterford 3 Startup Manual.

m) Assist in the review and evaluation of completed tests by the Joint Test Group and/or the Plant Operations Review Committee, as appropriate.

14.2.2.3 Phase III Test Organization

Development and implementation of all Phase III test procedures will be the responsibility of the Phase III Test Director. An organizational chart is depicted on Figure 14.2-4.

a) The Performance and Analysis Department Head has overall responsibility for the preparation and implementation of Phase III Testing. He reports directly to the Technical Support Superintendent-Nuclear in carrying out his responsibilities.

b) The Phase III Test Director shall:

   1) Direct and coordinate the Phase III test program and be responsible for the generation and completion of the Phase III test schedule.

   2) Ensure that sufficient test personnel are on duty for the performance of scheduled test activities.

   3) Assign Shift Test Directors and Shift Test Engineers.

   4) Provide Shift Test Directors with standing instructions for test execution during Phase III testing activities.

   5) Provide guidance to Support Engineers.

   6) Monitor test activities and report test progress to the Performance and Analysis Department Head.

   7) Be responsible for the identification, scheduling and completion of all tests required from fuel load until completion of the warranty run.

   8) Be responsible for the preparation of the Phase III portion of the startup report.

c) The Shift Test Director (STD) shall:

   1) Be the representative of the Phase III Test Director while on shift.

   2) After the concurrence of the Shift Supervisor, direct and coordinate all testing and plant activities while on shift.

   3) Coordinate with the Shift Supervisor and others as required to complete testing safely while efficiently scheduling testing time and personnel.

   4) Review test procedures and changes for completeness and correctness and approve minor test procedure changes.

   5) Conduct the preshift briefings.

   6) Ensure maintenance of Shift Test Chronological Log.

7) Ensure that the Phase III Test Director is notified of changes or delays to the test schedule that may occur while he is on duty.

8) Perform other duties as requested by the Phase III Test Director.

9) Be the primary interface with the Combustion Engineering Test Engineer while on shift.

d) The Support Engineer shall:

1) Report to the Phase III Test Director.

2) Review test procedure for completeness.

3) Flag deficiencies that may affect testing.

4) Support the Shift Test Director, as necessary, to expedite testing.

5) Review test results and acceptance criteria, and list test deficiencies as required.

6) Draft procedure changes and revisions as required by approved Plant Operating Manual procedures.

7) Write the test summary.

8) Present test results to the Plant Operations Review Committee (PORC) as required.

e) The Shift Test Engineer shall:

1) Functionally report to the Shift Test Director and the Shift Supervisor while on shift and keep them informed of all activities he plans to initiate that might affect testing.

2) Direct the setup of required test equipment.

3) Review test procedures for completeness.

4) Flag system deficiencies that may affect testing.

5) Prepare data as requested by the Shift Test Director.

6) Review test results and acceptance criteria, and list test deficiencies.

7) Draft procedure changes and revisions.

8) Assist the Shift Test Director in preparation and execution of tests as required.

f) The Shift Supervisor (SS) shall:

1) Have overall responsibility and authority for the operation of the plant.

2) Secure testing and place the plant in a safe condition at any time he feels it necessary to prevent jeopardizing plant safety.

3) Together with the Shift Test Director, direct and coordinate all plant activities while on shift.

g) The Lead Startup Engineer shall:

1) Coordinate the activities of the startup group in support of Phase III testing.

14.2.2.4 Joint Test Group (JTG)

The Joint Test Group (JTG), which reports to the Startup Manager, is organized as shown on Figure 14.2-3. Should any of the JTG members be unable to attend meetings, an appropriate qualified alternate member with full capacity to act for that member will be present, if available. The JTG chairman will determine the presence of a quorum.

The JTG will be formed early in startup to review Startup Administration Procedures (SAPs), Startup Technical Procedures (STPs), Preoperational Test Procedures, and results of Phase I and Phase II testing. The JTG will be staffed with personnel from LP&L and contractors. Principal design organizations shall have representation on the JTG, at the discretion of the Startup Manager when the need and the schedule dictate.

The JTG will be an advisory group to the Plant Operations Review Committee (PORC) for the review of the Phase III test program.

The JTG will perform the following functions during the startup test program:

a) Review Startup Administration Procedures, Startup Technical Procedures, Startup General Administrative Procedures, Phase I test results, Phase II test procedures, Phase II major test changes, Phase II test results, and recommend their disposition to the Lead Startup Engineer (LSE)

b) Review Phase III test procedures, Phase III test results, and other procedures as requested by the Plant Operations Review Committee (PORC), and recommend their disposition to the Chairman of the PORC.

c) Review test-related or safety-related Condition Identification Work Authorizations (CIWAS) as required by SAPs or at the request of the JTG Chairman.

d) Review procedures and documents other than those specified above to ensure adequacy, as directed by the JTG Chairman.

e) Conduct a comprehensive review of the Phase II test program prior to initial fuel load and the start of Phase III testing.

f) Review Phase II test results and recommend their disposition to the Plant Manager.

14.2.2.5 Ebasco Services Incorporated

Ebasco Services Incorporated, under the direction of LP&L, has been designated as the architect engineer and construction manager of Waterford 3. As the construction manager, Ebasco will coordinate construction schedules with the WSG test schedules and test program requirements, provide construction manpower support to meet the schedule, prepare release and turnover packages, conduct all assigned testing activities in accordance with the Waterford 3 Startup Manual, correct deficiencies, and make repairs.

14.2.2.5.1 Ebasco Assistance to WSG

As requested by LP&L during the startup, Ebasco will supply qualified Startup Engineers who will be incorporated into the WSG. Ebasco may supplement the WSG with design engineers temporarily assigned to the site as needed.

The Ebasco personnel assigned to the WSG will provide technical advice and consultation on matters relating to the design, operation, and testing of systems and equipment. Accordingly, the Ebasco personnel will:

a) Provide startup assistance as required by the WSG.

b) Review and provide input to the construction schedule and the WSG test schedule, and provide assistance in identifying required construction progress and/or testing needed to support the schedules.

c) Coordinate resolution of problem areas by acting as liaison between Ebasco engineering groups.

d) Assist in arranging for onsite vendor representation, as required for equipment other than the NSSS, through the Ebasco Construction Superintendent.

e) Direct and coordinate, as requested, the crafts in supporting construction-related test activities and resolution of deficiencies and problems.

f) Notify participating construction groups of required tests, system release, turnovers, and acceptance dates of systems and areas.

g) Conduct all assigned testing activities in accordance with the Waterford 3 Startup Manual.

14.2.2.6 Combustion Engineering Incorporated (CE)

During the installation, testing, initial fuel loading, and startup of the NSSS, Combustion Engineering will make available specialized personnel for technical assistance and advice concerning equipment in the NSSS vendor’s scope of supply. This assistance may include:

a) Written guidelines for preoperational testing of the NSSS, including the auxiliary systems furnished by Combustion Engineering.

b) Portions of special preoperational testing procedures for systems provided by others, which affect warranty considerations or nuclear safety.

c) Technical assistance in conducting preoperational tests of the NSSS.

d) Technical assistance in the analysis and interpretation of the results of preoperational testing in terms of meeting performance, warranty, and safeguard requirements for all systems for which test procedure guidelines are provided.

e) Special guidelines for initial fuel loading, low power testing, power ascension testing and technical assistance during the testing program. A detailed independent analysis and review of both low-power and power-ascension test procedures to verify the adequacy of these procedures. Following the testing, CE will assist LP&L in analyzing and interpreting the results of the test program. CE will provide the necessary technical specialists and special nuclear test equipment required for initial reactor startup.

f) Technical assistance for the NSSS warranty run. Following this warranty run, CE will assist in analyzing and interpreting the results in terms of performance warranties.

g) JTG members on an as-needed basis.

h) Resolution of problem areas by acting as liaison between the site and CE Power Systems in Windsor, Connecticut.

14.2.2.6.1 Combustion Engineering Assistance to WSG

As requested by LP&L during the startup, CE will provide startup personnel who will be incorporated into the WSG and the Phase III Test Group. These CE personnel may be supplemented during the initial test program by other engineers temporarily assigned to the site as needed.

The CE personnel assigned to LP&L will provide technical advice and consultation on matters relating to the design, operation, and testing of systems and equipment. Accordingly, the CE personnel will:

a) Provide startup assistance as requested by LP&L.

b) Review and provide input to the construction schedule and the test schedule, and provide assistance in identifying required construction progress and/or testing needed to support the schedule.

c) Direct and coordinate, as requested, the crafts in supporting construction-related test activities and resolution of deficiencies and problems.

d) Conduct all assigned testing activities in accordance with the Waterford 3 Startup Manual and/or the Plant Operating Manual.

14.2.2.7 Westinghouse Electric Corporation

Westinghouse will provide technical assistance for construction and installation of the turbine-generator and its support systems. They will provide technical advice and consultation on matters relating to the design, operation, and testing of the Westinghouse-supplied systems and equipment.

14.2.2.8 Other Consultants

Other consultants will be used at the discretion of the Startup Manager to supplement the WSG as need arises. These consultants may also serve on the JTG when so designated by the Startup Manager.

14.2.2.9 Qualification

The staffing and qualifications of the station organization are detailed in Chapter 13, "Conduct of Operations."

The WSG personnel and other (Phase III Test Group) personnel that perform the following tasks shall be certified by the Startup Manager (Phase I and II) or the Performance and Analysis Department Head (Phase III) in accordance with the intent of Regulatory Guide 1.58 (August 1973) and through previous experience and/or training as outlined below:

a) Personnel obtaining and handling data or test results controlling reports or records, or preparing Phase I test procedures shall be qualified to Level I.

b) Personnel preparing Phase II or III test procedures or reviewing, supervising or directing Phase I, II, and III test procedures or test results shall be qualified to Level II.

c) Personnel approving Phase I, II, and III test procedures or test results shall be qualified to Level III.

d) JTG members shall be qualified to Level III.

The certification of personnel shall be supported by documentation which contains job scope, education, training, experience, and level of certification. A review shall be accomplished to assure the continued proficiency of each person every two years or when a change of job scope is effected.

If it is determined by the Startup Manager (Phase I and II) or the Performance and Analysis Department Head (Phase III) that the capabilities of an individual are not in accordance with the qualifications specified to perform the WSG objectives, that person shall be removed from the job task until such time as the person has been trained in the needed skill and has been recertified as being qualified to perform the task or transferred to a task which the person is qualified to perform.

It is the intent of the Startup Manager and the Performance and Analysis Department Head that personnel meet the following minimum qualifications to perform the following:

a) Level I - The obtaining and handling of data or test results, the control of reports or records, and the preparation of Phase I test procedures. For this purpose, personnel will meet the following minimum qualifications:

   1) High school graduate, plus one year of experience in the nuclear field or equivalent work.

b) Level II - The preparation of Phase II or III test procedures and the reviewing, supervising, or directing of Phase I, II, and III test procedures or test results shall require individuals meeting the following minimum qualifications:

   1) Graduate of a four-year engineering or science college or university, plus two years of experience in the nuclear field or equivalent work, or

   2) High school graduate, plus four years of experience in the nuclear field or equivalent work.

c) Level III - The approval of Phase I, II, and III test procedures or test results shall require individuals meeting the following minimum requirements:

   1) Graduate of a four-year engineering or science college or university plus five years of experience in the nuclear field; or if not, the individual shall have training sufficient to acquaint him thoroughly with the safety aspects of a nuclear facility; or

   2) High school graduate, plus ten years of experience in the nuclear field or equivalent. The individual shall have training sufficient to acquaint him thoroughly with the safety aspects of a nuclear facility.

14.2.3 TEST PROCEDURES

Test procedures will be prepared for use during the startup test program in accordance with the Waterford 3 Startup Manual and/or the Plant Operating Manual. Each test procedure will be prepared using pertinent reference material such as test specifications and procedure guidelines provided by the appropriate design organizations, final safety analysis report, technical specifications, and applicable regulatory guides. The development, review, and approval of individual procedures associated with each phase of the test program are explained in the Waterford 3 Startup Manual and the Plant Operating Manual and are summarized as follows:

a) Phase I - Prerequisite Tests, as discussed in Subsection 14.2.1.1, will be performed in accordance with approved written procedures. These procedures will be written by individuals designated by the Waterford 3 Startup Group. Such procedures will be developed, reviewed, and approved in the following manner, as appropriate:

1) Originator - develop.

2) Designated Reviewers - review.

3) LSE - approve.

b) Phase II - Preoperational Tests, as discussed in Subsection 14.2.1.2, will be performed in accordance with approved written procedures. These procedures will be written by individuals designated by the Waterford 3 Startup Group. Such procedures will be developed, reviewed and approved in the following manner, as appropriate:

1) Originator - develop Phase II.

2) Designated Reviewers - review Phase II.

3) JTG - review Phase II.

4) LSE - approve Phase II for use.

5) Quality Control Representative - review Phase II for nuclear safety related test.

Specific guidelines to be followed in preparing Phase II test procedures will be detailed in the Waterford 3 Startup Manual. A specific format will be prescribed in the Waterford 3 Startup Manual. This format shall be similar to that presented in Tables 14.2-3 and 14.2-4.

c) Phase III - Initial Startup Test, as discussed in Subsection 14.2.1.3, will be performed in accordance with approved written procedures. These procedures will be written by individuals designated by the Phase III Test Group. Such procedures will be developed, reviewed and approved in the following manner:

1) Author - Develops Phase III

2) Designated Reviewer - Reviews Phase III

3) JTG - Reviews Phase III (Rev. 0 only)

4) LSE - Recommends Phase III approval to PORC (Rev. 0 only)

5) Technical Reviewer Reviews Phase III

6) QC Representative Reviews Phase III

7) PORC - Reviews Phase III and recommends approval

8) Plant Manager - Approves Phase III

d) Special Test Procedures

Special test procedures may be used during the startup test program for investigative purposes. Such procedures will be prepared, reviewed, approved, and conducted under the controls established for Phase II or Phase III test procedures.

14.2.4 CONDUCT OF TEST PROGRAM

The Waterford 3 Plant Operating Manual and Startup Manual will provide the guidance necessary for conducting the startup test program for Waterford 3. The following will be addressed in these manuals:

a) Responsibilities assigned to each principal onsite organization.

b) The scope of each phase of the test program.

c) Methods for control of startup system scoping.

d) Temporary modifications.

e) Procedure development, review, and approval.

f) Design changes.

g) Changes and revisions to procedures.

h) System release, turnover, and transfer directives.

i) Housekeeping.

i) Document control requirements.

k) Equipment and access controls.

1) Training and qualification of test personnel.

m) Instructions and forms needed.

Approved Phase I and II procedures shall be retained by the WSG until the scheduled test date. Should an approved procedure require a major change prior to the start of the test, the test procedure will be revised.

The revised procedure must be reviewed and approved in a manner similar to that used for an unapproved procedure. Minor changes required to approved procedures prior to the start of the test which do not modify the original intent of the procedure will be documented by completing a test procedure change form and will be reviewed and approved as directed in the Startup Manual. This change form will be attached to and become part of the existing procedure.

Phase II and Phase III tests will be performed when scheduled and in strict accordance with the approved written test procedure. Each procedure will include provisions to ensure that prerequisites are met. The prerequisites for each Phase II and Phase III testing evolution shall be consistent with the general recommendations contained in Appendix C to Regulatory Guide 1.68, August 1978. It shall be the responsibility of the Startup Engineer assigned the specific test to ensure that all prerequisites are satisfactorily completed or that any allowable exception are noted.

Minor changes required to approved Phase II and Phase III test procedures after testing has commenced which do not modify the original intent of the procedure will be documented by completing a test procedure change form. Such minor changes to Phase II procedures must be reviewed and approved as directed in the Startup Manual. Such minor changes to Phase III procedures must be reviewed and approved as directed by the Plant Operating Manual. The completed change form will be attached to and become part of the existing procedure.

Should an approved procedure require a major change, a test procedure change form will be completed. The completed change form will be attached to and become part of the existing procedure. The review and approval of the change form will be the same as the affected procedure.

As each test is performed, the Startup Engineer will initial appropriate steps of the detailed procedure to document completion. Where special conditions require abnormal valving or the use of jumpers or bypasses, special control measures will be specified to ensure that the abnormal configuration is returned to normal upon completion of the test.

Completed procedures and test results will be reviewed for acceptance by the responsible Startup Engineer. The specific acceptance criteria for determining the success or failure of the test will be included as part of the procedure and will be used by the Startup Engineer in this review. The procedure will also include a chronological log where the Startup Engineer can document remarks and recommendations before presenting the completed procedure to the designated reviewer. The designated reviewer will review the completed procedure for conformance with testing requirements specified in the Waterford 3 Startup Manual and Plant Operating Manual as well as for acceptance of the test results. The reviewer can, as appropriate, document additional remarks and recommendations. The completed procedure will then be submitted for final review, evaluation, and approval by the JTG or the PORC.

14.2.5 REVIEW, EVALUATION, AND APPROVAL OF TEST RESULTS

Individual test results will be reviewed as follows: Phase I test results will be reviewed by the JTG and approved by the Lead Startup Engineer. Phase II test results will be reviewed by the JTG, and approved by the Plant Manager - Nuclear. Phase III test results will be reviewed by PORC and approved by the Plant Manager - Nuclear. The JTG may serve as a subcommittee for PORC for the review of Phase III test results. If maintenance, modification, or retest of plant systems is determined to be necessary as a result of the review of a completed procedure, the JTG and/or PORC will coordinate and direct the appropriate action.

Test results for Phase I, II, and III tests will be reviewed and verified complete and satisfactory so that no succeeding test will be dependent on an untested system. In the case of Phase I testing, the review and verification will take place on a system basis. Phase II testing on a system will not normally be started until all applicable prerequisite tests have been completed, reviewed, and verified to be satisfactory by the LSE or his designated alternate. Prior to initial fuel loading and the start of Phase III testing, a comprehensive review of Phase II of the initial test program will be conducted by the JTG. This review will provide assurance that plant systems and structures will be capable of supporting the initial fuel loading and subsequent operational testing. Phase I and Phase II testing should be completed prior to commencing Phase III testing, with the following exceptions, which are generally noted on the individual test descriptions in Subsection 14.2.12.2:

a) Tests requiring the nuclear fuel to be in place.

b) Tests requiring sustained operation of the turbine-generator.

c) Tests which are not completed, but which will not have a major impact on Phase III testing and are approved by PORC for later completion.

Phase III of the test program is subdivided into the following categories: initial fuel load, postcore hot functional testing, initial criticality, low power physics test, power ascension tests, and the NSSS warranty run. Each subdivision, in itself, is a prerequisite which shall be completed, reviewed, and evaluated prior to commencing tests in the next category, so that further testing is not dependent on any unsafe conditions.

Power ascension tests will be scheduled and conducted at predetermined power levels. The testing plateaus to be used for the Waterford 3 startup program will be at 20, 50, 80, and 100 percent of rated power. The results of each plateau will be reviewed, evaluated, and approved before proceeding to the next test plateau.

Following the completion of the power ascension tests, a 100-hour warranty run at 100 percent of rated power will signify acceptance of the NSSS and completion of the test program. Final test results will be reviewed, evaluated, and approved at this time.

14.2.6 TEST RECORDS

A single copy of each test procedure will be designated as the official copy to be used for test documentation. The official copy of each test procedure and information specifically called for in that procedure, such as completed data sheets, tables, logs, chart recordings, etc., will constitute the completed test procedure. Completed test procedures are made a part of the plant's historical record and will be maintained at the facility for the life of the plant in accordance with LP&L administrative procedures and requirements for record retention.

14.2.7 COMPARISON OF TEST PROGRAM WITH REGULATORY GUIDES AND IEEE STANDARDS

The startup test program for Waterford 3 is structured in accordance with the following regulatory guides and IEEE standards with the exceptions and/or clarifications noted. The revision of the guide or standard that is listed is for test purposes only and does not affect design or constructions.

14.2.7.1 1.9 Selection of Diesel Generator Set Capacity for Standby Power Supplies (Safety Guide 9, 3/10/71)

14.2.7.2 1.16 Reporting of Operating Information Appendix A Technical Specifications (Revision 4, 8/75)

14.2.7.3 1.20 Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing (Revision 2, 5/76)

Waterford 3 is classified as non-prototype, Category I and will be consistent will the analyses and inspection program requirements as described in Subsection 3.9.2.

14.2.7.4 1.30 Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment (Safety Guide 30, 8/11/72)

14.2.7.5 1.32 Criteria for Safety Related Electric Power Systems for Nuclear Power Plants (Revision 2, 2/77)

14.2.7.6 1.38 Quality Assurance Requirements for Packaging, Shipping, Receiving,Storage, and Handling of Items for Water-Cooled Nuclear Power Plants (Revision 2, 5/77)

14.2.7.7 1.39 Housekeeping Requirements for Water-Cooled Nuclear Power Plants (Revision 2, 9/77)

14.2.7.8 1.41 Preoperational Testing of Redundant Onsite Electric Power Systems to Verify Proper Load Group Assignments (3/16/73)

14.2.7.9 1.52 Design, Testing, and Maintenance Criteria for Engineered-Safety- Feature Atmosphere Cleanup System Air Filtration and Absorption Units of Light-Water-Cooled Nuclear Power Plants (Revision 2, 3/78)

14.2.7.10 1.58 Qualification of Nuclear Power Plant Inspection, Examination, and Testing Personnel (8/73)

The recommendations of Regulatory Guide 1.58 have been followed with the exception that if physical examinations are required, re-examination shall be performed every two years and not annually as specified. ANSI N45.2.6, Paragraph 3, Qualification, as it applies to startup testing personnel, has been interpreted such that: experience in the operation and testing of power plants is acceptable in lieu of the stated experience in quality assurance on a one-for-one basis.

Site personnel may require the services of technically qualified individuals to assist them in the performance of duties necessary to certify them to a specific level of ANSI N45.2.6-1973. As such, site personnel may call on the services of site or home office specialists to perform some of the technical requirements of their duties, but only individuals qualified to Level II per ANSI N45.2.6-1973 will provide their signatures on documents as certification of the performance of the function.

14.2.7.11 <u>1.63 Electric Penetration Assemblies Containment Structures for Light-Water-Cooled Nuclear Power Plants (10/73)</u>

14.2.7.12 <u>1.65 Materials and Inspections for Reactor Vessel Closure Studs (10/73)</u>

14.2.7.13 <u>1.68 Initial Test Programs for Water-Cooled Reactor Power Plants (Revision 2, 8/78)</u>.

The following exceptions and/or clarifications address only significant differences between the Waterford 3 test program and the applicable regulatory position. Minor terminology differences, testing not applicable to the plant design, and testing that is part of required surveillance tests will not be addressed. Reference is made to the applicable portion of Regulatory Guide 1.68 (Revision 2, 8/78).

14.2.7.13.1 Reference Appendix A, Section 2.b

This section suggests that rod drop times be measured for all control element assemblies (CEAS) at hot and cold full-flow and no-flow conditions.

Waterford 3 CEA drop-time testing is consistent with the recommendations of the regulatory guide; however, tests which do not provide meaningful data will be deleted. As outlined in test summary 14.2.12.3.1, the CEA drop-time testing will consist of:

a) One drop of each CEA at cold, maximum permissible flow conditions (2 or 3 reactor coolant pumps) and at hot, full-flow conditions.

b) Those CEAs falling outside the two-sigma limit for similar CEAs will be dropped three additional times.

No-flow drops will not be performed as the Technical Specifications do not normally permit criticality under these conditions.

14.2.7.13.2 Reference Appendix A, Section 3, and Appendix C, Section 3

These sections require that a neutron count rate of at least 1/2 count per second should be registered on the startup channels before the startup begins. Combustion Engineering's design criteria call for a neutron count rate of 1/2 count per second with all CEAs fully withdrawn and a multiplication of 0.98. Therefore, prior to the initiation of the initial approach to criticality, the startup channels may see significantly less than 1/2 count per second; but prior to exceeding a multiplication of 0.98, the desired neutron count rate will have been achieved.

14.2.7.13.3 Reference Appendix A, Sections 4.b and 4.c

These sections require a greatest worth control rod stuck out of the core test and a psuedo-rod-ejection test to be performed during low power testing. Since the Waterford 3 core is essentially identical to the San Onofre core, these tests will not be performed at Waterford 3. Prior to the omission of these tests, the similarity of the San Onofre Unit No. 2 and the Waterford 3 cores will be demonstrated by the performance of CEA symmetry checks, CEA worth measurements, and critical boron measurements.

14.2.7.13.4 Reference Section C.8 and Appendix A, Section 5

The standard CE test plateau power levels of 20, 50, 80, and 100 percent are used instead of the recommended power levels of 25, 50, 75, and 100 percent.

14.2.7.13.5 Reference Appendix A, Section 5.a

The complete set (20, 50, 80, and 100 percent power) of power reactivity coefficients will be measured at San Onofre Unit No. 2. Since the Waterford 3 core is essentially identical to the San Onofre Unit No. 2 core, the power reactivity coefficients will be measured only at 50 and 100 percent power.

14.2.7.13.6 Reference Appendix A, Sections 5.d, 5.e, and 5.f

The xenon oscillation control, pseudo-rod-ejection, and dropped CEA tests will be performed at San Onofre Unit No. 2, which has a core essentially identical to the Waterford 3 core. Since these tests are not necessary to assure system operation or to verify fuel and CEA loading, they will not be performed at Waterford 3. The essentially identical nature of the cores will be demonstrated by an analysis of CEA symmetry checks, CEA group worths, critical boron concentrations, and, in the power ascension phase, by incore detector data, prior to any reduction in the Waterford 3 testing.

14.2.7.13.7 Reference Appendix A, Section 5.i

Since the Plant Protection System (CPCs and CEACS) detects the CEA positions by means of two independent sets of reed switches and uses this information in determining margin to trip, it is not necessary to rely on incore or excore nuclear instrumentation to detect control element misalignment. Thus, this testing will not be performed at Waterford 3.

14.2.7.13.8 Reference Appendix A, Section 5.q

Waterford 3 does not have a separate Failed Fuel Detection System. Therefore, this step does not apply.

14.2.7.13.9 Reference Appendix A, Section 5.x

Verification of the capabilities of auxiliary systems will be at the appropriate power level and will not be limited to the 50 and 100 percent plateaus.

14.2.7.13.10 Reference Appendix A, Section 5.hh

The dynamic response of the plant will be demonstrated with step and ramp changes less than design values. Although the control systems are designed to accommodate the design transients, it would not be prudent to deliberately subject the fuel to these transients. In addition, these step and ramp changes will be performed at 50 and 100 percent power instead of 25, 50, 75, and 100 percent power.

14.2.7.13.11 Reference Appendix A, Section 5.ii

This section requires a loss of Reactor Coolant System (RCS) flow to be performed at 100 percent power. At Waterford 3, this test is scheduled to be performed at 80 percent power. Performance of the test at 80 percent power provides the same plant verification that performance at 100 percent power would provide while exposing the plant to less risk if any difficulty is experienced during the performance of the test.

14.2.7.13.12 Reference Appendix A, Section 5.mm

This section requires that the dynamic response of the plant to the automatic closure of the main steam isolation valves be demonstrated at 100 percent power. Performance of this test would expose the plant to the possibility of opening the primary and main steam safety valves. Instead, the same information can be obtained from the 100 percent power turbine trip test when the turbine stop valves go closed. The 100 percent power turbine trip test will result in essentially identical plant response, but should ensure that the primary and main steam safety valves do not lift.

14.2.7.14 1.68.2 Initial Startup Test Program to Demonstrate Remote Shutdown Capability for Water-Cooled Nuclear Power Plants (Revision 1, 7/78)

14.2.7.15 1.79 Preoperational Testing of Emergency Core Cooling Systems for Pressurized Water Reactors (Revision 1, 9/75)

Instead of the recirculation test specified in C.l.b.(2), adequate vortex control and NPSH will be verified by a model test. The model test will be based on operating the high-pressure safety injection pumps and the containment spray pumps as the low-pressure safety injection pumps are stopped by a recirculation actuation signal.

Section C.I.c(2) recommends opening of the safety injection tank discharge isolation valves under maximum differential pressure using both the normal and emergency power supplies. Conditions at the valve motor are independent of the power source for this test. Therefore, opening the valves using the emergency power supply would provide no additional meaningful data. The valves will be opened using the normal power supply only.

14.2.7.16 1.80 Preoperational Testing of Instrument Air System (6/74)

Instead of the tests specified in regulatory positions C.8, C.9, and C.10, tests will be conducted to verify that a loss of instrument air pressure will not prevent the safety-related pneumatic valves from performing as designed.

14.2.7.17 1.88 Collection, Storage, and Maintenance of Nuclear Power Plant Quality Assurance Records (Revision 2, 10/76)

14.2.7.18 1.95 Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release (Revision 1, 1/77)

14.2.7.19 1.108 Periodic Testing of Diesel Generators Used as On site Electric Power Systems at Nuclear Power Plants (Revision 1, 8/77)

14.2.7.20 1.116 Quality Assurance Requirements for Installation, Inspection, and Testing of Mechanical Equipment and Systems (Revision O-R, 6/7; reissued 5/77)

14.2.7.21 1.123 Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants (Revision 1, 7/77)

14.2.7.22 1.129 Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Nuclear Power Plants (Revision 1, 2/78)

14.2.7.23 IEEE Standard 415-1976, Guide for Planning of Pre-Operational Testing Programs for Class 1E Power Systems for Nuclear Power Generating Stations

14.2.8 UTILIZATION OF REACTOR OPERATING AND TESTING EXPERIENCES IN DEVELOPMENT OF TEST PROGRAM

Startup with plant assistance will review testing and operating experiences that have occurred since January 1976 at nuclear power stations with the Combustion Engineering NSSS.

Additional sources of information may include NRC IE Circulars, NRC IE Information Notices, NRC IE Bulletins, CE Availability Data Program Quarterly Reports, NRC Current Events for Power Reactors, NPRDS Quarterly and Yearly Reports, and EEI Abnormal Occurrence Reports.

This review will identify specific problem areas where essentially similar installations are involved or those categories of abnormal occurrences that are repeatedly experienced that could be applicable to dissimilar installations. This information will be reviewed and evaluated with reference to impact on startup procedure preparation to identify potential problem areas that may require special testing, procedure modification, or design changes.

14.2.9 TRIAL USE OF PLANT PROCEDURES

One objective of the initial test program is to "use-test" plant procedures. Therefore, whenever practical, plant procedures will be referenced in, or used in lieu of, test procedures or portions thereof. A chronological log is utilized in Phase II and Phase III procedures and can be used by personnel as means for providing remarks and recommendations pertaining to plant procedures related to, or referenced in, each respective test procedure.

The plant procedures that may be used and/or reviewed in the different phases are instrumentation and control procedures, maintenance procedures, operating procedures and instructions, emergency procedures, chemistry procedures, and radiation protection procedures.

14.2.10 INITIAL FUEL LOADING AND INITIAL CRITICALITY

14.2.10.1 Initial Fuel Loading

Overall direction, coordination, and control of the initial fuel loading evolution will be the responsibility of the Plant Manager-Nuclear. The Phase III Test Director will direct and coordinate the preparation of, and assist in the performance of, the initial fuel loading procedures as part of Phase III of the test program. It is intended that qualified plant personnel will actually execute the procedures. Combustion Engineering will provide technical assistance during the initial fuel loading evolution.

The fuel loading evolution will be controlled by use of approved plant procedures which will be used to establish plant conditions, control access, establish security, control maintenance activities, and provide instructions pertaining to the use of fuel handling equipment. The overall process of initial fuel loading will be directed from the main control room. The evolution itself will be supervised by a licensed Senior Reactor Operator.

In the unlikely event that mechanical damage to a fuel assembly is sustained during fuel loading operations, an alternate core loading scheme whose characteristics closely approximate those of the initially prescribed core configuration will be determined and approved by PORC prior to implementation.

The fuel assemblies will be installed in the reactor vessel in water containing dissolved boric acid in a quantity calculated to maintain a core effective multiplication constant at 0.95, which is a boron concentration of approximately 1720 ppm. It is not anticipated that the refueling cavity will be completely filled; however, the water level in the reactor vessel will be maintained above the installed fuel assemblies at all times.

The Shutdown Cooling System will be in service to provide coolant circulation to ensure adequate mixing and a means of controlling water temperature. The refueling water storage pool will be in service and will contain borated water at a volume and concentration conforming to the Technical Specifications. Applicable administrative controls will be used to prevent unauthorized alteration of system lineups or change to the boron concentration in the Reactor Coolant System.

→(EC-12329, R306)
In addition to the two permanently installed source range flux monitors required by Technical Specifications, minimum instrumentation for fuel loading will consist of two temporary source range channels installed in the reactor vessel and response checked with a neutron source, one of which must be operable at all times during core alterations. The temporary channels will display neutron count rate on a count rate meter installed in the containment and will be monitored by personnel conducting the fuel loading operation. The permanent channel will display neutron count rate on a meter and recorder located in the main control room and will be monitored by licensed operators. In addition, at least one temporary channel and one permanent channel will be equipped with audible count rate indicators in two locations, temporary in the containment and permanent in the main control room.
←(EC-12329, R306)

Continuous area radiation monitoring will be provided during fuel handling and fuel loading operations. Permanently installed radiation monitors display radiation levels in the main control room and will be monitored by licensed operators.

Fuel assemblies together with inserted components will be placed in the reactor vessel one at a time according to a previously established and approved sequence which was developed to provide reliable core monitoring with minimum possibility of core mechanical damage. The initial fuel loading procedure will include detailed instructions which will prescribe successive movements of each fuel assembly from its initial position in the storage racks to its final position in the core. The procedures will establish a system and a requirement for verification of each fuel assembly movement prior to proceeding with the next assembly. Checks will be made for fuel assembly and inserted component serial numbers prior to the start of fuel load and a load verification will be made following completion of fuel movement to verify correct position and orientation of each assembly and CEA. The location of each fuel assembly and inserted component will be displayed on a status board in the control room throughout the fueling evolution.

At least two fuel assemblies containing neutron sources will be placed into the core at appropriate specified points in the initial fuel loading procedure to ensure a neutron population large enough for adequate monitoring of the core. As each fuel assembly is loaded, at least two separate inverse count rate plots will be maintained to ensure that the extrapolated inverse count rate ratio behaves as would be expected. In addition, nuclear instrumentation will be monitored to ensure that the "just loaded" fuel assembly does not excessively increase the count rate. The results of each loading step will be reviewed and evaluated by LP&L and designated technical advisors before the next prescribed step is started.

14.2.10.1.1 Safe Loading Criteria

Criteria for the safe loading of fuel require that loading operations stop immediately if:

a) The neutron count rate from either temporary nuclear channel unexpectedly doubles during any single loading step, excluding anticipated change due to detector and/or source movement or spatial effects (i.e., fuel assembly coupling source with a detector), or

b) The neutron count rate on any individual nuclear channel increases by a factor of five during any single loading step, excluding anticipated changes due to detector and/or source movement or spatial effects (i.e., fuel assembly coupling source with a detector).

In the event that an unexplained increase in count rate is observed on any nuclear channel, the last fuel assembly loaded shall be withdrawn. The procedure and loading operation will be reviewed and evaluated before proceeding to ensure the safe loading of fuel.

14.2.10.1.2 Fuel Loading Procedure

An approved detailed Phase III test procedure will be followed during the initial fuel loading to ensure that the evolution will be completed in a safe and controlled manner. This procedure will specify applicable precautions and limitations, prerequisites, initial conditions, and the necessary procedural steps.

14.2.10.1.3 Postcore Load Tests

Upon completion of fuel loading, the reactor upper guide structure and the pressure vessel head will be installed, and additional mechanical and electrical tests will be performed prior to initial criticality. These tests will include but will not be limited to:

a) Conducting final leak tests after the filling and venting of the Reactor Coolant System is completed.

b) Performing electrical and operational checks on the control element drive mechanisms.

c) Performing functional checks on the control element assembly position indication system.

d) Functional testing of the reactor control and protection system.

e) Measuring control element drop times.

f) Performing electrical, mechanical, and functional checks of the fixed and movable incore detectors.

g) Installation, calibration, and functional testing of the temporary reactivity computer.

Additional testing requirements are specified in Subsection 14.2.12.3.

14.2.10.2 Initial Criticality

Overall direction, coordination, and control of the initial criticality evolution will be the responsibility of the Plant Manager-Nuclear. The Phase III Test Director will direct and coordinate the preparation of, and assist in the performance of, the initial criticality procedure as part of Phase III of the test program. It is intended that qualified plant personnel will actually execute the procedure. Combustion Engineering will provide technical assistance during the initial criticality evolution.

A predicted boron concentration for criticality will be determined for the precritical CEA configuration specified in the procedure. This configuration will require all CEA groups to be fully withdrawn with the exception of the last regulating group, which will remain far enough into the core to provide effective control when criticality is achieved. This position will be specified in the procedure. The Reactor Coolant System (RCS) boron concentration will then be reduced to achieve criticality, at which time the regulating group will be used to control the chain reaction.

Core response during CEA group withdrawal and RCS boric acid concentration reduction will be monitored in the main control room by observing the change in neutron count rate as indicated by the permanent startup nuclear instrumentation.

Neutron count rate will be plotted as a function of CEA group position and RCS boron concentration during the approach to criticality. Primary safety reliance is based on inverse count rate ratio monitoring as an indication of the nearness and rate of approach to criticality during CEA group withdrawal and during the dilution of the reactor coolant boric acid concentration. The approach to criticality will be controlled, and specific holding points will be specified in the procedure. The results of the inverse count rate monitoring and the indications on installed instrumentation will be reviewed and evaluated by LP&L and designated technical advisors before proceeding to the next prescribed hold point.

14.2.10.2.1 Safe Criticality Criteria

Criteria for ensuring a safe and controlled approach to criticality require:

a) That high flux trip setpoints will be reduced to a value equivalent to five percent power or less.

b) That a sustained startup rate of one decade per minute will not be exceeded.

c) That CEA withdrawal or boron dilution shall be suspended if unexplainable changes in neutron count rates are observed.

d) That CEA withdrawal or boron dilution shall be suspended if the extrapolated inverse count rate ratio predicts criticality outside the tolerances specified in the procedure.

e) That the Technical Specifications are adhered to.

f) That criticality must be anticipated at any time positive reactivity is added by CEA withdrawal or boron dilution.

g) That a minimum of one decade of overlap must be observed between the startup and log safety channels of the excore nuclear instruments.

14.2.10.2.2 Initial Criticality Procedure

An approved detailed Phase III test procedure will be followed to attain the initial criticality of Waterford 3 in a safe and controlled manner. The procedure will specify applicable precautions and limitations, prerequisites, initial conditions, and the necessary procedural steps. It is intended that this procedure will reference, direct, and coordinate the use of approved plant operating procedures and instructions. The evolution will be conducted by the plant operating staff under the supervision of a licensed Senior Reactor Operator with support from participating organizations.

14.2.11 TEST PROGRAM SCHEDULE

The startup program for Waterford 3 encompasses approximately 36 months. Of this, approximately 22 months will be devoted to the different phases of testing. The remaining 14 months will be used to organize the WSG and to schedule procedure production and tests. To allow sufficient time to perform orderly and comprehensive testing, the WSG has scheduled at least nine months for Phase II testing and at least three months for Phase III testing.

The scheduling of individual tests or test sequences will be made to ensure that all appropriate systems or components which are relied upon to prevent or mitigate the consequences of postulated accidents will be tested prior to fuel loading. Prior to exceeding 25 percent of rated thermal power, appropriate safety-related systems will be tested for proper performance to provide reasonable assurance that they will operate satisfactorily when required.

Prior to major evolutions in Phase III testing, prerequisite lists will be prepared for PORC approval. The prerequisite lists shall enumerate tests that must be completed and approved by the JTG and/or PORC prior to the start of a particular Phase III testing sequence. The use of prerequisite lists will ensure that the safety of the plant will not be dependent on the performance of untested systems.

Phase II and Phase III test procedures shall be approved and available for review by NRC staff personnel from the Office of Inspection and Enforcement at least 60 days prior to their intended use. All Phase II and III test procedures to be completed after the receipt of the Operating License shall be approved and available for review by NRC staff personnel from the Office of Inspection and Enforcement at least 60 days prior to initial fuel load.

14.2.12 INDIVIDUAL TEST DESCRIPTION

14.2.12.1 Phase I Testing

Phase I testing will include requirements for verification of the completion and documentation of construction activities and the performance of certain prerequisite testing. The prerequisite testing will verify that the components, and systems as applicable, have been designed and installed properly and are ready for Phase II testing. Prerequisite testing includes items such as those listed in Appendix C, Regulatory Guide 1.68 (Revision 2, 8/78), which are required prior to Phase II testing.

The type and extent of testing on an individual system as well as the responsibility for completing such tests will be specified by the Waterford 3 Startup Group. Phase I tests may be reorganized and expanded as the test program develops.

14.2.12.2 Phase II Testing

Phase II testing will include requirements for completion of various preoperational test procedures to verify the functional and operational capabilities of systems prior to the initial fuel loading. Test descriptions are provided for the expected testing. Each description includes the objectives, special prerequisites, test methods, and acceptance criteria for the testing. The Phase II tests are tabulated in Table 14.2-1 and may be reorganized and expanded as the test program develops or as additional design modifications are made, such as Anticipated Transient Without Scram (ATWS) features.

14.2.12.2.1 ESF 125V DC SYSTEM

14.2.12.2.1.1 Objective

To verify that the ESF 125V DC System provides a reliable source of power for startup, operation, and shutdown under normal and emergency conditions. To verify that the separate power sources and their respective loads are independent of each other.

14.2.12.2.1.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is calibrated and operable.

C. Test equipment is available and calibrated.

D. Plant systems required to support testing are available, or temporary systems are installed and operable.

E. Batteries are fully charged.

F. Load bank is available for discharge test.

G. Operation of all breakers and cables is verified.

14.2.12.2.1.3 Test Method

A Demonstrate that the battery and battery charger of the 125V DC Power System meet design capacities by performing discharge test and charging test. Verify that minimum bank and individual cell limits are not exceeded.

B. Verify amperage capacity of the battery charger.

C. Verify independence and redundancy of A, B, and AB buses for each distribution system (see Subsection 14.2.12.2.2.3).

D. Verify emergency loads to be within battery size capability, performed concurrently with Subsection 14.2.12.2.2.3.

E. Verify operation of designed components such as protective devices, controls, instrumentation, interlocks, ground detection, computer inputs, and alarms, using actual or simulated signals.

F. Verify that emergency loads not previously verified by vendor tests can start and operate at a voltage equal to the battery design minimum voltage described in Subsection 8.3.2.1.

14.2.12.2.1.4 Acceptance Criteria

The ESF 125 V DC Power System performs all functions as described in Subsection 8.3.2.

14.2.12.2.2 PLANT ELECTRICAL DISTRIBUTION SYSTEM

14.2.12.2.2.1 Objective

To demonstrate the adequacy and reliability of the Plant Electrical Distribution System by performing tests of all systems during hot functional testing.

14.2.12.2.2.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Test equipment is available and calibrated.

C. 23O kV offsite power is available at both startup transformers.

D. Prerequisite and preservice testing is complete on the following systems:

1. Startup Transformer and Auxiliary Transformer

2. 6.9 kV Distribution System

3. Safety-Related and Nonsafety-Related 4.16 kV Systems

4. Safety-Related and Nonsafety-Related 480 V Systems

5. Safety-Related and Nonsafety-Related 208/120 V AC

6. Safety-Related and Nonsafety-Related 125 V DC

E. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.2.3 Test Method

A. Load all systems to the maximum extent practical, take voltage readings at each switchgear and MCC, and verify that full load voltage is within system design parameters.

B. If full load is impractical, record temperature and current at all transformers and, through correlation, demonstrate capability of full load for all transformers.

C. Verify automatic bus transfer from the auxiliary transformer to offsite power through the startup transformer when a simulated generator trip occurs.

D. Verify the proper operation of 4.16 kV and 480 V AB buses, including proper alignment with either the A or B buses and interlocks, preventing alignment with both simultaneously.

E. Verify that the 4.16 kV and 480 V Safety-Related Systems shed load as designed on undervoltage.

F. Verify operation of designed components, such as protective devices, instrumentation, computer inputs, and alarms, for actual or simulated conditions.

14.2.12.2.2.4 Acceptance Criteria

The Plant Electrical Distribution System performs as described in Sections 8.2 and 8.3.

14.2.12.2.3 <u>SAFETY-RELATED INVERTERS</u>

14.2.12.2.3.1 Objective

To verify proper operation of safety-related inverters and transfer devices and to demonstrate that the inverters supply full design capacity.

14.2.12.2.3.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant systems required to support testing are operable, or temporary systems are installed and operable.

C. Dummy load bank is available.

14.2.12.2.3.3 Special Prerequisites

A. Diesel generator testing will be performed concurrently with this test.
Portions of the testing in 14.2.12.2.3.4 below will be performed in
conjunction with diesel generator testing (Subsections 14.2.12.2.17 and 14.2.12.2.93).

14.2.12.2.3.4 Test Method

A. Verify all control logic.

B. Verify the proper operation of the inverters, manual transfer switches, frequency synchronization, and blocking diodes.

C. Simulate normal and abnormal operating conditions and verify that the computer/annunciator reacts to these conditions.

D. Verify that each inverter automatically transfers the input to the battery upon loss of preferred power while maintaining uninterrupted power output.

E. Using a dummy load bank, verify that the inverters supply 120 V AC at full load, using the normal power source.

F. Place the battery chargers on equalize and verify that DC equalizing voltage will not result in driving the inverter, relieving the rectifier from carrying the inverter load.

G. Verify proper operation of all protective devices, controls, interlocks, alarms, and computer inputs.

14.2.12.2.3.5 Acceptance Criteria

The inverters perform and meet the criteria as described in Section 8.3.

14.2.12.2.4 COMMUNICATIONS SYSTEM

14.2.12.2.4.1 Objective

To demonstrate the ability of the plant Communications System to provide adequate, reliable communications.

14.2.12.2.4.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.4.3 Test Method

A. Demonstrate the proper operation of the plant communications systems required by the Plant Emergency Plan.

B. Demonstrate the proper operation of the internal telephone system.

C. Demonstrate the proper operation of the external telephone system.

D. Demonstrate the proper operation of the alarm system.

E. Verify the proper operation of all designated components, such as protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

F. Demonstrate that the plant paging system provides an audible signal in critical and high-noise areas.

G. Demonstrate the proper operation of the sound-powered phone system.

14.2.12.2.4.4 Acceptance Criteria

The plant Communications System operates as described in Subsection 9.5.2.

14.2.12.2.5 LIGHTING SYSTEM

14.2.12.2.5.1 Objective

To verify the transfer capability from AC lighting to DC lighting and the adequacy of the lighting provided.

14.2.12.2.5.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Test instrumentation is available and calibrated.

C. The AC lighting system is operable.

D. The DC power source is available.

14.2.12.2.5.3 Test Method

A. Deenergize control room AC normal/emergency lighting and verify proper transfer to DC power.

B. Verify that acceptable lighting levels are provided where required with the loss of the AC lighting system.

C. Verify the operation of all protective devices, controls, and interlocks.

14.2.12.2.5.4 Acceptance Criteria

The Lighting System performs as described in Subsection 9.5.3 and is capable of supplying adequate lighting from the DC power source on loss of AC power.

14.2.12.2.6 SAFETY-RELATED HEAT TRACING

14.2.12.2.6.1 Objective

To demonstrate the functional performance of the safety-related heat tracing circuits to maintain controlled temperatures for applicable systems.

14.2.12.2.6.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Heat tracing circuits are installed, and insulation installation is completed.

C. Heat trace alarm panels are operable.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

E. Test equipment is available and calibrated.

14.2.12.2.6.3 Test Method

A. Fill the system with water and energize the individual heat tracing circuits, and monitor the increase in temperature.

B. Verify the amount of circuit current drawn during steady-state operations.

C. Verify that the system maintains piping temperature within design limits.

D. Verify proper operation of all interlocks, alarms, protective devices, and controls.

14.2.12.2.6.4 Acceptance Criteria

The safety-related heat tracing circuits perform as described in Subsection 9.3.4.

14.2.12.2.7 PLANT COMPUTER*

14.2.12.2.7.1 Objective

To verify that the plant computer is installed properly, responds correctly to external inputs, and provides proper inputs to computer peripheral equipment.

14.2.12.2.7.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Applicable vendor and owner manuals are available.

* Portions of this testing will be completed after fuel loading.

C. External test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.7.3 Test Method

A. Test programs will be run as specified by Louisiana Power & Light to verify the reliability of the computer system to perform the required hardware functions.

B. External inputs to the system will be simulated and measured.

C. Computer functional programs for selected programs will be verified using proper software or control panel inputs where applicable.

D. Alarm and indication functions will be verified by the computer instrumentation.

12.2.12.2.7.4 Acceptance Criteria

The plant computer performs as described in Subsection 7.7.1.6.

14.2.12.2.8 <u>SEISMIC MONITORING SYSTEM</u>

14.2.12.2.8.1 Objective

To demonstrate the functional operation of the Seismic Monitoring System.

14.2.12.2.8.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.8.3 Test Method

A. Verify the operability and calibration of the time-history accelerograph system and the seismic switch system.

B. Verify the operability and calibration of the response spectrum recorder system and the response spectrum annunciator.

C. Verify the operability and calibration of the peak acceleration recorder system.

D. Simulate a seismic event by activating the appropriate trigger units and verify that the recording accelerograph output records playback for analysis.

14.2.12.2.8.4 Acceptance Criteria

The Seismic Monitoring System performs as described in Subsection 3.7.4 and Table 3.3-7.

14.2.12.2.9 AIRBORNE AND AREA RADIATION MONITORING SYSTEM

14.2.12.2.9.1 Objective

To verify the functional performance of the Airborne and Area Radiation Monitoring System.

14.2.12.2.9.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Calibration check source is available.

E. Closed Component Cooling Water (CCCW) System, plant stack, and Fuel Handling Building Ventilating System are available to establish flow rates.

F. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.9.3 Test Method

A. Verify the calibration and operation of each area radiation monitor.

B. Adjust the detector flow rate for plant stack and CCCW System detectors.

C. Verify the self-testing feature of each radiation detector.

D. Verify proper operation of all control logic, protective devices, controls, interlocks, and alarms.

14.2.12.2.9.4 Acceptance Criteria

The Airborne and Area Radiation Monitoring System performs as described in Subsection 12.3.4.

14.2.12.2.10 PROCESS AND EFFLUENT RADIATION MONITORING SYSTEM

14.2.12.2.10.1 Objective

To verify that the Process and Effluent Radiation Monitoring System can detect and record specific radiation levels, and to verify all alarms and interlocks.

14.2.12.2.10.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

E. Suitable calibrated source material is available.

14.2.12.2.10.3 Test Method

A. Verify proper operation of controls, alarms, plant computer inputs, and displays, using actual or simulated signals.

B. Calibrate radiation monitors using check source materials.

C. Demonstrate that the proper isolation signals for the Effluent Waste Management System are developed upon detection of high radiation levels.

14.2.12.2.10.4 Acceptance Criteria

The Process and Effluent Radiation Monitoring System performs as described in Section 11.5.

14.2.12.2.11 <u>FIRE PROTECTION/DETECTION SYSTEM</u>

14.2.12.2.11.1 Objective

To verify the capability of the Fire Protection/Detection System to detect fires and provide fire-fighting and fire-suppression capabilities.

14.2.12.2.11.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is calibrated and operable.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.11.3 Test Method

A. Verify all control logic.

B. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of all fire-suppression and air operated valves.

C. Demonstrate the design head and flow from all pumps.

D. Demonstrate the operation of the Halon Fire Protection System using an alternate gas supply.

E. Verify the proper actuation time for the deluge system.

F. Verify the proper operation of designated components, such as protective devices, controls, interlocks, instrumentation, detectors, and alarms, using actual or simulated inputs.

14.2.12.2.11.4 Acceptance Criteria

The Fire Protection/Detection System operates as described in Subsection 9.5.1.

14.2.12.2.12 <u>COMPRESSED AIR SYSTEM</u>

14.2.12.2.12.1 Objective

To demonstrate the proper operation of the Compressed Air System to provide a safe and reliable source of compressed air for operation of plant equipment. To verify that any failure of the nonsafety-related portion of the system will not jeopardize the safety-related portion of the system.*

14.2.12.2.12.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

E. Sufficient permanent loads are connected to the Compressed Air System and are operable to verify air compressor loading.

14.2.12.2.12.3 Test Method

A. Verify all control logic.

B. Verify the proper operation and capacity of the compressors.

* Safety-related valves will be tested in the individual system-related preoperational test.

C. Demonstrate the operability of the air compressor dryers and filters.

D. Demonstrate the ability of the service air system to support the instrument air system on low instrument air demand.

E. Verify the proper operation of all protective devices, controls, interlocks, instruments, computer inputs, and alarms, using actual or simulated inputs.

F. Verify, if applicable, the proper operation, failure mode, and position indication of control valves.

14.2.12.2.12.4 Acceptance Criteria

The Compressed Air System performs as described in Subsection 9.3.1. Loss of instrument air header pressure does not result in any safety-related valves failing in the unsafe position.

14.2.12.2.13 NITROGEN SYSTEM

14.2.12.2.13.1 Objective

To verify the functional performance of the Nitrogen System to provide nitrogen gas to related equipment at defined pressures. To verify that failure of the nonsafety-related portion of the system will not jeopardize the safety-related portion of the system.*

14.2.12.2.13.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.13.3 Test Method

A. Verify all control logic.

B. Verify the proper operation of the nitrogen pump in transferring nitrogen from the liquid nitrogen tank to the nitrogen gas tank.

C. Demonstrate that the system nitrogen regulator regulates and maintains nitrogen gas bulk flow at 725 psi.

D. Demonstrate that the related system nitrogen regulators respond on demand to defined system pressures.

* Safety-related valves will be tested in the individual system-related preoperational test.

E. Verify the proper operation of all protective devices, controls, interlocks, instruments, and alarms.

F. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of control valves.

14.2.12.2.13.4 Acceptance Criteria

The Nitrogen System performs as described in FSAR Subsection 9.3.9.

14.2.12.2.14 CIRCULATING WATER SYSTEM

14.2.12.2.14.1 Objective

To demonstrate the proper operation of the Circulating Water System.

14.2.12.2.14.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instruments are available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

E. Traveling screens are installed.

F. Intake structure is flooded.

14.2.12.2.14.3 Test Method

A. Verify control logic.

B. Verify the head and flow characteristics for the circulating water pumps.

C. Verify proper valve operation of the discharge valve, failure mode of vacuum breakers, stroking speed of discharge valve, and position indication.

D. Demonstrate proper operation of components such as motors, pumps, and air eductors in all operating modes and flow paths.

E. Verify proper operation of designated components, such as protective devices, controls, interlocks, instrumentation, computer inputs, and alarms, using actual and simulated inputs.

14.2.12.2.14.4 Acceptance Criteria

The Circulating Water System operates as described in Subsection 10.4.5.

14.2.12.2.15 TURBINE BUILDING CLOSED COOLING WATER SYSTEM*

14.2.12.2.15.1 Objective

To verify proper operation of the Turbine Building Closed Cooling Water System.

14.2.12.2.15.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant systems required to support testing are operable, or temporary systems are installed and operable.

C. Test instrumentation is available and calibrated.

D. Permanently installed instrumentation is operable and calibrated.

14.2.12.2.15.3 Test Method

A. Verify all control logic.

B. Verify the proper operation of the cooling pumps, including head and flow characteristics.

C. Demonstrate flow paths and verify heat exchanger temperature rise, inlet and outlet water temperatures, equipment temperature and monitor performance and make appropriate flow rate adjustments to satisfy performance parameters.

D. Demonstrate that the heat exchangers will operate at design flow rate without exceeding heat exchanger design pressure drop.

E. Verify the proper operation of the surge tank level control and upper and lower level alarms.

F. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, and alarms.

G. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of control valves.

14.2.12.2.15.4 Acceptance Criteria

The Turbine Building Closed Cooling Water System performs as described in Subsection 9.2.7.

* All portions of this test with the exception of section 14.2.12.2.15.3.C will be completed prior to initial fuel load with the remainder of the test performed as part of the Phase III program.

14.2.12.2.16 COMPONENT COOLING WATER SYSTEM AND AUXILIARY COMPONENT COOLING WATER SYSTEM

14.2.12.2.16.1 Objective

To verify proper operation of the Component Cooling Water System and the Auxiliary Component Cooling Water System, including cooling tower performance and correct response to engineered safety features actuation signals.

14.2.12.2.16.2 Prerequisites

A. Construction activities on the systems to be tested are essentially complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.16.3 Test Method

A. Verify all system control logic.

B. Verify the proper operation of cooling water pumps including head and flow characteristics.

C. Demonstrate all flow paths and balanced flow through each supplied component.

D. Verify, if applicable, proper operation, failure mode, stroking speed, and position indication of control valves.

E. Verify response to signals from Engineered Safety Features Actuation System (ESFAS).

F. Verify the proper performance of the cooling towers.

G. Verify the proper operation of protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

14.2.12.2.16.4 Acceptance Criteria

The Component Cooling Water System and the Auxiliary Component Cooling Water System perform as described in Subsections 9.2.2 and 9.2.5.

14.2.12.2.17 EMERGENCY DIESEL GENERATORS*

14.2.12.2.17.1 Objective

To demonstrate the ability of the emergency diesel generators and their support equipment to provide reliable emergency power.

14.2.12.2.17.2 Prerequisites

A. Construction activities on the systems to be tested are essentially complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.17.3 Test Method

A. Verify all control logic.

B. Secure the starting air compressors and verify the number of starts that can be accomplished with one set of accumulators.

C. Start the air compressor and record the time required to recharge the accumulators.

D. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of control valves.

E. Verify the proper operation of protective devices, controls, alarms, interlocks, and instrumentation.

F. Verify proper operation of all emergency diesel generator auxiliary systems, e.g., starting, cooling, heating and ventilating, lubricating, and fueling.

G. Demonstrate proper startup operation by simulating loss of all AC voltage and demonstrate that the diesel generator unit can start automatically and attain the required voltage and frequency within acceptable limits and time.

H. Demonstrate proper operation for design-accident-loading sequence to design-load requirements and verify that voltage and frequency are maintained within required limits.

I. Demonstrate full-load-carrying capability for an interval of not less than 24 hours. The first 2 hours will be at a load equal to the 2-hour rating; the remainder, at a load equal to the continuous rating. Verify that voltage and frequency requirements are maintained. Verify that the cooling system functions within design limits.

* Portions of this test will be performed during Integrated Engineered Safety Features/Loss of Power Test in 14.2.12.2.93.

J. Immediately following the full-load test, demonstrate the functional capabilities at full-load temperature conditions by repeating steps G and H.

K. Demonstrate proper operation during diesel generator load shedding, including a test of the loss of the largest single load and of complete loss of load, and verify that the voltage requirements are met and that the overspeed limits are not exceeded.

L. Demonstrate the ability to 1) synchronize the diesel generator unit with offsite power while the unit is connected to the emergency load; 2) transfer this load to the offsite power; 3) isolate the diesel generator unit; and 4) restore it to standby status.

M. Demonstrate that the capability of the diesel generator unit to supply emergency power within the required time is not impaired during periodic testing.

N. Demonstrate the required reliability by means of 35 consecutive valid tests with no failures per diesel generator unit.

0. During the reliability demonstration, include simultaneous starts of both diesel generators and independent starts of each unit.

14.2.12.2.17.4 Acceptance Criteria

The emergency diesel generators and their support equipment perform as described in Subsection 8.3.1 and Section 9.5.

14.2.12.2.18 RB POLAR CRANE AND FHB BRIDGE CRANE

14.2.12.2.18.1 Objective

To demonstrate that the Reactor Building (RB) polar crane and the Fuel Handling Building (FHB) bridge crane are capable of performing to design criteria.

14.2.12.2.18.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Appropriate AC and DC power are available.

C. Test equipment and weights are available.

D. Handling strongbacks and slings are available.

E. The Joint Test Group finds the applicable crane acceptable for plant service on the basis of the construction 125 percent load static test and the construction 100 percent load dynamic test.

14.2.12.2.18.3 Test Method

A. Verify all control logic.

B. Verify proper operation of protective devices, controls, interlocks, and alarms using actual or simulated inputs.

C. Verify the travel limits of all hooks.

D. Verify the suitability of strongbacks and slings for handling loads.

E. Perform a preoperational 125 percent static load test of the RB polar crane.

→(EC-14270, R305)

F. Perform a 100 percent load test and a 125 percent load static test on the FHB bridge crane, bridge and runways.

G. Perform a factory 100 percent load test and a 125 percent load static test on the upgraded single-failure-proof FHB cask crane trolley and hoist, and perform an on-site operational no load test of the upgraded single-failure-proof FHB cask crane, including the main hoist and the two auxiliary hoists.

←(EC-14270, R305)

14.2.12.2.18.4 Acceptance Criteria

The RB polar crane and FHB bridge crane perform as described in Subsection 9.1.4.

14.2.12.2.19 <u>CONTAINMENT COOLING SYSTEM</u>

14.2.12.2.19.1 Objective

To verify the proper operation of the Containment Cooling System and that the system responds to a Safety Injection Actuation Signal (SIAS) from the Plant Protection System.

14.2.12.2.19.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Test instrumentation is available and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Containment is pressurized for 14.2.12.2.19.3E.

E. Permanently installed instrumentation is operable and calibrated.

14.2.12.2.19.3 Test Method

A. Verify all system control logic.

B. Verify proper balancing of the ventilation system and flow paths in normal and emergency modes.

C. Verify the automatic starting of the cooling units upon receipt of a SIAS.

D. Verify the proper operation of all protective devices, controls, interlocks, instrumentaton, and alarms, using actual or simulated inputs.

E. Demonstrate proper fan operation under peak design accident pressure.

14.2.12.2.19.4 Acceptance Criteria

The Containment Cooling System performs as described in Subsection 6.2.2.

14.2.12.2.20 SHIELD BUILDING VENTILATION SYSTEM

14.2.12.2.20.1 Objective

To verify the proper operation of the Shield Building Ventilation System during normal and emergency conditions.

14.2.12.2.20.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Test instrumentation is available and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Permanently installed instrumentation is operable and calibrated.

14.2.12.2.20.3 Test Method

A. Verify all control logic.

B. Verify proper operation of motors, fans, and electric heating coils in all modes and flow paths.

C. Operate the Shield Building Ventilation System in the exhaust and recirculation modes and verify system air flows and compliance with design parameters.

D. Verify the filter particle removal efficiency and filter bank air flow capacity.

E. During emergency operation, verify acceptable humidity conditions across the charcoal filters with electrical heating coils in service.

F. Verify the proper system response to inputs from the Plant Protection System.

G. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, and alarms, using simulated or actual inputs.

H. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of dampers.

14.2.12.2.20.4 Acceptance Criteria

The Shield Building Ventilation System performs in both normal and emergency modes as described in Subsection 6.2.3.

14.2.12.2.21 ANNULUS NEGATIVE PRESSURE AND VACUUM RELIEF SYSTEMS

14.2.12.2.21.1 Objective

To verify that the Annulus Negative Pressure System will maintain the required negative pressure in the annulus and that the Vacuum Relief System will respond to preset pressure differentials between the annulus and the containment.

14.2.12.2.21.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Test instrumentation is available and calibrated.

14.2.12.2.21.3 Test Method

A. Verify all control logic.

B. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of control valves and dampers.

C. Demonstrate that the annulus negative pressure system will maintain a negative pressure of -8 inches water gauge in the annulus.

D. Demonstrate the annulus negative pressure system response to a SIAS.

E. Verify the response of the vacuum relief system to a simulated pressure differential signal.

F. Verify on loss of air that the accumulators on the vacuum relief butterfly valve controls will supply enough air to cycle the valves twice.

G. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, and alarms.

14.2.12.2.21.4 Acceptance Criteria

The Annulus Negative Pressure and Vacuum Relief Systems perform as described in Subsections 9.4.5.8 and 3.8.2.3.

14.2.12.2.22 CONTAINMENT COMBUSTIBLE GAS CONTROL SYSTEM

14.2.12.2.22.1 Objective

To verify the proper operation of the Containment Atmospheric Release System, Hydrogen Recombiners, and Hydrogen Analyzers.

14.2.12.2.22.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is available and calibrated.

C. External test devices are available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable

E. Test instrumentation is available and calibrated.

14.2.12.2.22.3 Test Method

A. Verify all control logic.

B. Operate the Containment Atmospheric Release System, verifying proper louver and damper operation and system balancing.

C. Using a known source and test instrumentation, simulate various hydrogen concentrations and monitor the hydrogen analyzer for proper response.

D. Operate the hydrogen recombiner in manual mode and verify the proper heatup rate, design thermal capacity, and convective air flow rate.

E. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, computer inputs, and alarms, using actual or simulated inputs.

14.2.12.2.22.4 Acceptance Criteria

The equipment associated with combustible gas control performs as described in Subsection 6.2.5.

14.2.12.2.23 AIRBORNE RADIOACTIVITY REMOVAL SYSTEM*

14.2.12.2.23.1 Objective

To verify the proper operation of the Airborne Radioactivity Removal System.

* May be conducted following fuel loading but prior to initial criticality

14.2.12.2.23.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant systems required to support testing are operable, or temporary systems are installed and operable.

C. Permanently installed instrumentation is operable and calibrated.

D. Test instrumentation is available and calibrated.

14.2.12.2.23.3 Test Method

A. Verify all control logic.

B. Operate the system in the normal operating mode and verify system air balancing and air flow requirements.

C. Verify filter particulate removal efficiency and the air flow rate across the filter bank.**

D. Simulate actuation of the Reactor Coolant Pump Deluge System and verify that the Airborne Radioactivity Removal System shuts down automatically.

E. Verify the proper operation of all protective devices, controls, interlocks, and alarms, using actual or simulated inputs.

14.2.12.2.23.4 Acceptance Criteria

The Airborne Radioactivity Removal System performs as described in Subsection 9.4.5.2.

14.2.12.2.24 <u>CEDM COOLING SYSTEM</u>

14.2.12.2.24.1 Objective

To verify the proper operation of the Control Element Drive Mechanism (CEDM) Cooling System.

14.2.12.2.24.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

** Portions of this testing may be completed after fuel loading, but prior to entering Mode 4.

14.2.12.2.24.3 Test Method

A. Verify all control logic.

B. Operate the system in the normal mode and verify system air flow and balance.

C. Verify the proper operation of interlocks and alarms.

D. During hot functional testing, verify that the system maintains design temperature under actual heat load conditions.

14.2.12.2.24.4 Acceptance Criteria

The CEDM Cooling System performs as described in Subsection 9.4.5.7.

14.2.12.2.25 TURBINE BUILDING VENTILATING SYSTEM

14.2.12.2.25.1 Objective

To demonstrate that the Turbine Building Ventilating System provides a suitable operating environment for equipment and personnel during normal operations.

14.2.12.2.25.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Test instrumentation is available and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.25.3 Test Method

A. Verify all control logic.

B. Verify the proper operation of all inlet air dampers and damper controls.

C. Verify the proper operation of the exhaust fan units and dampers.

D. Demonstrate the ability of the air handling units to provide proper air flow to the switchgear room.

E. Demonstrate that the proper operation of the condensate pump motor exhaust fan system provides adequate cooling air flow.

F. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, and alarms.

14.2.12.2.25.4 Acceptance Criteria

The Turbine Building Ventilating System performs as described in Subsection 9.4.4.

14.2.12.2.26 CABLE VAULT AND SWITCHGEAR AREA HVAC SYSTEM

14.2.12.2.26.1 Objective

To demonstrate the proper operation of the Cable Vault and Switchgear Area HVAC System in manual and automatic operation.

14.2.12.2.26.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.26.3 Test Method

A. Verify all control logic.

B. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of all dampers in all modes of operation.

C. Operate the system in normal mode and verify air flow and balance.

D. Verify the proper operation of the unit in the smoke purge mode.

E. Verify the proper operation of all protective devices, controls, interlocks, and alarms, using actual or simulated inputs.

14.2.12.2.26.4 Acceptance Criteria

The Cable Vault and Switchgear Area HVAC System performs as described in Subsection 9.4.3.5.

14.2.12.2.27 CONTROL ROOM ENVELOPE HVAC SYSTEM

14.2.12.2.27.1 Objective

To verify the functional operation of the control room and computer room HVAC units and ensure a proper environment for personnel and equipment under all postulated conditions.

14.2.12.2.27.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.27.3 Test Method

A. Verify all control logic.

B. Verify, if applicable, the proper operation, stroking speed, and position indication of all dampers.

C. In manual operating mode, verify proper operation of the units, system rated air flow, and air balance.

D. In automatic mode, demonstrate the transfer to emergency operations as a result of radiation detection, toxic chemical detection, and safety injection actuation signals.

E. Demonstrate the automatic isolation of the computer room as a result of smoke detection and the ability to purge the area to the atmosphere.

F. Verify the filter particle removal efficiency and filter bank air flow capacity.

G. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

H. Verify that the system maintains the control room at positive pressure relative to the outside atmosphere during system operation in the pressurized mode as required by the Technical Specifications.

14.2.12.2.27.4 Acceptance Criteria

The Control Room Envelope HVAC System performs as described in Subsections 9.4.1 and 6.4.3.

14.2.12.2.28 RAB NORMAL VENTILATION AND CONTAINMENT PURGE SYSTEMS*

14.2.12.2.28.1 Objective

To verify the proper operation of the RAB Normal Ventilation and Containment Purge Systems.

* May be conducted following fuel loading but prior to initial criticality.

14.2.12.2.28.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant systems required to support testing are operable, or temporary systems are installed and operable.

C. Permanently installed instrumentation is operable and calibrated.

D. Test instrumentation is available and calibrated.

14.2.12.2.28.3 Test Method

A. Verify all control logic.

B. Verify the proper operation of centrifugal fans, electrical heating coils, and air handling units in all modes and flow paths.

C. Perform filter tests and verify filter particulate removal efficiency and filter bank air flow capacity.**

D. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of control valves and dampers.

E. Operate the ventilating system in normal mode and verify air balance.

F. Operate the Containment Purge System in conjunction with the RAB Normal Ventilation System and verify proper air flow.

G. Verify that the containment purge valves close on receipt of a CIAS.

H. Verify the proper operation of protective devices, controls, interlocks, computer inputs, instrumentation and alarms, using actual or simulated inputs.

14.2.12.2.28.4 Acceptance Criteria

The RAB Normal Ventilating and Containment Purge Systems perform as described in Subsections 9.4.3.1, 9.4.3.2, and 9.4.5.3.

14.2.12.2.29 <u>CONTROLLED VENTILATION AREA SYSTEM</u>

14.2.12.2.29.1 Objective

To verify the proper operation of the Controlled Ventilation Area System.

** Portions of this testing may be completed after fuel loading, but prior to entering Mode 4.

14.2.12.2.29.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant systems required to support testing are operable, or temporary systems are installed and operable.

C. Permanently installed instrumentation is operable and calibrated.

D. Test instrumentation is available and calibrated.

14.2.12.2.29.3 Test Method

A. Verify all control logic.

B. Verify the proper operation of centrifugal fans, filtration units, and air handling units.

C. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of control valves and dampers.

D. Verify the filter particle removal efficiency and filter bank air flow capacity.

E. Verify the proper system balance when operating the system.

F. Verify proper response to signals from the Plant Protection System.

G. Verify proper operation of protective devices, controls, interlocks, and alarms, using actual or simulated inputs.

H. Verify that the system maintains the minimum required negative pressure

14.2.12.2.29.4 Acceptance Criteria

The Controlled Ventilation Area System performs as described in Subsection 6.5.1.

14.2.12.2.30 CHILLED WATER

14.2.12.2.30.1 Objective

To verify the proper operation of the Chilled Water System.

14.2.12.2.30.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Test instrumentation is available and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Permanently installed instrumentation is operable and calibrated.

14.2.12.2.30.3 Test Method

A. Verify all control logic.

B. Demonstrate that each chilled water train can be operated from its local and remote manual station.

C. Verify that each chilled water unit performs as designed and supplies chilled water at rated flow and temperature.

D. Verify chilled water flow to all supplied components.

E. Verify that the chilled water systems respond automatically to the appropriate engineered safety features actuation signal (ESFAS).

F. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

14.2.12.2.30.4 Acceptance Criteria

The Chilled Water System performs as described in Subsection 9.2.9.

14.2.12.2.31 RAB MISCELLANEOUS HVAC SYSTEM

14.2.12.2.31.1 Objective

To verify the proper operation of the RAB Miscellaneous HVAC System to provide adequate climate control for the Hot Machine Shop and Decontamination Area, Emergency Diesel Generator Rooms, RAB Heating and Ventilating Equipment Room, and the Control Room Air Conditioning System Equipment Room.

14.2.12.2.31.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test equipment is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.31.3 Test Method

A. Verify all control logic.

B. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of all dampers.

C. Verify proper operation of the cooling units, unit rated air flow, and system air balance.

D. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, and alarms.

E. Verify system response to the Plant Protection System.

F. Perform filter testing, as appropriate, including particulate removal efficiency and air flow capacity.

14.2.12.2.31.4 Acceptance Criteria

The RAB Miscellaneous HVAC System performs as described in Subsections 9.4.1, 9.4.3.3, 9.4.3.4 and 9.4.3.6.

14.2.12.2.32 FUEL HANDLING BUILDING VENTILATING SYSTEM

14.2.12.2.32.1 Objective

To verify the proper operation of the Fuel Handling Building Ventilating System.

14.2.12.2.32.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Test instrumentation is available and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Permanently installed instrumentation is operable and calibrated.

14.2.12.2.32.3 Test Method

A. Verify control logic.

B. Verify normal operation of the system, and verify air balance and flow of the system.

C. Verify emergency operation of the system, and verify air balance and flow of the system.

D. During emergency operation, operate an electric heating coil to verify that humidity through the charcoal absorbers is acceptable.

E. Verify filter particle removal efficiency and filter bank air flow capacity.

F. Verify the proper operation of all protective devices, controls, interlocks, and alarms, using actual or simulated inputs.

G. Verify that the system maintains the minimum required negative pressure.

H. Verify proper system response to a high-radiation signal.

14.2.12.2.32.4 Acceptance Criteria

The Fuel Handling Building Ventilating System performs as described in Subsection 9.4.2.

14.2.12.2.33 PRIMARY WATER STORAGE SYSTEM

14.2.12.2.33.1 Objective

To verify that the Primary Water Storage System can provide adequate makeup water to the Reactor Coolant System.

14.2.12.2.33.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant systems required to support testing are operable, or temporary systems are installed and operable.

C. Permanently installed instrumentation is operable and calibrated.

D. Test instrumentation is available and calibrated.

14.2.12.2.33.3 Test Method

A. Verify all logic.

B. Verify, if applicable, the proper operation, failure mode, and position indication of control valves.

C. Verify the proper operation of the primary water pumps, including pump head and flow capacity.

D. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, computer inputs, and alarms, using actual or simulated inputs.

14.2.12.2.33.4 Acceptance Criteria

The Primary Water Storage System performs as described in Subsection 9.2.8.

14.2.12.2.34 REACTOR COOLANT SYSTEM QUENCH TANK SUBSYSTEM

14.2.12.2.34.1 Objective

To verify the proper operation of the quench tank subsystem.

14.2.12.2.34.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Test instrumentation is available and calibrated.

14.2.12.2.34.3 Test Method

A. Verify, if applicable, the proper operation, stroking speed, failure mode, and position indication of control valves.

B. Fill the quench tank from the primary water system and check level alarm setpoints.

C. Purge the quench tank, then pressurize with nitrogen and check pressure alarm setpoints.

D. Verify by sampling that the quench tank can be purged and nitrogen blanketed.

E. Vent the quench tank to the gas collection header and verify proper operation.

F. Simulate a high temperature alarm for the quench tank and verify the alarm setpoint.

G. Verify the operability of the quench tank sample lines.

14.2.12.2.34.4 Acceptance Criteria

The quench tank subsystem operates as described in Subsection 5.4.11.

14.2.12.2.35 <u>PRESSURIZER PRESSURE AND LEVEL CONTROL SYSTEM</u>

14.2.12.2.35.1 Objective

To verify the proper operation of the Pressurizer Pressure and Level Control System.

14.2.12.2.35.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Test instrumentation is available and calibrated.

14.2.12.2.35.3 Test Method

A. Verify all control logic.

B. Verify proper operation of the backup heater circuits by manually opening and closing breakers from the control room.

C. Simulate a decreasing pressurizer pressure signal and verify proper backup heater response and alarm setpoints.

D. Simulate a low level error in the pressurizer and verify proper response of the charging pumps and alarm setpoints.

E. Simulate a high level error in the pressurizer and verify proper response of the backup heaters, the letdown valves, and alarm setpoints.

F. Lower the pressurizer level to low-low setpoint and verify that all pressurizer heaters are deenergized.

14.2.12.2.35.4 Acceptance Criteria

The Pressurizer Pressure and Level Control System performs as described in Subsection 5.4.10 and Section 7.7.

14.2.12.2.36 PRESSURIZER SAFETY VALVE

14.2.12.2.36.1 Objective

To verify the proper operation and setpoints of the pressurizer safety valve.

14.2.12.2.36.2 Prerequisites

A. A lifting device (Hydroset) and associated support equipment are available.

B. The Reactor Coolant System is stabilized at hot zero power, temperature, and pressure conditions in conjunction with the Precore Hot Functional test (14.2.12.2.94).

C. The quench tank subsystem is operational.

14.2.12.2.36.3 Test Method

A. With the pressurizer at hot zero power conditions, increase the Hydroset pressure until the safety valve starts to simmer.

B. Determine the safety valve popping pressure from the Hydroset correlation data.

C. Adjust the valve set pressure and retest as required.

14.2.12.2.36.4 Acceptance Criteria

The pressurizer safety valve lifts at the required setpoint in accordance with the Technical Specifications and Section 3.4.2.

14.2.12.2.37 CHEMICAL AND VOLUME CONTROL SYSTEM CHARGING SUBSYSTEM

14.2.12.2.37.1 Objective

To verify the proper performance of the Chemical and Volume Control System (CVCS) charging subsystem.

14.2.12.2.37.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. The volume control tank subsystem is operational to support testing.

C. Permanently installed instrumentation is operable and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

E. Test instrumentation is available and calibrated.

14.2.12.2.37.3 Test Method

A. Verify, if applicable, the proper operation, stroking speed, failure mode, and position indication of control valves.

B. Operate each charging pump seal lube pump and verify proper operation of the seal lubrication system.

C. Operate the charging pumps in manual mode and verify all flow paths.

D. Simulate pressurizer level and verify proper charging pump response.

E. Simulate a safety injection actuation signal (SIAS) and verify proper charging pump response.

F. Verify proper operation of all protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

14.2.12.2.37.4 Acceptance Criteria

The CVCS charging subsystem performs as described in Section 9.3.

14.2.12.2.38 CHEMICAL AND VOLUME CONTROL SYSTEM LETDOWN SUBSYSTEM

14.2.12.2.38.1 Objective

To verify the proper operation of the Chemical and Volume Control System (CVCS) letdown subsystem during normal and emergency operation

14.2.12.2.38.2 Prerequisites

A. Construction activities on the systems to be tested are complete

B. Permanently installed instrumentation is operable and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Test instrumentation is available and calibrated.

14.2.12.2.38.3 Test Method

A. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of control valves

B. Simulate a safety injection actuation signal/containment isolation actuation signal (SIAS/CIAS) and verify proper valve response

C. Simulate pressurizer level and verify proper letdown valve response

D. Establish flow via letdown and verify flow path and proper response of back-pressure regulators.

E. Simulate letdown temperature and verify response of control valves.

F. Verify the proper operation of all protective devices, interlocks, instrumentation, and alarms, using actual or simulated inputs

14.2.12.2.38.4 Acceptance Criteria

The CVCS letdown subsystem performs as described in Section 9.3.

14.2.12.2.39 VOLUME CONTROL TANK SUBSYSTEM

14.2.12.2.39.1 Objective

To verify the proper operation of the Chemical and Volume Control System (CVCS) volume control tank (VCT) subsystem.

14.2.12.2.39.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Test instrumentation is available and calibrated.

14.2.12.2.39.3 Test Method

A. Verify the proper operation, failure mode, stroking speed, and position indication of control valves.

B. Simulate a safety injection actuation signal (SIAS) and verify proper valve response.

C. Fill the VCT using primary makeup via makeup flow path to the VCT and pressurize using the Nitrogen Pressurization System.

D. Vent the VCT and repressurize using temporary nitrogen supply through the nitrogen and hydrogen header. Verify alarm operation.

E. Drain and refill the VCT and verify level alarms.

F. Verify the proper operation of all protective devices, interlocks, instrumentation, and alarms, using actual or simulated inputs.

14.2.12.2.39.4 Acceptance Criteria

The CVCS volume control tank subsystem performs as described in Section 9.3.

14.2.12.2.40 BORONOMETER

14.2.12.2.40.1 Objective

To verify the proper operation, indication, and alarms of the wide-range digital boronometer.

14.2.12.2.40.2 Prerequisites

A. Construction activities on the systems to be tested are completed.

B. Permanently installed instrumentation is operable and calibrated.

C. Appropriate AC and DC power are available.

D. Test instrumentation is available and calibrated.

14.2.12.2.40.3 Test Method

A. Using external test equipment, simulate pulse input signals to the boronometer and monitor the boronometer output. Verify the proper operation of the remote range indicators.

B. Verify that the boronometer alarms are properly set.

C. Verify proper operation of the boronometer self-test circuit.

14.2.12.2.40.4 Acceptance Criteria

The boronometer performs as described in Section 9.3.

14.2.12.2.41 CHEMICAL AND VOLUME CONTROL SYSTEM REACTOR COOLANT PURIFICATION SUBSYSTEM

14.2.12.2.41.1 Objective

To verify the operation of the Chemical and Volume Control System (CVCS) reactor coolant purification subsystem.

14.2.12.2.41.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Test instrumentation is available and calibrated.

14.2.12.2.41.3 Test Method

A. Verify, if applicable, the proper operation, stroking speed, failure mode, and position indication of control valves.

B Verify flow path by supplying water through letdown to the volume control tank.

C. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

14.2.12.2.41.4 Acceptance Criteria

The CVCS reactor coolant purification subsystem performs as described in Section 9.3.

14.2.12.2.42 BORIC ACID BATCHING TANK SUBSYSTEM

14.2.12.2.42.1 Objective

To demonstrate the proper operation of the boric acid batching tank subsystem.

14.2.12.2.42.2 Prerequisites

A. Construction activities on the systems to be tested complete.

B. Plant systems required to support testing are operable, or temporary systems are installed and operable.

C. Permanently installed instrumentation is operable and calibrated.

D. Test instrumentation is available and calibrated.

14.2.12.2.42.3 Test Method

A. Fill the boric acid batching tank and energize the tank heaters. Record the time required to bring the tank temperature to 160º F.

B. Verify the heater control setpoints and the tank temperature alarm setpoint.

C. Dissolve boric acid crystals and start the tank mixer. Drain the tank, taking samples to determine the boric acid concentration.

14.2.12.2.42.4 Acceptance Criteria

The boric acid batching tank subsystem performs as described in Section 9.3.

14.2.12.2.43 BORIC ACID MAKEUP AND CHEMICAL FEED SYSTEM

14.2.12.2.43.1 Objective

To demonstrate the proper operation of the Boric Acid Makeup and Chemical Feed System.

14.2.12.2.43.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. The reactor coolant charging subsystem is complete and operable.

D. The volume control tank subsystem is complete and operable

E. The boric acid batching tank subsystem is complete and operable.

F. Plant systems required to support testing are operable, or temporary systems are installed and operable.

G. Test instrumentation is available and calibrated.

14.2.12.2.43.3 Test Method

A. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of control valves.

B. Demonstrate the proper operation of the boric acid makeup tank heaters.

C. Demonstrate the head and capacity of the boric acid makeup tank pumps.

D. Verify all design flow paths.

E. Demonstrate the proper system response to a SIAS.

F. Demonstrate the proper operation of the chemical addition subsystem.

G. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

14.2.12.2.43.4 Acceptance Criteria

The Boric Acid Makeup and Chemical Feed System performs as described in Section 9.3.

14.2.12.2.44 PROCESS SAMPLING SYSTEM

14.2.12.2.44.1 Objective

To verify the ability of the Process Sampling System to monitor the chemical conditions in the primary and secondary systems.

14.2.12.2.44.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Systems being sampled are at or near normal operating pressure and temperature.

C. Calibrating gases and solutions are available.

D. Test instrumentation is available and calibrated.

14.2.12.2.44.3 Test Method

A. Withdraw fluid at each sample point, verifying adequate flow.

B. Verify the proper operation of all alarms and interlocks.

C. Verify the proper operation of all pump and heat exchangers in all operating modes and flow paths.

D. Verify the proper calibration of the analytical instrumentation.

E. Calculate the holdup times using the piping volume and measured flow rate for Reactor Coolant System and pressurizer samples.

14.2.12.2.44.4 Acceptance Criteria

The Process Sampling System performs as described in Subsection 9.3.2.

14.2.12.2.45 WASTE MANAGEMENT SYSTEM*

14.2.12.2.45.1 Objective

To verify the ability of the Waste Management System (WMS) to safely handle liquid, gaseous, and solid waste.

14.2.12.2.45.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant systems required to support testing are operable, or temporary systems are installed and operable.

C. Test instrumentation is available and calibrated.

D. Permanently installed instrumentation is operable and calibrated.

14.2.12.2.45.3 Test Method

A. Verify that an unobstructed flow path exists from the radioactive tanks to the gas surge tank.

B. Verify proper operation of gas compressors in all modes and flow paths.

C. Verify that the dewatering tank and waste concentrate tank receive an unobstructed flow of resin and concentrated waste from their supply source.

D. Verify that the waste concentrate tank can receive an unobstructed flow of concentrated waste from its supply source.

E. Verify that no free liquids are present in packaged waste.

F. Demonstrate that a batch of resin can be transferred from each ion exchanger to the spent resin tank, then to the dewatering tank, in a smooth and orderly operation.

* Portions of this test will be completed after fuel load but prior to exceeding five percent power.

G. Verify that the laundry tank collection headers shift from full to empty tank on initiation of full-level signal.

H. Verify that the waste concentrator can receive and process liquids from the waste collection system.

I. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of control valves.

J. Verify the ability to change all filter elements in the Waste Management System.

K. Verify the proper operation of all pumps in all operating modes and flow paths.

L. Verify the proper operation of radioactive sump pumps, level control, and discharge paths.

M. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

14.2.12.2.45.4 Acceptance Criteria

The Waste Management System performs as described in Sections 11.2, 11.3, and 11.4.

14.2.12.2.46 BORON MANAGEMENT SYSTEM

14.2.12.2.46.1 Objective

To verify that the Boron Management System (BMS) operates as designed to handle excess primary water. Portions of the Boric Acid Heat Tracing System Test will be run concurrently.

14.2.12.2.46.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant systems required to support testing are operable, or temporary systems are installed and operable.

C. Test instrumentation is available and calibrated.

D. Permanently installed instrumentation is operable and calibrated.

14.2.12.2.46.3 Test Method

A. Verify all control logic.

B. Verify that the boric acid concentrators can receive and process liquids from the holdup tanks.

C. Verify the operability of level alarms on the holdup tanks, reactor drain tank, and equipment drain tank.

D. Verify, if applicable the proper operation, failure mode, stroking speed, and position indication of control valves.

E. Demonstrate the ability to change the filter and load resin in the preconcentrator filters and ion exchangers.

F. Verify the proper operation of all system pumps in all operating modes and flow paths.

G. Verify the proper operation of protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated signals.

14.2.12.2.46.4 Acceptance Criteria

The Boron Management System performs as described in Section 11.2.

14.2.12.2.47 REFUELING WATER SYSTEM

14.2.12.2.47.1 Objective

To verify that the Refueling Water Storage Pool (RWSP) and the Safety Injection System (SIS) sump provide a safe and reliable source of borated water for the Safety Injection and Containment Spray Systems.

14.2.12.2.47.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant systems required to support testing are operable, or temporary systems are installed and operable.

C. Permanently installed instrumentation is operable and calibrated.

D. Test instrumentation is available and calibrated.

14.2.12.2.47.3 Test Method

A. Verify all control logic.

B. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of control valves.

C. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, computer inputs, and alarms, using actual or simulated inputs.

D. Demonstrate that Emergency Core Cooling System (ECCS) suction transfers to the SIS sump and other control functions are accomplished on receipt of a Recirculation Actuation Signal (RAS).

E. Verify operability of check valves in the sump suction lines.

14.2.12.2.47.4 Acceptance Criteria

The Refueling Water System and the SIS sump perform as described in Section 6.3 and Subsection 6.2.2.

14.2.12.2.48 CONTAINMENT SPRAY SYSTEM

14.2.12.2.48.1 Objective

To verify the proper operation of the Containment Spray System and the containment spray pumps.

14.2.12.2.48.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant systems required to support testing are operable, and temporary systems are installed and operable.

C. Permanently installed instrumentation is operable and calibrated.

D. Test instrumentation is available and calibrated.

14.2.12.2.48.3 Test Method

A. Verify proper operation of each containment spray pump with minimum flow established by recirculation to the refueling water storage pool.

B. Verify pump performance, including head and flow characteristics.

C. Verify, if applicable, proper operation, failure mode, stroking speed, and position indication of control valves.

D. Verify by using service air that the containment spray header and nozzles are free of obstructions.

E. Verify the automatic operation of all components in response to a containment spray actuation signal.

F. Verify the proper operation of the protective devices, controls, interlocks, and alarms, using actual or simulated signals.

G. Demonstrate proper operation of the containment spray riser pumps and riser level control.

H. Verify an unobstructed flow path, using water and air with overlapping flow paths.

14.2.12.2.48.4 Acceptance Criteria

The Containment Spray System and containment spray pumps perform as described in Subsection 6.2.2.

14.2.12.2.49 <u>HIGH-PRESSURE SAFETY INJECTION SYSTEM</u>

14.2.12.2.49.1 Objective

To verify that the High-Pressure Safety Injection (HPSI) System operates as designed and provides water to the reactor vessel at the design rate in response to signals from the Plant Protection System.

14.2.12.2.49.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. The reactor vessel head is off, and the Reactor Coolant System and refueling cavity are ready to receive water.

E. The refueling water storage pool is filled with an adequate supply of primary water for test execution and is available to supply suction for the HPSI pumps.

F. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.49.3 Test Method

A. Verify all control logic.

B. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of control valves.

C. Manually operate the HPSI pumps, verifying head, capacity, and flow paths.

D. Perform flow test to determine optimum HPSI header valve settings and adequate flow rate.

E. Simulate a safety injection actuation signal (SIAS) to verify proper HPSI System response.

F. Verify the proper operation of all check valves in the HPSI System that see higher than ambient temperatures during power operation.

G. Verify proper operation of all protective devices, controls, interlocks, instrumentation, alarms, and computer inputs, using actual or simulated signals.

H. Verify operability of all check valves in the HPSI System not verified by previous testing.

14.2.12.2.49.4 Acceptance Criteria

The HPSI System performs as described in Section 6.3.

14.2.12.2.50 <u>LOW-PRESSURE SAFETY INJECTION SYSTEM</u>

14.2.12.2.50.1 Objective

To verify that the Low-Pressure Safety Injection (LPSI) System operates as designed and provides water to the reactor vessel at the design rate in response to signals from the Plant Protection System.

14.2.12.2.50.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. The reactor vessel head is off, and the Reactor Coolant System and refueling cavity are ready to receive water.

E. The refueling water storage pool is filled with an adequate supply of primary water for test execution and is available to supply suction for the LPSI pumps.

F. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.50.3 Test Method

A. Verify all control logic.

B. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of control valves.

C. Manually operate the LPSI pumps, verifying head, capacity, and flow paths.

D. Set LPSI header valves to: 1) balance flow and 2) prevent pump runout Verify balanced flow.

E. Simulate a safety injection actuation signal (SIAS) and a recirculation actuation signal (RAS) to verify proper LPSI System response.

F. Verify proper operation of all protective devices, controls, interlocks, instrumentation, alarms, and computer inputs, using actual or simulated signals.

G. Verify operability of check valves in the LPSI System not already verified above, and verify operability of any check valves in the Emergency Core Cooling System (ECCS) not verified in high-pressure safety injection (HPSI) testing (Subsection 14.2.12.2.49) or above.

14.2.12.2.50.4 Acceptance Criteria

The LPSI System performs as described in Section 6.3.

14.2.12.2.51 SAFETY INJECTION TANK SYSTEM

14.2.12.2.51.1 Objective

To demonstrate the proper operation of the Safety Injection Tank (SIT) System.

14.2.12.2.51.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant systems required to support testing are operational, or temporary systems are installed and operational.

C. The refueling water storage pool is filled with sufficient primary water to fill the safety injection tanks and support the test.

D. Permanently installed instrumentation is operable and calibrated.

E. Test instrumentation is available and calibrated.

14.2.12.2.51.3 Test Methods

A. Verify, if applicable, the proper operation, failure mode, stroking speed, and position indication of control valves.

B. Verify proper operation of protective devices, controls, interlocks, and alarms, using actual or simulated inputs.

C. Fill and drain safety injection tanks from the refueling water storage pool and verify level indication.

D. Pressurize and depressurize safety injection tanks and verify pressure indication.

E. With tanks full and pressurized, verify proper operation of safety injection check valves by pumping water through the check valve and the safety injection tank isolation motor-operated valve, then through the injection leakage drain to the Boron Management System.

F. Verify proper operation of the Reactor Coolant System (RCS) isolation check valve by pumping water with a charging pump to the upstream side of the RCS safety injection check valve and injecting water into the reactor vessel.

G. Simulate a safety injection actuation signal (SIAS) to each safety injection tank and verify the operation of valves, recording the response time required to discharge the tanks to the Reactor Coolant System.

14.2.12.2.51.4 Acceptance Criteria

The Safety Injection Tank System performs as described in Section 6.3.

14.2.12.2.52 FUEL HANDLING AND STORAGE SYSTEM

14.2.12.2.52.1 Objective

To verify the proper operation of the Fuel Handling and Storage System.

14.2.12.2.52.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Test instrumentation is available and calibrated.

14.2.12.2.52.3 Special Prerequisites

A. The reactor vessel head and upper guide structure are removed.

B. The core support barrel as installed and aligned.

C. Dummy fuel assemblies, dummy CEAS, and test weights are available.

14.2.12.2.52.4 Test Method

A. Verify the proper operation of the new fuel elevator and the full load interlock disabling the elevator raise feature.

B. Verify the proper operation of the spent fuel handling bridge, checking bridge, trolley, and hoist speeds, load limits, interlocks, and limit switches.

C. Using the X-Y coordinates and the spent fuel handling machine, trial fit each of the spent fuel storage rack positions.

D. Verify the transfer system using both consoles and upenders to prove proper operation.

E. Verify the proper operation of the dual-masted refueling machine checking bridge, trolley, and hoist speed, limit switches, interlocks, and load limits.

F. Index the reactor core positions using the X-Y coordinates with the refueling machine.

G. Using a dummy fuel assembly, trial fit the Reactor Building storage racks and record coordinates.

H. Prove operability of the dry sipping equipment, checking console resistance temperature detector (RTD) responses and complete pneumatic and blowdown cycle.*

I. Using the full sequence of focusing, camera tilt, and camera rotation, verify the proper operation of the underwater TV camera system.

J. Utilizing the complete Fuel Handling and Storage System, transfer a dummy fuel assembly from the new fuel elevator through a total fuel loading cycle in the reactor core and a total spent fuel cycle from the core to the spent fuel storage area, both in automatic and manual modes of operation.

K. Demonstrate the capabilities of the special fuel handling tools through proper operation with dummy fuel assembly and dummy control element assembly.

14.12.2.52.5 Acceptance Criteria

The Fuel Handling and Storage System performs as described in Section 9.1.

14.2.12.2.53 <u>FUEL POOL COOLING AND PURIFICATION SYSTEM</u>

14.2.12.2.53.1 Objective

To demonstrate the ability of the Fuel Pool Cooling and Purification System to maintain design flow, level, and water quality in the spent fuel pool and refueling cavity.

14.2.12.2.53.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Test instrumentation is available and calibrated.

C. Permanently installed instrumentation is operable and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

* This portion of the test need not be performed prior to initial fuel load, but may be performed prior to initial use of dry sipping equipment

14.2.12.2.53.3 Test Method

A. Verify all control logic.

B. Demonstrate, if applicable, the proper operation, failure mode, stroking speed, and position indication of control valves.

C. Verify the operability of all flow paths.

D. Verify head and flow characteristics for all pumps operated in all modes and flow paths.

E. Verify the ability to change resin and filters.

F. Verify the proper operation of protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

G. Verify the operability of the fuel pool gates and verify leakage within acceptable limits.

14.2.12.2.53.4 Acceptance Criteria

The Fuel Pool Cooling and Purification System performs as described in Section 9.1.

14.2.12.2.54 <u>ENGINEERED SAFETY FEATURES ACTUATION SYSTEM</u>

14.2.12.2.54.1 Objective

To demonstrate the functional operation of the Engineered Safety Features Actuation System (ESFAS) including the following subsystems:

A. Safety Injection Actuation System (SIAS)

B. Containment Isolation Actuation System (CIAS)

C. Containment Spray Actuation System (CSAS)

D. Recirculation Actuation System (RAS)

E. Main Steam Isolation System (MSIS)

F. Emergency Feedwater Actuation System (EFAS)

14.2.12.2.54.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Test instrumentation is available and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Permanently installed instrumentation is operable and calibrated.

14.2.12.2.54.3 Test Method

A. Verify proper assignment of engineered safety features (ESF) components to each test group.

B. Individually deenergize each group relay and monitor contact operation.

C. Perform the ESFAS logic test and verify the response to test signals into each two of four logic channels within the matrix of each actuation system.

D. Verify ESFAS response time for all subsystem actuation signals.

E. Perform integrated ESFAS tests to verify the completed loop to each system component.

14.2.12.2.54.4 Acceptance Criteria

The ESFAS performs as described in Section 7.3.

14.2.12.2.55 <u>CONTROL ELEMENT DRIVE MECHANISM CONTROL SYSTEM</u>

14.2.12.2.55.1 Objective

To verify the proper operation of the Control Element Drive Mechanism Control System (CEDMCS), the position indicators, and the reactor trip switchgear.

14.2.12.2.55.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. All prerequisite testing on the system is complete and accepted.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Special control element drive mechanism (CEDM) test instrumentation is available and calibrated.

E. Permanently installed instrumentation is operable and calibrated.

14.2.12.2.55.3 Test Method

A. Using special test equipment, simulate control element assembly (CEA) position; verify the proper operation of the CEA position indicators; and monitor the input signals to the CEA calculator.

B. Using special test equipment, verify that withdraw and insert signals are passed to the proper CEDM coil in the proper sequence.

C. Verify that the CEDM coils are deenergized upon receipt of a reactor trip signal.

D. Verify the proper operation of the CEDM motor generator set.

E. Demonstrate the proper operation of protective devices, inhibit features, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

F. Demonstrate proper failure mode on loss of power.

G. Demonstrate proper group sequencing.

14.2.12.3.55.4 Acceptance Criteria

The CEDMCS operates as described in Section 7.7, and position indication operates as described in Subsection 7.2.1.1.2.2.

14.2.12.2.56 EXCORE NEUTRON FLUX MONITORING SYSTEM

14.2.12.2.56.1 Objective

To verify the proper performance of the Excore Neutron Flux Monitoring System.

14.2.12.2.56.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Test instrumentation is available and calibrated.

14.2.12.2.56.3 Test Method

A. Using simulated signals, vary all input signals to the startup, safety, and control channels of the Excore Neutron Flux Monitoring System.

B. Monitor and record all input signals as a function of variable inputs provided by external test instrumentation.

C. Verify the performance of audio and visual indicators in response to changing input signals.

D. Verify the independent performance of channels by testing each channel separately.

E. Verify the fail-safe status of the system in case of power failure.

14.2.12.2.56.4 Acceptance Criteria

The Excore Neutron Flux Monitoring System performs as described in Section 7.2.

14.2.12.2.57 FIXED INCORE DETECTOR SYSTEM*

14.2.12.2.57.1 Objective

To verify the proper operation of the Fixed Incore Detector (Neutron Flux) System.

14.2.12.2.57.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Test instrumentation is available and calibrated.

14.2.12.2.57.3 Test Method

A. Using external test instrumentation, simulate incore detector signals into the signal (amplifier) circuits.

B. Vary the simulated inputs to the amplifier and record its outputs to the plant computer.

14.2.12.2.57.4 Acceptance Criteria

The Fixed Incore Detector System operates as described in Subsection 7.7.1.7.

14.2.12.2.58 MOVABLE INCORE DETECTOR SYSTEM,**

14.2.12.2.58.1 Objective

To verify the proper performance of the Movable Incore Detector System.

* The electrical operability of the system will be tested prior to fuel load. However, the detector responsiveness and comparison testing will be done under the Phase III program (See Subsection 14.2.12.3.3).

** The mechanical operability of the system will be tested prior to fuel load. However, the detector responsiveness and comparison testing will be done under the Phase III program (See Subsection 14.2.12.3.3).

14.2.12.2.58.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Test instrumentation is available and calibrated.

14.2.12.2.58.3 Test Method

A. Operate one set of drive and transfer machines at a time and record all pertinent outputs, including encoder signals.

B. Using external instrumentation, simulate the plant computer command signals to drive the detectors and to change inlet-to-outlet instrument loop alignments. Monitor all feedback signals as required for verification of simulated commands.

C Operate the system from the main control room board and verify proper operation by monitoring the feedback signals.

D. Operate the system from the local position with the portable control set and verify proper operation by monitoring the feedback signals.

14.2.12.2.58.4 Acceptance Criteria

The Movable Incore Detector System performs as described in Subsection 7.7.1.7.

14.2.12.2.59 <u>PLANT PROTECTION SYSTEM</u>

14.2.12.2.59.1 Objective

To verify the proper operation of the Plant Protection System.

14.2.12.2.59.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant computer, process analog control, and annunciator are operable and available.

C. Excore Nuclear Instrumentation System safety drawers are operational.

D. Safety-related 120 V AC power is available.

E. Test instrumentation is available and calibrated.

14.2.12.2.59.3 Test Method

A. Verify the operation of each trip unit at the correct setpoint.

B. Verify that the proper two-out-of-four logic will provide a trip signal to the reactor trip circuit breakers or an actuation signal to the Engineered Safety Features Actuation System (ESFAS).

C. Verify the operation of the trip bypass features of any one channel.

D. Verify that functional trip bypasses become automatically canceled when certain plant parameters exceed specified setpoints.

E. Verify the proper tracking and reset functions of the setpoints for low pressurizer pressure and low steam generator pressure trips.

F. Demonstrate the proper operation of testing equipment installed in the Plant Protection System.

G. Verify the proper operation of the core protection calculator subsystem and the control element assembly calculator subsystem through input/output tests as well as internal functioning test.

H. Verify the proper operation of all protective devices, controls, interlocks, computer inputs, and alarms, using actual or simulated signals.

I. Determine the Reactor Protection System trip response time by injecting signals into appropriate sensors or sensor terminals and measuring the elapsed time to achieve tripping of the reactor trip circuit breakers. Trip paths may be tested in several segments, with the total trip response time being the sum of the response times of the individual segments making up the entire trip path.

14.2.12.2.59.4 Acceptance Criteria

A. The Plant Protection System performs as described in Sections 7.2 and 7.3.

B. The measured Reactor Protection System trip response times are conservative with respect to the times used in the accident analysis (Chapter 15).

14.2.12.2.60 REACTOR REGULATING SYSTEM

14.2.12.2.60.1 Objective

To verify the proper operation of the Reactor Regulating System (RRS).

14.2.12.2.60.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant computer, process analog control, and annunciator are available to support testing.

C. Non-safety-related 120 V AC power is available.

D. Test instrumentation is available and calibrated.

E. Permanently installed instrumentation is operable and calibrated.

14.2.12.2.60.3 Test Method

A. Demonstrate that the RRS will signal the control element assemblies (CEAs) to control average primary coolant temperature based on inputs from the hot and cold leg temperatures, pressurizer pressure, and turbine first stage pressure.

B. Verify the proper control signal to the Pressurizer Level Control System.

C. Verify Steam Bypass Control System proper input signals.

D. Verify the proper operation of all protective devices, interlocks, alarms, and annunciation associated with the RRS.

14.2.12.2.60.4 Acceptance Criteria

The RRS performs as described in Section 7.7.

14.2.12.2.61 <u>VIBRATION AND LOOSE PARTS MONITORING SYSTEM</u>

14.2.12.2.61.1 Objective

A. To verify the proper operation of the Vibration and Loose Parts Monitoring System.

B. To adjust the loose parts alert setpoint for power operation.

14.2.12.2.61.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Sensors, cables, and preamplifiers are installed and operable.

C. Power cabinets, test circuits, and amplifier assemblies are checked out.

D. X-Y plotter and cassette recorders are operable.

4.2.12.2.61.3 Test Method

A. Verify the calibration and alert setpoint of the lose parts channels with a mechanical impulse type device.

B. Verify the calibration of the vibration channels with a shaker table.

C. Verify the ability to detect and record reactor core internal motion by applying simulated signals to the core internal motion channels.

D. Verify all alarm functions.

E. Establish baseline data for a cold, subcritical plant.

F. Establish the alert level for loose parts channels in a cold, subcritical plant. This alert level will apply to the preoperational test phase, to startup, and to power operations.

14.2.12.2.61.4 Acceptance Criteria

A. The Vibration and Loose Parts Monitoring System performs as described in Subsection 4.4.6.1.

B. The loose parts alert setpoint has been adjusted for power operation in accordance with Rockwell International Vibration and Loose Parts Monitoring Technical Manual (AI-73-1).

14.2.12.2.62 <u>REACTOR POWER CUTBACK SYSTEM*</u>

14.2.12.2.62.1 Objective

To verify the ability of the reactor power cutback module (RPCM) and the reactor power cutback control panel (RPCCP) to provide outputs to initiate a step reduction in reactor power following an input for full load rejection or the loss of one main feedwater pump.

14.2.12.2.62.2 Prerequisites

A. Plant systems required to support testing are operable, or temporary systems are installed and operable.

B. Permanently installed instrumentation associated with the Reactor Power Cutback System operable and calibrated.

C. Test instrumentation is available and calibrated.

14.2.12.2.62.3 Test Method

A. Demonstrate proper operational interface between the reactor power cutback control panel and the reactor power cutback module.

* Portions of this test will be completed after fuel load.

B. Demonstrate the proper performance of all lamps and alarms.

C. Verify outputs to the Control Element Drive Mechanism Control System, Plant Monitoring System, Turbine Control System, Main Feedwater Pumps, and Nuclear Steam Supply System (NSSS) Control System.

D. Demonstrate operation in both the auto and manual modes.

4.2.12.2.62.4 Acceptance Criteria

The Reactor Power Cutback System operates in accordance with Subsection 7.7.1.9.

14.2.12.2.63 CONDENSATE SYSTEM

14.2.12.2.63.1 Objective

To demonstrate that the Condensate System is capable of supplying an adequate flow of water at design pressure to support the remainder of the Power Conversion System.

14.2.12.2.63.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.63.3 Test Method

A. Verify all control logic.

B. Verify proper operation of pumps, pump head, and flow characteristics.

C. Demonstrate minimum flow recirculation protection.

D. Demonstrate all design flow paths.

E. Demonstrate proper operation of the hotwell level control system.

F. Verify, if appropriate, proper operation, failure mode, stroking speed, and position indication of control valves.

G. Verify proper operation of designated components, such as protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

14.2.12.2.63.4 Acceptance Criteria

The Condensate System performs as described in Subsection 10.4.7.

14.2.12.2.64 CONDENSATE STORAGE AND TRANSFER SYSTEM

14.2.12.2.64.1 Objective

To demonstrate that the Condensate Storage and Transfer System provides a reliable source of water for the condenser and Condensate System.

14.2.12.2.64.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is calibrated and operable.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.64.3 Test Method

A. Verify all control logic.

B. Verify the pump head and flow characteristics.

C. Demonstrate the operability of all design flow paths.

D. Verify, if appropriate, proper operation, failure mode, stroking speed, and position indication of control valves.

E. Verify operation of protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

14.2.12.2.64.4 Acceptance Criteria

The Condensate Storage and Transfer System performs as described in Subsection 9.2.6.

14.2.12.2.65 FEEDWATER REGULATING SYSTEM

14.2.12.2.65.1 Objective

To demonstrate the proper performance of the Feedwater Regulating System.

14.2.12.2.65.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. External test equipment is operational and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.65.3 Test Method

A. Verify that all associated installed instrumentation is operable and properly calibrated, and record the response of the Feedwater Regulating System.

B. Verify proper function of the program calculators.

C. Verify proper outputs in all modes of operation.

D. Verify proper override, interlock, and alarm operation.

E. Verify proper response by the main and bypass feedwater valves and position indicators.

14.2.12.2.65.4 Acceptance Criteria

The Feedwater Regulating System operates as specified in Subsection 7.7.1.3.

14.2.12.2.66 FEEDWATER SYSTEM*

14.2.12.2.66.1 Objective

To demonstrate that the Feedwater System is capable of supplying feedwater to the steam generators and maintaining steam generator level.

14.2.12.2.66.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is calibrated and operable.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.66.3 Test Method

A. Verify all control logic.

* Portions of this test will be performed after initial fuel load and at reactor power greater than 15%.

B. Demonstrate all design flow paths.

C. Verify the starting, head, and flow characteristics of the turbine driven feedwater pumps at the full range of steam pressures.

D. Demonstrate minimum flow recirculation protection.

E. Verify proper operation of protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

F. Verify, if appropriate, proper operation, failure mode, stroking speed, and position indication of control valves.

14.2.12.2.66.4 Acceptance Criteria

The Feedwater System performs as described in Subsection 10.4.7 and Section 7.7.

14.2.12.2.67 EMERGENCY FEEDWATER SYSTEM

14.2.12.2.67.1 Objective

To demonstrate the ability of the Emergency Feedwater System to supply feedwater to the steam generators for design emergency conditions.

14.2.12.2.67.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.67.3 Test Method

A. Verify all control logic.

B. Verify head and flow characteristics of motor-driven emergency feedwater pumps.

C. Verify the starting time and head and flow characteristics of the turbine-driven emergency feedwater pump at the full design range of steam pressures.

D. During the course of the startup program, demonstrate five consecutive cold quick starts for the steam-driven emergency feedwater pump.

E. Verify all design flow paths.

F. Verify proper operation in response to signals from the Plant Protection System.

G. Verify, if appropriate, proper operation, failure mode, stroking speed, and position indication of control valves.

H. Verify proper operation of protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

I. Demonstrate proper pump performance during an endurance test.

14.2.12.2.67.4 Acceptance Criteria

The Emergency Feedwater System performs as described in Subsection 10.4.9.

14.2.12.2.68 CHEMICAL FEED SYSTEM

14.2.12.2.68.1 Objective

To verify the ability of the Chemical Feed System to add chemicals to the secondary systems.

14.2.12.2.68.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Test instrumentation is available and calibrated.

14.2.12.2.68.3 Test Method

A. Verify, if appropriate, proper operation, failure mode, stroking speed, and position indication of control valves.

→(EC-34060, R306)

B. Align the hydrazine system for normal operation and verify that each will supply the proper solution at controlled rate to the secondary systems.

←(EC-34060, R306)

C. Verify that the hydrazine solution pump can be controlled by the computer on signals received from the hydrazine residual analyzer.

D. Verify that the ammonia solution pump can be controlled by the computer on signals received from the pH/conductivity analyzer.

E. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, and alarms.

14.2.12.2.68.4 Acceptance Criteria

The Chemical Feed System performs as described in Subsection 10.4.10.

14.2.12.2.69 MAIN STEAM SYSTEM AND STEAM GENERATORS*

14.2.12.2.69.1 Objective

To verify that the Main Steam System and steam generators provide a safe and reliable path for transferring steam from the steam generators to the turbine/condenser.

14.2.12.2.69.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is calibrated and operable.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.69.3 Test Method

A. Verify all control logic.

B. Demonstrate all flow paths.

C. Verify, if appropriate, proper operation, failure mode, stroking speed, and position indication of control valves.

D. Verify the operation of the main steam isolation valves by a main steam isolation actuation signal.

E. Verify main steam safety valve setpoints by simmer testing (during hot functional testing).

F. Verify operability of the atmospheric dump valves and steam bypass valves at no-load steam pressure (during hot functional testing).

G. Verify proper operation of designated components, such as protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

14.2.12.2.69.4 Acceptance Criteria

The Main Steam System performs as described in Sections 10.3 and 7.7.

* Portions of this test will be completed after initial fuel load but prior to exceeding 5 percent power.

14.2.12.2.70 STEAM GENERATOR BLOWDOWN SYSTEM*

14.2.12.2.70.1 Objective

To verify the proper operation of the Steam Generator Blowdown System.

14.2.12.2.70.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Test instrumentation is available and calibrated.

14.2.12.2.70.3 Test Method

A. Verify the flow paths for generator blowdown and subsequent condensate recycle.

B. Verify, if appropriate, the proper operation, failure mode, stroking speed, and position indication of control valves.

C. Verify the proper operation of pump, motors, and heat exchangers in all operating modes and flow paths.

D. Verify the ability to regenerate resin.

E. Verify the proper operation of all protective devices, controls, interlocks, and alarms, using actual or simulated inputs.

F. Verify the proper system response to inputs from the Plant Protection System.

14.2.12.2.70.4 Acceptance Criteria

The Steam Generator Blowdown System performs as described in Subsection 10.4.8.

14.2.12.2.71 EXTRACTION STEAM SYSTEM**

14.2.12.2.71.1 Objective

To verify the proper operation of the Extraction Steam System nonreturn valves.

* This test will be completed after initial fuel load but prior to exceeding 5 percent power.

** Portions of this test will be performed after fuel load.

14.2.12.2.71.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.71.3 Test Method

A. Verify all control logic.

B. Verify the proper response of the nonreturn valves to a turbine trip.

C. Verify the proper response of the nonreturn valves to feedwater heater control high level signals.

D. Verify the proper operation of all protective devices, instrumentation, interlocks, and alarms, using actual or simulated inputs.

14.2.12.2.71.4 Acceptance Criteria

The Extraction Steam System performs as described in Subsection 10.2.2.2.6.

14.2.12.2.72 <u>HEATER DRAINS AND VENTS*</u>

14.2.12.2.72.1 Objective

To verify the proper operation of the moisture separator reheater (MSR) and feedwater drain systems.

14.2.12.2.72.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Plant systems required to support testing are operable, or temporary systems are installed and operable.

D. Test instrumentation is available and calibrated.

14.2.12.2.72.3 Special Prerequisites

A. The unit is in service and operating at greater that 25 percent reactor power.

* Portions of this test will be performed after fuel load.

14.2.12.2.72.4 Test Method

A. Verify all control logic.

B. Verify heater drain pump capacity, head, and flow paths.

C. Verify pump operation and that automatic shutdown occurs on low water level in the No. 2 feedwater heater.

D. Verify that all heater, drain, and collector tanks operate to maintain proper levels through proper operation of level controllers.

E. Verify the proper operation of all protective devices, controls, interlocks, and alarms.

F. Verify, if appropriate, the proper operation, failure mode, stroking speed, and position indication of control valves.

14.2.12.2.72.5 Acceptance Criteria

The heater drains and vents perform as described in Section 10.2, Table 10.4-4, and the applicable flow diagrams, electrical diagrams, control wiring diagrams, instrument diagrams, and instrument schematics.

14.2.12.2.73 <u>MAIN CONDENSER AIR EVACUATION SYSTEM</u>

14.2.12.2.73.1 Objective

To demonstrate that the Main Condenser Air Evacuation System provides a safe and reliable heat sink for normal operations.

14.2.12.2.73.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

E. Steam seals and lagging are available.

F. Turbine is on turning gear.

G. All electrical testing is complete on the vacuum pumps and condenser valves.

14.2.12.2.73.3 Test Method

A. Verify the integrity of the condenser.

B. Verify, if appropriate, the proper operation, failure mode, stroking speed, and position indication of control valves.

C. Demonstrate the proper operation of the vacuum pumps in all operating modes and flow paths.

D. Verify the proper operation of protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

14.2.12.2.73.4 Acceptance Criteria

The Main Condenser Air Evacuation System performs as described in Section 10.4.

14.2.12.2.74 <u>FEEDPUMP LUBE OIL SYSTEM</u>

14.2.12.2.74.1 Objective

To verify the functional performance of the Feedpump Lube Oil System to provide lube oil at proper temperature and pressure.

14.2.12.2.74.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant systems required to support testing are operable, or temporary systems are installed and operable.

C. Permanently installed instrumentation is operable and calibrated.

D. Test instrumentation is available and calibrated.

14.2.12.2.74.3 Test Method

A. Verify the proper operation of the lube oil reservoir vapor extractors and interlock with the reservoir heaters.

B. Verify the operation of the reservoir heaters and the interlock with low reservoir oil level.

C. Demonstrate the proper operation of the system to supply lube oil to the turbine and pump bearing, turbine control mechanism, and turbine overspeed trip reset mechanism.

D. Demonstrate the proper operation of the DC emergency oil pump in response to a preset low lube oil header pressure.

E. Demonstrate the functional performance of the lube oil transfer pump in transferring lube oil from the reservoir to oil batch tank B.

F. Verify the proper operation of all protective devices, controls, interlocks, alarms, and instrumentation.

G. Verify, if appropriate, the proper operation, failure mode, stroking speed, and position indication of control valves.

14.2.12.2.74.4 Acceptance Criteria

The Feedpump Lube Oil System performs in accordance with Westinghouse Instruction Book for Nuclear Feed Pump Drive Turbines (5817-9) and Pacific Pumps Technical Manual (1564-9855).

14.2.12.2.75 GLAND SEAL SYSTEM *

14.2.12.2.75.1 Objective

To verify that the Gland Seal System provides adequate sealing to the turbine shaft and the main feed pump turbine shafts against leakage of air to the turbine casings and escape of steam to the Turbine Building.**

14.2.12.2.75.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant systems required to support testing are operable, or temporary systems are installed and operable.

C. Permanently installed instrumentation is operable and calibrated.

D. Test instrumentation is available and calibrated.

14.2.12.2.75.3 Test Method

A. Verify, if appropriate, the proper operation, failure mode, stroking speed, and position indication of control valves.

B. At turbine startup, place the Gland Seal System in operation using auxiliary steam and verify proper operation of the system after turbine load has increased and the system has sealed off.

* Portions of this test will be performed after initial fuel load.

** Gland Seal System testing will be performed concurrently with the Turbine Control System test.

C. Verify the proper performance of the gland seal exhauster blowers and the gland seal condenser.

D. Verify the proper operation of the high pressure turbine gland spillover valve for dumping excess gland seal leakage.

E. Verify the proper operation of all protective devices, controls, interlocks, instrumentation, and alarms.

14.2.12.2.75.4 Acceptance Criteria

The Gland Seal System performs as described in Subsection 10.4.3.2.

14.2.12.2.76 <u>MAIN TURBINE CONTROL SYSTEM</u>

14.2.12.2.76.1 Objective

To verify the functional performance of the Main Turbine Control System and system protective devices.

14.2.12.2.76.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Plant systems required to support testing are operable, or temporary systems are installed and operable.

C. Permanently installed instrumentation is operable and calibrated.

D. Test instrumentation is available and calibrated.

14.2.12.2.76.3 Test Method

A. Verify all control logic.

B. Demonstrate the proper operation of the throttle and control valves utilizing the digital electro-hydraulic control system with simulated signals.

C. Verify the proper operation of all control system protective devices, controls, interlocks, instrumentation, trip devices, and alarms.

14.2.12.2.76.4 Acceptance Criteria

The Main Turbine Control System performs as described in Section 10.2 and Subsection 7.7.1.4.2.

14.2.12.2.77 REACTOR COOLANT GAS VENTING SYSTEM

14.2.12.2.77.1 Objective

To verify the proper operation of the Reactor Coolant Gas Venting System.

14.2.12.2.77.2 Prerequisites

A. Construction activities on the system to be tested are essentially complete.

B. Plant systems required to support testing are operable, or temporary systems are installed and operable.

C. Permanently installed instrumentation is operable and calibrated.

14.2.12.2.77.3 Test Method

A. Verify that flow paths can be established through the Reactor Coolant Gas Venting System from the pressurizer to the quench tank.

B. Verify that flow paths can be established through the Reactor Coolant Gas Venting System from the reactor vessel to the quench tank.

C. Verify that total flow from the reactor vessel through the Reactor Coolant Gas Venting System does not exceed 44 gpm.

D. Verify proper operation of keylock switches.

14.2.12.2.77.4 Acceptance Criteria

A. The Reactor Coolant Gas Venting System allows venting of the pressurizer and reactor vessel through designed flow paths.

B. The total flow from the reactor vessel does not exceed 44 gpm.

C. Keylock switches prevent operation of vent valves when the key is in the OFF position.

14.2.12.2.78 MAIN CONTROL ROOM EMERGENCY BREATHING AIR

14.2.12.2.78.1 Objective

To demonstrate the proper operation of the Main Control Room Emergency Breathing Air System and its ability to provide a safe and reliable source of compressed breathing air for Control Room and Security personnel.

14.2.12.2.78.2 Prerequisites

A. Construction activities on the system to be tested are essentially complete.

B. Permanently installed instrumentation is operable and calibrated.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.78.3 Test Method

A. Verify all control logic.

B. Verify proper operation of compressor.

C. Demonstrate that the Purification Filtering System operates properly.

D. Verify the proper operation of all controls, instruments, annunciations, and alarms, using actual and/or simulated signals.

E. Verify that the system provides Grade D breathing air as designed.

14.2.12.2.78.4 Acceptance Criteria

The Main Control Room Emergency Breathing Air System performs as described in Subsection 6.4.4.2(f).

14.2.12.2.79 QUALIFIED SAFETY PARAMETERS DISPLAY SYSTEM

14.2.12.2.79.1 Objective

Verification that QSPDS is properly installed, responds correctly to external inputs, displays plant safety parameters on plasma display units.

Saturation margin, reactor vessel level, core exit thermocouples and self diagnostics are common to both Channels "A" and "B." Inputs are unique to each channel therefore either channel will operate independent of themselves or PMC.

14.2.12.2.79.2 Prerequisites

A. Construction activities are essentially complete on each system to be tested.

B. Vendor and owner manuals are available and up to date.

C. Test instrumentation is available and calibrated.

D. Plant systems required to support testing are operable, or temporary systems are installed and operable.

14.2.12.2.79.3 Test Method

A. Introduce inputs into system and compare with required displays that they meet accuracy specifications.

B. Verify pages, alarms, calculations, display updates and data links operate per design requirements.

C. Functionally check software program to ensure no errors.

D. Verification that QSPDS and PMC programs are compatible by comparing QSPDS and PMC readouts for selected inputs.

14.2.12.2.79.4 Acceptance Criteria

Qualified Safety Parameter Display System performs as described in document 281-ICE-0505.

14.2.12.2.90 SECONDARY SYSTEM HYDROSTATIC TEST

14.2.12.2.90.1 Objective

To hydrostatically test the secondary side of the steam generators and non-isolable piping.

14.2.12.2.90.2 Prerequisites

A. The steam generators and main steam piping to the main steam isolation valves are filled, vented, and at the required temperature.

B. Reactor Coolant System (RCS) is filled, vented, and at the required temperature.

C. The reactor coolant pumps are operable.

D. Test pump is available.

E. Main steam safety valves are gagged or removed.

F. Test instrumentation is available and calibrated.

G. Permanently installed instrumentation necessary for testing is operable and calibrated.

14.2.12.2.90.3 Test Method

A. Increase RCS pressure to a value that will ensure that the secondary to primary differential pressure does not exceed design value.

B. Perform the test in accordance with the ASME code.

14.2.12.2.90.4 Acceptance Criteria

The Secondary System hydrostatic test meets the requirements of ASME Boiler and Pressure Vessel Code, Section III; (Venting in performing the hydrostatic test was done according to NC-6211-Summer, 1981 Addenda).

14.2.12.2.91 REACTOR COOLANT SYSTEM HYDROSTATIC TEST

14.2.12.2.91.1 Objective

To verify the integrity of the Reactor Coolant System (RCS) pressure boundary and associated Safety Class I piping.

14.2.12.2.91.2 Prerequisites

A. The RCS is filled, vented, and at the required temperature.

B. The reactor coolant pumps are operable.

C. Test pump is available.

D. Primary safety valves are gagged or removed.

E. Permanently installed instrumentation necessary for testing is operable and calibrated.

F. Test instrumentation is available and calibrated.

14.2.12.2.91.3 Test Method

A. Operate reactor coolant pumps to sweep gases from the steam generator tubes.

B. Vent the RCS and all control element drive mechanism housings.

C. Operate the reactor coolant pumps to increase the RCS temperature to that required for pressurization of RCS to test pressure.

D. Perform the test in accordance with the ASME code.

14.2.12.2.91.4 Acceptance Criteria

The RCS hydrostatic test meets the requirements of ASME Boiler and Pressure Vessel Code, Section III; (Venting in performing the hydrostatic test was done according to NC-6211-Summer, 1981 Addenda).

14.2.12.2.92 CONTAINMENT INTEGRATED LEAK RATE TEST

14.2.12.2.92.1 Objective

To demonstrate that the measured leakage from the containment at peak accident pressure is within limits stated in the Technical Specifications.

14.2.12.2.92.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Temporary pressurization equipment is installed and instrumentation is calibrated.

C. Personnel airlock, isolation valves, and containment ventilation system are operable.

D. The containment testing described in Subsection 3.8.2.7 is complete.

E. Local leak rate testing on isolation valves and penetrations as described in Section 6.2 is complete.

F. Test instrumentation is available and calibrated.

14.2.12.2.92.3 Test Method

A. Perform an integrated leak rate test at peak accident conditions as described in Section 6.2.

14.2.12.2.92.4 Acceptance Criteria

The containment leakage does not exceed the plant Technical Specifications limit or that stated in Section 6.2.

14.2.12.2.93 INTEGRATED ENGINEERED SAFETY FEATURES/LOSS OF POWER TEST

14.2.12.2.93.1 Objectives

A. To verify the full operational sequence of the engineered safety features (ESF).

B. To demonstrate electrical redundancy, independence, and load group assignment.

C. To demonstrate proper plant response to partial and full losses of offsite power.

14.2.12.2.93.2 Prerequisites

A. Individual system preoperational tests are complete.

B. Containment spray isolation valves are tagged shut.

C. Permanently installed instrumentation is operable and calibrated.

D. Test instrumentation is available and calibrated.

14.2.12.2.93.3 Test Method

A. Perform partial and full losses of offsite power. Verify the proper response of ESF systems, alternate power sources, uninterruptible power supplies, and instrumentation and control systems.

B. Under loss-of-power conditions, verify operability of systems/ components from energized buses and absence of voltage on deenergized buses. Include ESF systems, appropriate HVAC systems, decay heat removal systems, and systems required under post-accident conditions.

C. Demonstrate the proper diesel generator response to loss of power, including bus energization, load sequencing, and load carrying capability. Verify that full load is within diesel generator design capability.

D. Demonstrate proper response to actual or simulated engineered safety features actuation signals (ESFAS).

14.2.12.2.93.4 Acceptance Criteria

A. The ESFs respond as described in Chapter 6 and in Sections 7.3, 8.3, 9.3, 9.5, and 10.4.

B. Electrical redundancy, independence, and load group assignments are as designed.

C. Plant response to partial and full losses of offsite power is as designed.

D. The diesel generators reenergize loads as designed, and full load is within design capability.

14.2.12.2.94 <u>HOT FUNCTIONAL TESTING</u>

14.2.12.2.94.1 Objective

To verify the proper integrated operation of the plant systems when in simulated or actual operating configurations.*

14.2.12.2.94.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation, to the extent necessary, is operable and calibrated on systems to be tested.

C. Test instrumentation is available and calibrated.

14.2.12.2.94.3 Test Method

Tests will be conducted on the following systems to verify proper system operation and/or to obtain baseline data:

A. Pressurizer level and pressure control

* Portions of some preoperational tests already described may be performed during hot functional testing.

B. Emergency feedwater operation

C. Reactor Coolant System (RCS) leakage

D. Primary and secondary sampling and chemistry

E. Chemical and Volume Control System (CVCS) operation

F. Atmospheric steam dump and steam bypass operation

G. HVAC temperature survey

H. RCS instrumentation intercomparison

I. Main steam isolation valve (MSIV) operation

J. RCS expansion measurements

K. Control element drive mechanism (CEDM) performance

L. Safety injection check valves test

M. Piping expansion measurements and vibration

N. RCS heat loss

0. RCS preliminary flow measurements

P. Component cooling water operation

Q. RCS boration and dilution test

R. Shutdown cooling operation

14.2.12.2.94.4 Acceptance Criteria

The performance of the plant systems tested is in accordance with the design criteria and the applicable section of the FSAR.

14.2.12.2.95 SNUBBER THERMAL MOTION

14.2.12.2.95.1 Objective

To verify that plant snubbers are installed properly, are capable of responding correctly, and are capable of performing to design criteria.

14.2.12.2.95.2 Prerequisites

A pre-service examination will be made on all snubbers listed in Table 3.7-4 of Standard Technical Specifications 3/4.7.9. This examination will be made after snubber installation but not more than six months prior to initial system preoperational testing, and will as a minimum, verify the following:

A. Construction activities on the systems to be tested are complete.

B. There are no visible signs of damage or impaired operability as a result of storage, handling, or installation.

C. The snubber location, orientation, position setting, and configuration (attachments, extensions, etc) are according to design drawings and specifications.

D. Snubbers are not seized, frozen or jammed.

E. Adequate swing clearance is provided to allow snubber movement.

F. If applicable, fluid is to the recommended level and is not leaking from the snubber system.

G. Structural connections such as pins, fasteners, and other connecting hardware such as lock nuts, tabs, wire, cotter pins are installed correctly.

If the period between the initial pre-service examination and initial system preoperational test exceeds six months due to unexpected situations, re-examination of items B, E, and F shall be performed. Snubbers which are installed incorrectly or otherwise fail to meet the above requirements will be repaired or replaced and re-examined in accordance with the above criteria.

14.2.12.2.95.3 Test Method

During preoperational testing, snubber thermal movements for systems whose operating temperature exceeds 250ºF will be verified as follows:

A. During initial system heatup and cooldown, at specified temperature intervals for any system which attains operating temperature, verify the snubber expected thermal movement.

B. For those systems which do not attain operating temperature, verify via observation and/or calculation that the snubber will accommodate the projected thermal movement.

14.2.12.2.95.4 Acceptance Criteria

A. Snubbers demonstrate uninhibited freedom of motion during plant heatup and cooldown.

B. Snubber movement is measured and/or calculated to be within the projected design tolerances.

14.2.12.3 Phase III Testing

Phase III testing begins with initial fuel loading and includes postcore load testing that could not be performed prior to fuel load, initial criticality, low power physics testing, and power ascension tests. All testing will be performed in strict accordance with the Technical Specifications, as modified by special test exceptions. Some portions of preoperational tests, as previously noted, will be performed during Phase III testing. Test descriptions are provided for the expected testing. Each description includes the objectives, special prerequisites, test methods, and acceptance criteria for the testing. The Phase III tests are tabulated in Table 14.2-2 and may be reorganized and expanded as the test program develops.

14.2.12.3.1 CEDM PERFORMANCE

14.2.12.3.1.1 Objectives

A. To demonstrate the proper operation of the control element drive mechanisms (CEDMs).

B. To verify the proper operation of the control element assembly (CEA) position indication systems, group sequencing, interlocks, and alarms.

C. To measure CEA drop times at cold, maximum permissible flow conditions (2 or 3 reactor coolant pumps); and at hot, full-flow conditions.

14.2.12.3.1.2 Prerequisites

A. Construction activities on the systems to be tested are essentially complete.

B. The Control Element Drive Mechanism Control System (CEDMCS) preoperational test is complete.

C. Test instrumentation is available and calibrated.

D. Prerequisites for postcore load testing are met.

E. Reactor Coolant System (RCS) conditions are stable at the desired temperature and pressure for the CEDM testing.

F. The CEDM motor generators are operational.

G. CEDM coil resistances have been measured for the RCS conditions of the test.

H. CEDM cooling system is operating.

I. For portions of this test performed during the initial approach to criticality, all prerequisites for initial criticality are met.

14.2.12.3.1.3 Test Method

A. Withdraw and insert each CEA while recording appropriate position indications, speeds, and alarm functions.

B. Under cold, maximum permissible flow and hot, full-flow conditions, individually measure drop times for each CEA.

C. Perform three additional drop-time measurements for those CEAs that fall outside the two-sigma limit for similar CEAS.

D. Verify proper CEA group sequencing, operation of interlocks, and control functions.

E. Verify, by inspection of CEA position versus time recorder trace, that the dropped CEA decelerates as it approaches the fully inserted position.

F. During the power ascension test program, record CEA drop times for selected plant trips.

14.2.12.3.1.4 Acceptance Criteria

A. The CEDMs and the CEA position indication systems, group sequencing, interlocks and alarms operate in accordance with Subsection 3.9.4, Section 4.6, and the CEDMCS technical manual.

B. CEA drop times are consistent or conservative with respect to the values stated in the safety analysis and as specified in the Technical Specifications.

14.2.12.3.2 REACTOR COOLANT SYSTEM FLOW, FLOW COASTDOWN, AND VERIFICATION OF FLOW-RELATED ALGORITHMS

14.2.12.3.2.1 Objectives

A. To determine as-built Reactor Coolant System (RCS) flow.

B. To verify that the RCS flow coastdown is consistent or conservative with respect to safety analysis.

C. To verify the validity of the flow-related algorithms and constants in the Core Operating Limit Supervisory System (COLSS) and the core protection calculators (CPCs).

D. To establish reference postcore RCS pressure drops.

14.2.12.3.2.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is calibrated and operable.

C. Test instrumentation is available and calibrated.

D. Prerequisites for postcore load testing are met.

E. RCS is operating at nominal hot zero power conditions.

F. Desired reactor coolant pumps are operating.

G. COLSS and CPCs are in operation.

14.2.12.3.2.3 Test Method

A. Operate the specified reactor coolant pump combinations and collect the necessary data to calculate the RCS flow.

B. Trip the appropriate reactor coolant pump(s) and collect flow coastdown rate data.

C. Verify flow-related algorithms by comparison with measured values of flow and/or pump speed.

D. Establish reference postcore RCS pressure drops.

14.2.12.3.2.4 Acceptance Criteria

A. Measured RCS flow is consistent or conservative with respect to the flow rates used in the safety analysis.

B. Measured RCS flow coastdown is consistent or conservative with respect to the coastdown used in the safety analysis.

C. Flow-related algorithms and constants used in the COLSS and the CPCs are verified, and appropriate modifications were made if necessary for on-line flow determination.

D. Reference postcore RCS pressure drops are established.

14.2.12.3.3 INCORE DETECTOR PRECRITICAL MECHANICAL AND ELECTRICAL PERFORMANCE

14.2.12.3.3.1 Objectives

A. To measure the leakage resistance of the fixed incore detectors.

B. To demonstrate the mechanical operation of the Movable Incore Detector System.

14.2.12.3.3.2 Prerequisites

A. Permanently installed instrumentation is calibrated and operable.

B. Prerequisites for postcore load testing are met.

C. The Reactor Coolant System is operating at nominal hot zero power conditions.

D. Installation and preoperational checkout of the incore instrumentation is complete.

14.2.12.3.3.3 Test Method

A. Measure the leakage resistance of each incore detector.

B. Demonstrate proper operation of the Movable Incore Detector System. This demonstration will include indexing and movement to all accessible locations.

14.2.12.3.3.4 Acceptance Critieria

A. Leakage resistance stance of the incore detectors is greater than or equal to 10^7 ohms.

B. The Movable Incore Detector System is capable of properly accessing the various locations within the core.

14.2.12.3.4 PRECRITICAL INTERCOMPARISON OF PLANT PROTECTION SYSTEM, CORE PROTECTION CALCULATOR, AND PLANT COMPUTER INPUTS AND OUTPUTS

14.2.12.3.4.1 Objective

To demonstrate that the inputs and appropriate outputs of the Plant Protection System (PPS), the Core Protection Calculators (CPCs), and the plant computer are in satisfactory agreement with one another.

14.2.12.3.4.2 Prerequisites

A. The plant is operating at the desired conditions.

B. Permanently installed instrumentation is calibrated and operable.

C. Prerequisites for postcore load testing are met.

14.2.12.3.4.3 Test Method

Simultaneous readings of related inputs and appropriate outputs of the PPS, the CPCS, and the plant computer are made and compared with each other.

14.2.12.3.4.4 Acceptance Criteria

Inputs and appropriate outputs of the PPS, CPCS, and the plant computer agree within the combined accuracy of the individual instruments.

14.2.12.3.5 PRESSURIZER SPRAY EFFECTIVENESS

14.2.12.3.5.1 Objectives

A. To establish the proper settings of the continuous spray valves.

B. To measure the rate at which pressurizer pressure can be reduced using pressurizer spray.

14.2.12.3.5.2 Prerequisites

A. The Reactor Coolant System (RCS) is being operated at nominal hot zero power conditions with four reactor coolant pumps operating.

B. Permanently installed instrumentation is calibrated and operable.

C. Prerequisites for postcore load testing are met.

14.2.12.3.5.3 Test Method

A. Adjust the continuous spray valves to provide the desired amount of continuous spray.

B. Reduce RCS pressure using the possible combinations of pressurizer spray valves.

14.2.12.3.5.4 Acceptance Criteria

A. The continuous spray valves are adjusted to provide the desired amount of continuous spray.

B. The ability of the pressurizer spray to reduce pressurizer pressure is consistent with the design requirements.

14.2.12.3.6 REACTOR COOLANT SYSTEM HEAT LOSS

14.2.12.3.6.1 Objective

To measure the Reactor Coolant System (RCS) heat loss at hot zero power conditions. If successfully performed during hot functional testing, this test will not be repeated during postcore load testing.

14.2.12.3.6.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Permanently installed instrumentation is calibrated and operable.

C. Test instrumentation is available and calibrated.

D. Prerequisites for postcore load testing are met.

E. RCS is operating at nominal hot zero power conditions with four reactor coolant pumps operating.

F. The Steam Bypass System (SBS) is in operation.

14.2.12.3.6.3 Test Method

Determine the RCS heat loss by securing feedwater flow to the steam generators and maintaining steady-state RCS conditions by using steam flow to remove excess RCS heat.

14.2.12.3.6.4 Acceptance Criteria

The measured heat loss is less than or equal to the anticipated heat loss or an engineering evaluation finds the results acceptable.

14.2.12.3.10 ISOTHERMAL TEMPERATURE COEFFICIENT

14.2.12.3.10.1 Objective

To measure the isothermal temperature coefficient (ITC) and calculate the moderator temperature coefficient (MTC) for various control element assembly (CEA) configurations and boron concentrations.

14.2.12.3.10.2 Prerequisites

A. The reactivity computer is calibrated and in operation.

B. The reactor is critical at hot zero power conditions, with stable boron concentration.

C. The CEAs are in the desired configuration.

14.2.12.3.10.3 Test Method

Introduce changes in reactor coolant temperature and measure the resultant changes in reactivity. Limit reactivity and power swings, when necessary, by compensating with CEA motion.

14.2.12.3.10.4 Acceptance Criteria

A. The measured ITCs are in satisfactory agreement with the predicted values.

B. The MTCs derived from the measured ITCs are consistent with the Technical Specifications and the safety analysis.

14.2.12.3.11 CRITICAL BORON CONCENTRATION

14.2.12.3.11.1 Objective

To measure the critical boron concentration for various Control Element Assembly (CEA) configurations.

14.2.12.3.11.2 Prerequisites

A. The reactor is critical at hot zero power conditions.

B. The appropriate portion of the regulating and shutdown CEA group worth test is completed. (See Subsection 14.2.12.3.12.)

14.2.12.3.11.3 Test Method

A. The reactor is stabilized in a particular CEA configuration (arrived at as an endpoint of selected plateaus in the regulating and shutdown CEA group worth test).

B. Circulation through the pressurizer and the volume control tank is maximized so as to bring their boron concentration to equilibrium with the Reactor Coolant System.

C. Coolant samples are taken and chemically analyzed for boron content until it is established that an equilibrium steady state is achieved.

14.2.12.3.11.4 Acceptance Criteria

Measured critical boron concentrations are in satisfactory agreement with the predictions.

14.2.12.3.12 SHUTDOWN AND REGULATING CEA GROUP WORTH

14.2.12.3.12.1 Objectives

A. To measure the regulating (including part-length Control Element Assemblies) and the Group B shutdown Control Element Assembly (CEA) group worths at hot zero power.

B. Verify that the CEA insertion limits are adequate to ensure the required shutdown margin.

14.2.12.3.12.2 Prerequisites

A. The reactor is critical at hot zero power conditions.

B. The reactivity computer is calibrated and in operation.

14.2.12.3.12.3 Test Method

A. Initiate boration/dilution and compensate for reactivity changes with small CEA movements.

B. During CEA motion, record changes in reactivity from the reactivity computer to determine CEA group worth for different CEA configurations.

C. Where boration/dilution is not feasible, determine worths by CEA drop and/or by use of alternate CEA configurations.

14.2.12.3.12.4 Acceptance Criteria

A. The measured CEA group worths are in satisfactory agreement with predictions.

B. Evaluation of the measurements verifies that the CEA insertion limits are adequate to ensure shutdown margin.

14.2.12.3.13 INVERSE BORON WORTH

14.2.12.3.13.1 Objective

To measure the inverse boron reactivity worth for various control element assembly (CEA) configurations.

14.2.12.3.13.2 Prerequisites

The reactor is critical at hot zero power conditions.

14.2.12.3.13.3 Test Method

Determine the inverse boron worth by analyzing the change in boron concentration and the change in reactivity from CEA motion associated with the steady-state endpoints measured during the CEA group worth tests.

14.2.12.3.13.4 Acceptance Criteria

The measured boron worths are in satisifactory agreement with predicted values.

14.2.12.3.14 <u>CEA SYMMETRY</u>

14.2.12.3.14.1 Objectives

A. To verify that no core loading or fabrication errors that result in measurable control element assembly (CEA) asymmetries have occurred.

B. To verify proper coupling of each CEA to its drive mechanism.

14.2.12.3.14.2 Prerequisites

A. The reactivity computer is calibrated and in operation.

B. The reactor is critical at hot zero power conditions with the appropriate CEA group partially inserted in manual control.

14.2.12.3.14.3 Test Method

A. The relative reactivity difference of each CEA within each group is measured to determine if any intergroup abnormalities exist.

B. The relative reactivity difference of a CEA from each group is measured by insertion of the CEA, compensated by withdrawal of an inserted CEA, and group movement as necessary.

14.2.12.3.14.4 Acceptance Criteria

A. The reactivities of symmetric CEAs are equal within measurement limitation.

B. All CEAs are demonstrated to be coupled.

14.2.12.3.15 BIOLOGICAL SHIELD SURVEY

14.2.12.3.15.1 Objectives

A. To measure and document radiation levels in accessible locations of the plant outside of the biological shield while at power.

B. To obtain baseline levels for comparison with future measurements of radiation level buildup with operation.

C. To establish adequacy of shielding and to identify high radiation zones as defined in 10CFR20.

14.2.12.3.15.2 Prerequisites

A. Background radiation levels are measured in designated locations prior to initial criticality.

B. Radiation survey instruments are calibrated.

C. Reactor is critical at specified power levels (<15, 50, 100 percent).

14.2.12.3.15.3 Test Method

Measure gamma and neutron dose rates at designated locations during low power and power ascension testing. The initial survey at <15 percent power will be a limited (reduced) survey.

14.2.12.3.15.4 Acceptance Criteria

A. Radiation levels are recorded and are acceptable for full-power operation in accordance with Figures 12.3-1 through 12.3-8 and Subsection 12.3.2.2. Baseline radiation levels have been obtained for comparison with future radiation measurements.

B. Accessible areas and occupancy times are defined for power operation.

14.2.12.3.16 CHEMISTRY

14.2.12.3.16.1 Objectives

A. To maintain proper chemistry for the Reactor Coolant System (RCS) and for the steam generators.

B. To establish necessary sampling frequencies to comply with the Technical Specifications and to provide assurance that chemistry limits are not exceeded.

C. To verify that sampling procedures are adequate.

D. To verify the calibration of the process radiation monitor against an acceptable standard.

E. To monitor any activity buildup in the Reactor Coolant System during fuel loading, initial criticality, and power ascension testing.

F. To establish baseline activity levels for the Reactor Coolant System.

14.2.12.3.16.2 Prerequisites

A. Sampling systems for the RCS, Chemical and Volume Control System (CVCS), and steam generators are operable.

B. Required lab instrumentation and standards are available and calibrated.

C. The plant is stable at the desired conditions. The test will be started at fuel loading and will be continued throughout the postfuel-load test program.

14.2.12.3.16.3 Test Method

A. The RCS and the steam generators will be sampled at specified intervals.

B. Samples will be analyzed by the plant chemistry group.

C. Chemical additions will be made as required by the approved chemistry manual.

D. Reactor Coolant System radioactivity levels from routine analyses will be compared with the process radiation monitor to verify proper operation periodically during initial escalation to full power.

E. Sampling techniques will be verified; and background activity levels will be established by sampling the RCS, starting with fuel loading and continuing throughout power operation, to follow any buildup of activity.

14.2.12.3.16.4 Acceptance Criteria

A. Chemistry of the RCS and the steam generators is maintained within specifications in accordance with FSAR Subsections 9.3.2 and 10.3.5.

B. Appropriateness of established sampling frequencies is demonstrated in accordance with Waterford 3 Chemistry Department procedures.

C. Baseline data for RCS and steam generator chemistry are established.

D. Procedures for sample collection and analysis are verified as acceptable.

E. Baseline activity levels for the RCS are established.

F. Laboratory analyses agree satisfactorily such that process radiation monitors indicate proper response.

14.2.12.3.17 PIPING THERMAL GROWTH, VIBRATION AND SHOCK

14.2.12.3.17.1 Objectives

To demonstrate that the essential Nuclear Steam Supply System (NSSS) and balance of plant components meet acceptable limits for thermal expansion, vibration, and dynamic response in accordance with design parameters during steady-state and transient conditions.*

14.2.12.3.17.2 Prerequisites

A. Construction activities on the systems to be tested are complete.

B. Temporary instrumentation is installed where required.

C. Baseline positions and alignment are recorded.

D. Preservice inspection of the snubbers identified in the Technical Specifications (Section 3/4.7.9) has been completed within 6 months of the start of the individual system preoperational tests.

14.2.12.3.17.3 Test Method

A. Expansion will be monitored during plant heatups, cooldowns, and operation at various power levels.

B. Piping vibration will be monitored during steady-state and transient operation.

C. Demonstrate that the dynamic response during transient operation meets design parameters.

D. On original system heatup and cooldown, verify snubber operability by comparing actual and expected thermal movement at specified temperature intervals. Also verify by observation and/or measurement that adequate swing clearance exists.

E. For systems that do not attain design operating temperature, verify by observation and/or calculation that the snubbers will accommodate the predicted thermal movement.

14.2.12.3.17.4 Acceptance Criteria

A. Sufficient allowance is made to allow for free and unrestricted thermal expansion of essential plant piping, snubbers, and components, and the shock and vibration measurements satisfactorily agree with the stress analysis.

B. The testing and analysis described in Subsection 3.9.2.1 are complete.

* If additional restraints are installed as a result of the preoperational piping test, the NRC will be advised of the change. In addition, any stress analysis required to verify the change will be maintained on file for NRC review.

14.2.12.3.25 NATURAL CIRCULATION*

14.2.12.3.25.1 Objective

A. To provide operator training in natural circulation under various plant conditions as described in the TMI Action Plan Item I.G.l. and clarified in NRC Letter of November 14, 1980.

B. To evaluate natural circulation flow conditions and heat removal capability.

14.2.12.3.25.2 Prerequisites

The reactor is operating so as to provide a satisfactory heat source after a trip. This test is normally performed in conjunction with the 80 percent loss of flow test (see 14.2.12.3.34).

14.2.12.3.25.3 Test Method

A. All reactor coolant pumps are secured simultaneously.

B. The plant is tripped.

C. Reactor Coolant System (RCS) temperatures, pressurizer pressure and level, and steam generator levels and pressures are continuously recorded under the following conditions:

(1) Deenergized pressurizer heaters
(2) Reduced RCS pressure
(3) Isolated secondary side (feedwater and steam) of one steam generator

D. Natural circulation flow is verified by stabilized or gradually decreasing hot leg temperatures.

E. The natural circulation power-to-flow ratio is calculated.

14.2.12.3.25.4 Acceptance Criteria

A. The natural circulation power-to-flow ratio is less than 1.0.

B. Operator training requirements are met.

14.2.12.3.26 VARIABLE TAVG

14.2.12.3.26.1 Objective

To measure the power and isothermal temperature coefficient (ITC) of reactivity at selected power levels.

* Additional natural circulation testing is described in 14.2.12.3.35 and 14.2.12.3.41.

14.2.12.3.26.2 Prerequisites

A. Predicted values for the worth of the CEAs to be used for the variable Tavg test are available at power conditions.

B. Equilibrium xenon and boron conditions are established at the desired power level and CEA configuration.

C. Reactor is at the applicable power level (50 and 100 percent).

14.2.12.3.26.3 Test Method

A. Measure the ITC by changing the core average temperature while maintaining the power essentially constant. Compensate for changes in reactivity by movement of the selected CEAs (50 percent power only).

B. Measure the power coefficient by changing the core power while maintaining the core average temperature essentially constant. Compensate for changes in reactivity by movement of the selected CEAs (50 percent power only).

C. Measure the ITC and the power coefficient by changing the core average temperature while compensation for changes in reactivity by changing the core power (50 percent and 100 percent power levels).

14.2.12.3.26.4 Acceptance Criteria

The measured power and isothermal coefficients are in satisfactory agreement with the predicated values and are conservative with respect to the Technical Specifications.

14.2.12.3.27 <u>STEADY STATE CORE PERFORMANCE</u>

14.2.12.3.27.1 Objective

To document the Reactor Coolant System (RCS) steady-state parameters and incore power distributions as a function of reactor power.

14.2.12.3.27.2 Prerequisites

A. Steady-state conditions exist at the applicable power level (20, 50, 80, and 100 percent) and CEA configuration.

B. Equilibrium xenon and boron conditions exist.

C. The Core Operating Limit Supervisory System (COLSS) and Incore Detector System are in operation.

14.2.12.3.27.3 Test Method

A. Determine the measured core power level and calibrate the nuclear instrumentation.

B. Determine the core power distribution using the incore detectors.

C. Determine the peaking factors from the core power distribution.

D. Determine the departure from nucleate boiling ratio (DNBR) and local power density (LPD) from incore power distribution.

14.2.12.3.27.4 Acceptance Criteria

A. Results of the measurements at each power level indicate that acceptable performance at the next power level can be expected.

B. The agreement between predicted and measured power distributions is satisfactory.

C. The measured peaking factors are in satisfactory agreement with predicted values.

D. COLSS and/or core protection calculator (CPC) calculations of DNBR and LPD are in agreement with predicted values.

14.2.12.3.28 VERIFICATION OF CPC POWER-DISTRIBUTION-RELATED CONSTANTS

14.2.12.3.28.1 Objective

To verify the planar radial peaking factor, shape annealing matrix, boundary point power correlation coefficients, temperature calibration constants, and rod shadowing factor, and to verify the algorithms used in the core protection calculators (CPCs) to relate excore signals to incore power distributions.

14.2.12.3.28.2 Prerequisites

A. The Incore Detector System operates satisfactorily.

B. The safety channels are calibrated and operating satisfactorily.

C. The reactor is critical and at the applicable power level (20 percent, 50 percent).

14.2.12.3.28.3 Test Method

A. Determine the planar radial peaking factor for all rods out and various other control element assembly (CEA) configurations by analysis of incore detector readings. Compare these values with the CPC values (50 percent power only).

B. For various CEA configurations, determine rod shadowing factors from excore detector readings and compare them to the CPC values (50 percent power only).

C. Determine shape annealing matrix and boundary point power correlation coefficients by analysis of incore detector readings during xenon oscillations and compare them to the CPC values.

D. Verify temperature decalibration constants (50 percent power only).

14.2.12.3.28.4 Acceptance Criteria

The measured radial peaking factors determined from incore flux maps are no higher than the corresponding values used in the CPCs. Other CPC power-distribution-related constants, used in the power distribution synthesis, are satisfactorily in agreement with the predicted values.

14.2.12.3.29 TURBINE BYPASS AND ATMOSPHERIC STEAM DUMP VALVE CAPACITY

14.2.12.3.29.1 Objectives

A. To verify that the maximum steam flow capacity of a turbine bypass valve is less than that assumed for the most severe excess heat removal accident as described in Chapter 15.

B. To verify that the maximum steam flow capacity of an atmospheric dump valve is less than that assumed for the most severe excess heat removal accident as described in Chapter 15.

C. To verify that the minimum steam flow capacity of an atmospheric dump valve is sufficient to remove decay heat as described in Subsection 6.3.3.4.

14.2.12.3.29.2 Prerequisites

A. The reactor is critical at approximately 60 percent power.

B. The Steam Bypass Control System (SBCS) is being used to dump steam to the condenser.

14.2.12.3.29.3 Test Method

A. Determine the capacity of each of the turbine bypass valves.

B. Determine the capacity of each of the atmospheric steam dump valves.

14.2.12.3.29.4 Acceptance Criteria

A. The turbine bypass valve capacities are less than the capacities of the valves used in the safety analysis (Chapter 15).

B. The atmospheric steam dump valve capacities are less than the capacities of the valves used in the safety analysis (Chapter 15).

C. The atmospheric steam dump valve capacities are greater than the capacities needed to remove decay heat (Subsection 6.3.3.4).

14.2.12.3.30 AT-POWER INTERCOMPARISON OF PLANT PROTECTION SYSTEM, CORE PROTECTION CALCULATOR, AND PLANT COMPUTER INPUTS AND OUTPUTS

14.2.12.3.30.1 Objective

To demonstrate that the inputs and appropriate outputs of the Plant Protection System (PPS), the core protection calculators (CPCs), and the plant computer are in satisfactory agreement with one another.

14.2.12.3.30.2 Prerequisites

A. The plant is at steady-state conditions at the applicable power level (20, 50, 80, and 100 percent).

B. Permanently installed instrumentation is calibrated and operable.

14.2.12.3.30.3 Test Method

A. Take simultaneous readings of the inputs and appropriate outputs of the PPS, the CPCs, and the plant computer.

B. Evaluate the readings taken.

14.2.12.3.30.4 Acceptance Criteria

The inputs and appropriate outputs of the PPS, CPCs, and the plant computer agree within the combined accuracy of the individual instruments.

14.2.12.3.31 CONTROL SYSTEMS CHECKOUT

14.2.12.3.31.1 Objective

To demonstrate that various control systems operate satisfactorily during steady-state and transient conditions.

14.2.12.3.31.2 Prerequisites

A. The Reactor Regulating System (RRS), Feedwater Control System (FWCS), Steam Bypass Control System (SBCS), Pressurizer Level and Pressure Control System, Hotwell Level Control System, and Boration/Dilution Systems are in operation or are operable.

B. The plant is operating at the applicable power level (50, 80 and 100 percent).

14.2.12.3.31.3 Test Method

A. Monitor control systems' performance during steady-state operation (50 and 80 percent), and following selected plant trips.

B. Monitor control systems' performance during ramp unit load changes (100 percent).

C. Initiate control system transients on selected control systems, and monitor system response (50, 80, and 100 percent).

14.2.12.3.31.4 Acceptance Criteria

A. The control systems maintain reactor power, Reactor Coolant System (RCS) temperature and pressurizer pressure and level within acceptable ranges during both steady-state and transient operation.

B. The control systems maintain the steam generator levels and pressures, turbine-generator load, and hotwell level within acceptable ranges during both steady-state and transient operation.

14.2.12.3.32 VENTILATION CAPABILITY

14.2.12.3.32.1 Objective

To verify that various heating, ventilating, and air conditioning (HVAC) systems for the containment, annulus, and areas housing engineered safety features (ESF) continue to maintain design temperatures.

14.2.12.3.32.2 Prerequisites

The plant is operating at or near the desired power (50 and 100 percent).

14.2.12.3.32.3 Test Method

A. Record temperature readings in specified areas while operating with normal ventilation lineups.

B. Record temperature readings in specified areas while operating the designed minimum number of HVAC components consistent with existing plant conditions.

C. Record temperature readings in specified areas during the loss of offsite power test (14.2.12.3.35).

D. Record surface concrete temperatures adjacent to high-temperature piping penetrations and at selected locations on the concrete shielding (at 100 percent power only).

14.2.12.3.32.4 Acceptance Criteria

A. Temperature conditions are maintained in the containment, annulus, and ESF areas in accordance with Table 9.4-1.

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←(DRN 05-1545, R14-A)

14.2.12.3.33 REMOTE SHUTDOWN AND COOLDOWN*

14.2.12.3.33.1 Objective

To verify the capability to shut down the plant, establish hot standby conditions, and perform a plant cooldown from outside the main control room.

14.2.12.3.33.2 Prerequisites

A. Plant is operating at ≥10 percent generator output. This test is normally performed at the end of the 50 percent power plateau.

B. A standby crew of operators is available in the main control room to assume control in case of emergency.

C. The operating crew of operators consists of the minimum shift complement for the evacuation of the main control room and the reactor trip evolution. Additional personnel who could be made available to the unit prior to the time that cooldown would have to be initiated may be added to the operating crew for the plant cooldown from outside the main control room.

14.2.12.3.33.3 Test Method

A. The operating crew evacuates the main control room and trips the reactor from outside the main control room.

B. The operating crew brings the plant to hot standby and maintains these conditions from outside the main control room for at least 30 minutes.

C. A plant cooldown is initiated from outside the main control room. The cooldown will be continued until shutdown cooling has been established and the ability to cool down the plant from outside the main control room using shutdown cooling has been demonstrated by cooling down approximately an additional 50ºF.

14.2.12.3.33.4 Acceptance Criteria

The capability to bring the plant to hot standby, maintain it in that condition, and manually initiate a plant cooldown from outside the main control room following a reactor trip has been demonstrated.

14.2.12.3.34 TOTAL LOSS OF FLOW

14.2.12.3.34.1 Objective

To verify proper plant response following a total loss of reactor coolant flow.

* Plant cooldown may be delayed until it coincides with a planned maintenance outage.

14.2.12.3.34.2 Prerequisites

A. The plant is operating at or near 80 percent power.

B. The Reactor Regulating System (RRS), Feedwater Control System (FWCS), Steam Bypass Control System (SBCS), and the Pressurizer Level and Pressure Control System are in operation.

C. The natural circulation test (14.2.12.3.25) is normally performed in Conjunction with this test.

14.2.12.3.34.3 Test Method

A. All reactor coolant pumps are secured simultaneously.

B. The plant is tripped.

C. Reactor Coolant System (RCS) temperatures, pressurizer pressure and level, and steam generator levels and pressures are continuously recorded.

14.2.12.3.34.4 Acceptance Criteria

The plant responds safely, and in accordance with the design, during and after the total loss of coolant flow transient.

14.2.12.3.35 <u>LOSS OF OFFSITE POWER*</u>

14.2.12.3.35.1 Objective

To verify that the reactor can be shut down and maintained in hot standby conditions in the event of a loss of offsite power.

14.2.12.3.35.2 Prerequisites

A. The reactor is operating at approximately 20 percent power.

B. The natural circulation test has been performed and the results accepted (14.2.12.3.25).

C. The turbine generator is in normal operation.

14.2.12.3.35.3 Test Method

A. The plant is tripped in a manner which produces a generator trip and a loss of offsite power.

B. The plant is brought to and maintained in hot standby using only engineered safety features (ESF) power for at least 30 minutes.

* Additional natural circulation testing is described in 14.2.12.3.25 and 14.2.12.3.41.

14.2.12.3.35.4 Acceptance Criteria

The ability to shut down and maintain the reactor in hot standby using only ESF power is verified.

14.2.12.3.37 TURBINE TRIP

14.2.12.3.37.1 Objective

To demonstrate that the plant responds and can be controlled as designed following a turbine trip at 100 percent power.

14.2.12.3.37.2 Prerequisites

A. The plant is operating at or near 100 percent power.

B. The Reactor Regulating System (RRS), Feedwater Control System (FWCS), Steam Bypass Control System (SBCS), and the Pressurizer Level and Pressure Control System are in operation

14.2.12.3.37.3 Test Method

A. Manually trip the turbine.

B. Monitor plant behavior continuously during the resultant transient to ensure that the RRS, FWCS, SBCS, and Pressurizer Pressure and Level Control System properly control the plant following a turbine trip.

14.2.12.3.37.4 Acceptance Criteria

The plant control systems and operator actions satisfactorily control a turbine trip at 100 percent power.

14.2.12.3.38 LOSS OF LOAD TRANSIENTS AT 50 PERCENT*, 80 PERCENT* AND 100 PERCENT POWER

14.2.12.3.38.1 Objective

To demonstrate that the Nuclear Steam Supply System (NSSS) and the Control Systems properly respond to a load rejection with the Reactor Power Cutback (RPCS) in operation.

14.2.12.3.38.2 Prerequisites

A. The plant is operating at the applicable power level (50, 80, 100 percent).

* Testing at these power levels is required only if the RPCS is to be declared operational.

B. The Reactor Regulating System (RRS), Feedwater Control System (FWCS), Steam Bypass Control System (SBCS), and the Pressurizer Level and Pressure Control System are in operation.

C. RPCS is in the auto-select/auto-actuate mode.

D. Plant computer is operational.

E. The plant's electrical distribution system is aligned for normal full power operation (plant electrical loads from the unit auxiliary transformer).

14.2.12.3.38.3 Test Method

A. Manually trip the generator main breakers.

B. Monitor RPCS to ensure proper operation.

C. Monitor plant behavior continuously during the resultant transient to assure that the RRS, FWCS, SBCS, Pressurizer Level and Pressure Control System and RPCS properly control the load rejection transient.

14.2.12.3.38.4 Acceptance Criteria

A. Plant Control Systems and operator actions satisfactorily control the load rejection.

B. The transient is in accordance with the computer modeled predictions.

14.2.12.3.39 UNIT LOAD TRANSIENTS

14.2.12.3.39.1 Objective

To demonstrate that plant load changes can be made at the desired rates.

14.2.12.3.39.2 Prerequisites

A. The unit is operating at the desired power level.

B. The Reactor Regulating System (RRS), Feedwater Control System (FWCS), Steam Bypass Control System (SBCS), and the Pressurizer Level and Pressure Control System are in operation.

C. This test may be performed in conjunction with the control systems checkout test (14.2.12.3.31).

14.2.12.3.39.3 Test Method

Perform load reductions and load increases, at specified rates and at selected power levels between 15 and 100 percent of full power, while monitoring selected plant parameters. Both step and ramp changes will be made.

14.2.12.3.39.4 Acceptance Criteria

The plant control systems function to maintain reactor power, Reactor Coolant System (RCS) temperatures, pressurizer pressure and level, and steam generator level and pressures within acceptable ranges during transient operations.

14.2.12.3.40 <u>BASELINE VIBRATION AND LOOSE PARTS MONITORING</u>

14.2.12.3.40.1 Objectives

A. To obtain baseline loose parts and vibration monitoring data for various reactor coolant pump combinations.

B. To obtain vibration and loose parts monitoring and reactor core motion monitoring baseline data at 0, 20, 50, 80, and 100 percent power.

C. To verify, or reestablish if necessary, that the existing loose parts alarm setpoint is acceptable for power operation.

14.2.12.3.40.2 Prerequisites

A. Plant is stable at the applicable power level (0, 20, 50, 80, and 100 percent).

B. Vibration and Loose Part Monitoring System is operational.

14.2.12.3.40.3 Test Method

A. Collect baseline data at the applicable power levels.

B. Collect baseline data with various reactor coolant pump combinations.

14.2.12.3.40.4 Acceptance Criteria

A. Baseline vibration and loose parts data have been collected for various reactor coolant pump combinations.

B. Baseline vibration and loose parts monitoring and reactor core motion monitoring have been collected at 0, 20, 50, 80, and 100 percent power.

14.2.12.3.41 <u>SIMULATED LOSS OF OFFSITE AND ONSITE AC POWER*</u>

14.2.12.3.41.1 Objectives

* This test will be combined into one test procedure with the test outlined in Subsection 14.2.12.3.35 (Loss of Offsite Power). Additional natural circulation testing is described in 14.2.12.3.25 and 14.2.12.3.35.

A. To demonstrate that following a loss of all offsite AC power and a simulated loss of onsite AC power, decay heat can be removed by natural circulation flow in the Reactor Coolant System (RCS) and the steam driven emergency feedwater pump.

B. To provide operator training under a total loss of AC power conditions.

14.2.12.3.41.2 Prerequisites

A. The loss of offsite power test outlined in Subsection 14.2.12.35 is in progress.

B. Plant conditions have been stabilized (hot standby) for at least 30 minutes using only engineered safety features (ESF) power.

14.2.12.3.41.3 Test Method

A. Additional AC loads (such as the motor-driven emergency feedwater pumps) are secured to simulate a loss of onsite AC power sources.

B. The plant is maintained in hot standby using natural circulation flow in the RCS and the steam-driven emergency feedwater pump.

14.2.12.3.41.4 Acceptance Criteria

A. The ability to remove decay heat from the RCS following a loss of onsite and offsite ac power has been demonstrated.

B. Operator training requirements have been met.

14.2.12.3.42 <u>LOSS OF ONE OPERATING FEEDWATER PUMP AT 70 PERCENT AND 100 PERCENT POWER*</u>

14.2.12.3.42.1 Objective

To demonstrate that the Nuclear Steam Supply System (NSSS), the Reactor Power Cutback System (RPCS), and the Feedwater Control System (FWCS) respond as designed to a loss of one of the two operating feed pumps.

14.2.12.3.42.2 Prerequisites

A. The plant is operating at the applicable power level (70 or 100 percent power).

B. The Reactor Regulating System (RRS), Feedwater Control System (FWCS), Pressurizer Level and Pressure Control System and the Turbine Control System are in operation.

C. RPCS is in auto-select/auto-actuate mode.

D. Plant computer is operational.

* Testing required only if the RPCS is to be declared operational.

14.2.12.3.42.3 Test Method

A. Manually trip one of the two operating feed pumps.

B. Monitor plant behavior continuously during the resulting transient to assure that RRS, FWCS, RPCS, the Pressurizer Level and Pressure Control System, and the Turbine Control System properly control the loss of feedwater pump transient.

C. Loss of one feedwater pump test at 100 percent power will be optional based on the results of previous reactor cutback tests.

14.2.12.3.42.4 Acceptance Criteria

A. Plant Control Systems and operator actions satisfactorily control a loss of one operating feedwater pump.

B. The transient was in accordance with computer modeled predictions.

Table 14.2-1 (Sheet 1 of 4)

PHASE II TEST

Subsection	Title
	PREOPERATIONAL TESTS
14.2.12.2.1	ESF 125V DC System
14.2.12.2.2	Plant Electrical Distribution System
14.2.12.2.3	Safety-Related And Nonsafety-Related Inverters
14.2.12.2.4	Communications System
14.2.12.2.5	Lighting System
14.2.12.2.6	Safety-Related Heat Tracing
14.2.12.2.7	Plant Computer
14.2.12.2.8	Seismic Monitoring System
14.2.12.2.9	Airborne And Area Radiation Monitoring System
14.2.12.2.10	Process and Effluent Radiation Monitoring System
14.2.12.2.11	Fire Protection/Detection System
14.2.12.2.12	Compressed Air System
14.2.12.2.13	Nitrogen System
14.2.12.2.14	Circulating Water System
14.2.12.2.15	Turbine Building Closed Cooling Water System
14.2.12.2.16	Component Cooling Water System And Auxiliary Component Cooling Water System
14.2.12.2.17	Emergency Diesel Generators
14.2.12.2.18	RB Polar Crane And FHB Bridge Crane
14.2.12.2.19	Containment Cooling System

Table 14.2-1 (Sheet 2 of 4)

Subsection	Title
14.2.12.2.20	Shield Building Ventilation System
14.2.12.2.21	Annulus Negative Pressure And Vacuum Relief Systems
14.2.12.2.22	Containment Combustible Gas Control Syystem
14.2.12.2.23	Airborne Radioactivity Removal System
14.2.12.2.24	CEDM Cooling System
14.2.12.2.25	Turbine Building Ventilating System
14.2.12.2.26	Cable Vault and Switchgear Area HVAC System
14.2.12.2.27	Control Room Envelope HVAC System
14.2.12.2.28	RAB Normal Ventilation and Containment Purge Systems
14.2.12.2.29	Controlled Ventilation Area System
14.2.12.2.30	Chilled Water System
14.2.12.2.31	RAB Miscellaneous HVAC System
14.2.12.2.32	Fuel Handling Building Ventilating System
14.2.12.2.33	Primary Water Storage System
14.2.12.2.34	Reactor Coolant System Quench Tank Subsystem
14.2.12.2.35	Pressurizer Pressure And Level Control System
14.2.12.2.36	Pressurizer Safety Valve
14.2.12.2.37	Chemical And Volume Control System Charging Subsystem
14.2.12.2.38	Chemical And Volume Control System Letdown Subsystem
14.2.12.2.39	Volume Control Tank Subsystem
14.2.12.2.40	Boronometer

Table 14.2-1 (Sheet 3 of 4)

Subsection	Title
14.2.12.2.41	Chemical And Volume Control System Reactor Coolant Purification Subsystem
14.2.12.2.42	Boric Acid Batching Tank Subsystem
14.2.12.2.43	Boric Acid Makeup and Chemical Feed System
14.2.12.2.44	Process Sampling System
14.2.12.2.45	Waste Management System
14.2.12.2.46	Boron Management System
14.2.12.2.47	Refueling Water System
14.2.12.2.48	Containment Spray System
14.2.12.2.49	High-Pressure Safety Injection System
14.2.12.2.50	Low-Pressure Safety Injection System
14.2.12.2.51	Safety Injection Tank System
14.2.12.2.52	Fuel Handling And Storage System
14.2.12.2.53	Fuel Pool Cooling And Purification System
14.2.12.2.54	Engineered Safety Features Actuation System
14.2.12.2.55	CEDM Control System
14.2.12.2.56	Excore Neutron Flux Monitoring System
14.2.12.2.57	Fixed Incore Detector System
14.2.12.2.58	Movable Incore Detector System
14.2.12.2.59	Plant Protection System
14.2.12.2.60	Reactor Regulating System
14.2.12.2.61	Vibration and Loose Parts Monitoring System
14.2.12.2.62	Reactor Power Cutback System
14.2.12.2.63	Condensate System

Table 14.2-1 (Sheet 4 of 4)

Subsection	Title
14.2.12.2.64	Condensate Storage And Transfer System
14.2.12.2.65	Feedwater Regulating System
14.2.12.2.66	Feedwater System
14.2.12.2.67	Emergency Feedwater System
14.2.12.2.68	Chemical Feed System
14.2.12.2.69	Main Steam System And Steam Generators
14.2.12.2.70	Steam Generator Blowdown System
14.2.12.2.71	Extraction Steam System
14.2.12.2.72	Heater Drains And Vents
14.2.12.2.73	Main Condenser Air Evacuation System
14.2.12.2.74	Feedpump Lube Oil System
14.2.12.2.75	Gland Seal System
14.2.12.2.76	Main Turbine Control System
14.2.12.2.77	Reactor Coolant Gas Venting System
14.2.12.2.78	Main Control Room Emergency Breathing Air
14.2.12.2.79	Qualified Safety Parameters Display System
	INTEGRATED TESTS
14.2.12.2.90	Secondary System Hydrostatic Test
14.2.12.2.91	Reactor Coolant System Hydrostatic Test
14.2.12.2.92	Containment Integrated Leak Rate Test
14.2.12.2.93	Integrated Engineered Safety Features/Loss of Power Test
14.2.12.2.94	Hot Functional Testing
14.2.12.2.95	Snubber Thermal Motion

Table 14.2-2 (Sheet 1 of 2)

PHASE III TESTS

Subsection	Title
	PRECRITICAL
14.2.12.3.1	CEDM Performance
14.2.12.3.2	Reactor Coolant System Flow, Flow Coastdown, and Verification of Flow Related Algorithms
14.2.12.3.3	Incore Detector Precritical Mechanical and Electrical Performance
14.2.12.3.4	Precritical Intercomparison of Plant Protection System, Core Protection Calculator, and Plant Computer Inputs and Outputs
14.2.12.3.5	Pressurizer Spray Effectiveness
14.2.12.3.6	Reactor Coolant System Heat Loss
	LOW POWER TESTS
14.2.12.3.10	Isothermal Temperature Coefficient
14.2.12.3.11	Critical Boron Concentration
14.2.12.3.12	Shutdown and Regulating CEA Group Worth
14.2.12.3.13	Inverse Boron Worth
14.2.12.3.14	CEA Symmetry
	CONTINUING TESTS
14.2.12.3.15	Biological Shield Survey
14.2.12.3.16	Chemistry
14.2.12.3.17	Piping Thermal Growth, Vibration, and Shock
	POWER ASCENSION TESTS
14.2.12.3.25	Natural Circulation
14.2.12.3.26	Variable Tavg
14.2.12.3.27	Steady-State Core Performance

Table 14.2-2 (Sheet 2 of 2)

Subsection	Title
	POWER ASCENSION TESTS (Cont'd)
14.2.12.3.28	Verification of CPC Power-Distribution-Related Constants
14.2.12.3.29	Turbine Bypass and Atmospheric Steam Dump Valve Capacity
14.2.12.3.30	At-Power Intercomparison of Plant Protection System, Core Protection Calculator, and Plant Computer Inputs And Outputs
14.2.12.3.31	Control System Checkout
14.2.12.3.32	Ventilation Capability
14.2.12.3.33	Remote Shutdown and Cooldown
14.2.12.3.34	Total Loss of Flow
14.2.12.3.35	Loss of Offsite Power
14.2.12.3.36	Deleted
14.2.12.3.37	Turbine Trip
14.2.12.3.38	Loss of Load Transients at 50 Percent, 80 Percent, and 100 Percent Power
14.2.12.3.39	Unit Load Transients
14.2.12.3.40	Baseline Vibration And Loose Parts Monitoring
14.2.12.3.41	Simulated Loss of Offsite and Onsite AC Power
14.2.12.3.42	Loss of One Operating Feedwater Pump at 70 Percent and 100 Percent Power

Table 14.2-3 (Sheet 1 of 5)

PHASE II TEST FORMAT

The Phase II test format is designed to provide the operator with a logical sequence of information during the performance of the test.

Note: The Integrated Tests performed prior to fuel load, although classified as Phase II tests, will follow the Phase III test format (Table 14.2-4).

1.0 Test Objective

2.0 References

3.0 Acceptance Criteria

4.0 Test Equipment

4.1 Test Instrumentation
4.2 Other Test Equipment

5.0 Precautions and Notes

6.0 Prerequisites

6.1 Prerequisite Testing
6.2 System Status
6.3 Additional Prerequisites
6.4 Pretest Walkdown
6.5 Release To Perform Testing

7.0 Procedure

7.1 Temporary Modifications
7.2 Initial Conditions
7.3 Test
7.4 Restoration

8.0 Attachments

8.1 Valve Lineup Tables
8.2 Data Tables
8.3 System Deficiency Record
8.4 Temporary Modifications
8.5 Miscellaneous Attachments

TESTING PROCEDURES

1.0 Test Objective

This section states the purpose of the test procedure and defines the specific test objectives to be accomplished.

Table 14.2-3 (Sheet 2 of 5)

2.0 References

This section identifies references used in preparing the procedure. References which describe the test methods, acceptance criteria, and instructions for operating components or systems should be included and organized in categories such as commitment documents, purchase orders, design documents, vendor documents, and miscellaneous references.

3.0 Acceptance Criteria

This section provides the criteria used to determine the success or failure of a test when completed, signifying whether or not the system and its equipment meet the intent of design function. Such acceptance criteria can be either qualitative or quantitative in nature, with acceptable tolerances specified for quantitative criteria.

4.0 Test Equipment

This section specifies any instrumentation and equipment other than permanent plant equipment required for the test. All test equipment M&TE tag numbers will be recorded with verification of calibration and classified as follows:

4.1 Test Instrumentation

This section lists all indicating test equipment and recording equipment such as pressure gauges, tachometers, stroboscopes, stopwatches, flow meters, analog or sequential recorders, and chart recorders, as well as sensors and transducers, signal generators, and special test instrumentation such as dew point testers and gas analyzers.

4.2 Other Test Equipment

This section records components used to modify the system for testing and includes temporary strainers, valves, piping, jumper cables, and test switches.

5.0 Precautions and Notes

This section specifies all applicable precautions that are appropriate to the testing being undertaken, specifying any limiting conditions or parameters that could be exceeded during the operation.

Specific attention should be noted regarding personnel safety, equipment protection precautions, fire hazards, and cleanliness precautions with respect to the test area.

6.0 Prerequisites

This section provides a listing of activities, conditions, systems, and special requirements that must be completed and/or available before the procedure can be released for testing, including but not limited to the following:

6.1 Prerequisite Testing

Phase I tests and inspections of individual components and systems which verify that they have been properly installed and are capable of supporting preoperational testing should be listed in this section. Referencing the prerequisite tests should be sufficient to satisfy the construction test verification requirements.

6.2 System Status

An audit of the system Quality Assurance records is a prerequisite to preoperational testing. This section is used to verify that available system documentation has been reviewed and that the system status is acceptably defined.

6.3 Additional Prerequisites

This section lists those temporary modifications which require much time to install, such as temporary piping.

6.4 Pretest Walkdown

This section is used to record the pretest walkdown to ensure that the system is ready for testing and to identify and evaluate any deficiencies to determine their impact on system testing.

6.5 Release To Perform Testing

The LSE has the option to release all or part of a procedure for testing. This section records a signed statement by the LSE authorizing the commencement of testing, with or without restrictions.

7.0 Procedure

The step-by-step listing of all manipulations required to perform the necessary functions for the conduct of the procedure is specified in this section as follows:

Table 14.2-3 (Sheet 4 of 5)

7.1 Temporary Modifications

This section documents the installation of temporary modifications, needed to modify the system for testing, that is not covered in Subsection 6.3.

List each modification on Attachment 8.4, which provides independent verification columns for installation and removal. Certain modifications to the system may be left installed at the conclusion of testing and transferred to the system deficiency record, Attachment 8.3.

7.2 Initial Conditions

In this section, document the initial conditions required for support systems and for the system being tested.

List the mechanical support systems and subsystems and the electrical support systems and components needed to support testing.

Specify in the system to be tested all initial valve lineups, breaker positions, control switch positions, and other information needed to establish the initial conditions for the system and components.

7.3 Tests

This section details the steps which will accomplish the test objective stated in Section 1.0.

Each test may require steps to establish the initial conditions relating to valve lineups, breaker and control switch positions, desired pressure, temperature, flow, etc.

All data will be recorded on the appropriate tables in Attachment 8.2.

7.4 Restoration

The removal of temporary modifications and alignment of the system in post-test condition is recorded in this section.

Temporary modifications that have not been removed by a step within the procedure will be dispositioned in this section. The valve lineup sheet will be used to specify the post-test condition of the system if it differs from the final valve position.

Table 14.2-3 (Sheet 5 of 5)

8.0 Attachments

Checklists and information necessary for the performance of the procedure are presented in tabular or graphic format as attachments. Typical items to be included are:

8.1 Lineup Tables

Initial breaker positions or the initial valve lineup for all valves except check valves, including process valves mounted on equipment skids, will be specified and documented on the appropriate lineup tables. Restoration of the valves at completion of tests will be documented in the valve lineup tables.

8.2 Data Tables

Data tables may be standard forms or developed especially to meet the requirements of the procedure.

8.3 System Deficiency Record

All deficiencies against the system, from turnover to test completion, will be logged. Temporary modifications that remain open after completion of testing will also become deficiencies.

8.4 Temporary Modifications

Temporary modifications covered by procedural steps in Subsection 7.1 will be logged. Those still outstanding in Subsection 6.3, and those not removed under Subsection 7.4 after completion of testing, will become deficiencies and will be listed on the system deficiency record and will revert to control by SAP-10, Temporary System Modifications.

8.5 Miscellaneous Attachments

All other attachments deemed necessary will be included in this section and will include pump performance curves, marked-up flow diagrams, chronological logs, etc.

Table 14.2-4 (Sheet 1 of 4)

PHASE III TEST FORMAT

The Phase III test format is designed to provide the operator with a logical sequence of information during the performance of the test.

1.0 Objectives

2.0 References

3.0 Acceptance Criteria

4.0 Test Equipment

5.0 Precautions and Notes

5.1 Precautions

5.2 Notes

6.0 Prerequisites

7.0 Procedure

7.1 Initial Conditions

7.2 Tests

7.3 Restoration

8.0 Attachments

8.1 Instruction Tables/Graphs

8.2 Data Tables

8.3 Calculations Sheets

8.4 Miscellaneous Attachments

TESTING PROCEDURES

1.0 Objectives

This section gives a statement of the purpose of the procedure.

Table 14.2-4 (Sheet 2 of 4)

2.0 References

This section identifies references used to develop or perform the procedure as well as any references called out in the body of the procedure. Typical references may include, but are not limited to: FSAR chapter, technical specifications, vendor manuals, flow diagrams, control wiring diagrams, controlling test documents, and operating procedures.

3.0 Acceptance Criteria

This section identifies the acceptance criteria which, if attained during testing, signify that the system and its equipment can meet the intended design functions. Such acceptance criteria can be either qualitative or quantitative in nature, with acceptable tolerances specified for quantitative criteria. The procedure subsection that outlines the steps which verify the acceptance criteria will be listed adjacent to the acceptance criteria. Acceptance criteria should be written so that there is a direct correspondence with the test objectives listed in Section 1.0.

4.0 Test Equipment

This section lists the test instrumentation and equipment, other than permanent plant installations, required for performing the test. For each item listed in Section 4.0, an "MT&E or Serial No." and a "Calibration Verification" column will be included if applicable.

5.0 Precautions And Notes

This section specifies the general precautions to be observed during the test and the general notes and instructions concerning the implementation of the test procedure.

5.1 Precautions

Specific personnel safety and equipment protection precautions will be included here.

5.2 Notes

Notes specifying the extent to which out-of-sequence testing is allowed and conditions or possible consequences pertaining to the performance of a step will be specified here.

Table 14.2-4 (Sheet 3 of 4)

6.0 Prerequisites

This section lists the general requirements pertaining to system readiness for testing. Typical prerequisites would identify support systems that should be in operating or nonoperating condition, required preoperational tests that have been performed, parameters being used for computer trend groups, and so on. This section will also specify that a pretest briefing has been held to ensure that test objectives and methods are properly understood by the individuals conducting the test.

7.0 Procedure

The step-by-step listing of all manipulations required to perform the necessary functions for the conduct of the procedure is specified in this section as follows:

7.1 Initial Conditions

Initial conditions pertain to specific steps undertaken just prior to testing. Typical initial conditions would be quantitative requirements for certain operating parameters (i.e., flow, pressure, temperature, tank level, etc.).

7.2 Tests

The test section details the steps taken to accomplish test objectives and meet acceptance criteria. All data generated will be recorded on attachments to the procedure. The test section includes "note" and "caution" statements just prior to the steps to which they apply.

7.3 Restoration

Normally, restoration of a system is as directed by the controlling document for the test (e.g., SIT-TP-300 for Precore Hot Functional Test, SIT-TP-500 for Postcore Hot Functional). Additional instructions for restoration, such as post-test valve lineup, would be provided here.

8.0 Attachments

This section presents additional information necessary for the performance of the procedure, as follows:

Table 14.2-4 (Sheet 4 of 4)

8.1 Instruction Tables/Graphs

Instruction tables or graphs typically provide parameters for certain operating characteristics of the system. They are not used for recording data.

8.2 Data Tables

Forms for data tables will be developed as required by the procedure. Data tables include signoff and date lines for performance and review.

8.3 Calculation Sheets

These attachments contain the mathematical calculations which may be required by certain test steps. Calculation sheets include signoff and date lines for performance and review.

8.4 Miscellaneous Attachments

These attachments include, as needed, a valve lineup table, jumper log, chronological log, and so on.

Table 14.2-5 (Sheet 1 of 5)

POWER ASCENSION TESTING SEQUENCE

Power		Tests
20% Power Plateau	1)	Biological Shield Effectiveness Survey (14.2.12.3.15)*
	2)	Process Variable Intercomparison (14.2.12.3.30)*
	3)	Chemistry and Radiochemistry (14.2.12.3.19)*
	4)	Baseline Vibration and Loose Parts Monitoring (14.2.12.3.40)*
	5)	Deleted
	6)	Nuclear and Thermal Power Calibration (14.2.12.3.27)
	7)	Core Performance Record (14.2.12.3.27)
	8)	CPC/COLSS Verification (14.2.12.3.28)
	9)	Shape Annealing Matrix (14.2.12.3.28)
	10)	Load Changes (Control Systems Checkout) (14.2.12.3.31)
	11)	Remote Reactor Trip with Subsequent Remote Plant Cooldown (14.2.12.3.33)

Table 14.2-5 (Sheet 2 of 5)

POWER ASCENSION TESTING SEQUENCE

Power		Tests
50% Power Plateau	1)	Process Variable Intercomparison (14.2.12.3.30)*
	2)	Chemistry and Radiochemistry (14.2.12.3.19)*
	3)	Reactor Internals Vibration Monitoring (14.2.12.3.40)*
	4)	Biological Shield Effectiveness Survey (14.2.12.3.18)*
	5)	Ventilation Capability (14.2.12.3.42)*
	6)	Nuclear and Thermal Power Calibration (14.2.12.3.27)
	7)	Core Performance Record (14.2.12.3.27)
	8)	CPC/COLSS Verification (14.2.12.3.27)
	9)	Temperature Decalibration Verification (14.2.12.3.28)
	10)	Shape Annealing Matrix (14.2.12.3.28)
	11)	Radial Peaking Factor Verification (14.2.12.3.28)
	12)	Variable Tavg (14.2.12.3.26)
	13)	Load Changes (Control Systems Checkout) (14.2.12.3.31)
	14)	RPCS 50% Loss of Load (14.2.12.3.39)

Table 14.2-5 (Sheet 3 of 5)

POWER ASCENSION TESTING SEQUENCE

Power		Tests
Pre 80% Power Plateau		
	1)	RPCS 70% Loss of One Operating Feedwater Pump (14.2.12.3.42)
	2)	Atmospheric Steam Dump and Turbine Bypass Valve Capacity Checks (14.2.12.3.29)
80% Power Plateau	1)	Process Variable Intercomparison (14.2.12.3.30)*
	2)	Chemistry and Radiochemistry (14.2.12.3.19)*
	3)	Reactor Internals Vibration Monitoring (14.2.12.3.40)*
	4)	Nuclear and Thermal Power Calibration (14.2.12.3.27)
	5)	Core Performance Record (14.2.12.3.27)
	6)	CPC/COLSS Verification (14.2.12.3.27)
	7)	Load Changes (Control Systems Checkout) (14.2.12.3.31)
	8)	80% Total Loss of Flow/Natural Circulation Test (14.2.12.3.25)
	9)	RPCS 80% Loss of Load (14.2.12.3.38)

Table 14.2-5 (Sheet 4 of 5)

POWER ASCENSION TESTING SEQUENCE

Power		Tests
Post-80% Power Plateau	1)	Loss of Offsite Power Trip (14.2.12.3.35 and .41)
	2)	Load Changes (Control Systems Checkout) (14.2.12.3.31)
	3)	Nuclear and Thermal Power Calibration (14.2.12.3.27)
100% Power Plateau	1)	Process Variable Intercomparison (14.2.12.3.30)*
	2)	Chemistry and Radiochemistry (14.2.12.3.16)*
	3)	Reactor Internals Vibration Monitoring (14.2.12.3.40)*
	4)	Biological Shield Effectiveness Survey (14.2.12.3.15)*
	5)	Ventilation Capability (14.2.12.3.32)*
	6)	Nuclear and Thermal Power Calibration (14.2.12.3.27)*
	7)	Core Performance Record (14.2.12.3.27)
	8)	CPC/COLSS Verification (14.2.12.3.27)
	9)	Variable Tavg (14.2.12.3.26)

* May be conducted at any time during the test plateau. All other tests are expected to be accomplished in the order given.

Table 14.2-5 (Sheet 5 of 5)

POWER ASCENSION TESTING SEQUENCE

Power (Cont'd)	Tests (Cont'd)
	10) Load Changes (Control Systems Checkout) (14.2.12.3.31 and .39)
	11) 100% Turbine Trip - Load Rejection (14.2.12.3.38)
	12) 100% Generator Trip - Load Rejection (14.2.12.3.38)

The table is representative of the actual testing sequence to be performed at Waterford 3. However, based on future startup experience, the testing sequence may be modified to improve and/or optimize testing.