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14.0 INITIAL TEST PROGRAM

The information in this chapter is historical. That is, information originally provided in the Final Safety Analysis Report to meet the requirements of 10 CFR 50.34(b) and was accurate at the time the plant was originally licensed, but is not intended to be updated for the life of the plant.

14.1 SPECIFIC INFORMATION TO BE INCLUDED IN PRELIMINARY SAFETY ANALYSIS REPORTS

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

14.2 PERRY NUCLEAR POWER PLANT TEST PROGRAM

14.2.1 SUMMARY OF TEST PROGRAM AND OBJECTIVES

14.2.1.1 Initial Test Program Summary

The initial test program consists of three phases categorized into initial checkout and run-in, preoperational and startup test phases. Construction verification is performed prior to initial checkout and run-in. The three test phases are:

a. Initial checkout and run-in test phase

   The purpose of the initial checkout and run-in (IC&R) test phase is to conduct various prerequisite checkout activities which are necessary to prepare systems for the preoperational test phase. IC&R testing activities include functional check outs, calibration, initial component operation, motor and pump run-ins, valve operability, final flushing, logic checks, etc. These tests demonstrate that system components are correctly installed and operational.

b. Preoperational test phase

   Preoperational tests are performed prior to fuel loading and after the individual components in a system have been tested. They are conducted on an integrated system or subsystem basis to verify that the systems are capable of operating in a safe and efficient manner compatible with the system design bases.

   During the preoperational test phase, two types of tests are performed. Preoperational tests are performed to demonstrate the ability of nuclear safety-related and selected nonsafety-related systems to meet operational system performance requirements.

Acceptance tests were performed to demonstrate the operational acceptability of selected nonsafety-related systems or equipment as designed, manufactured, and constructed. Since the objectives of both types of tests were similar, the scope, format and testing method were similar for both preoperational and acceptance tests.

Preoperational phase testing was conducted on those systems that:

1. Are relied upon for safe shutdown and cooldown of the reactor under normal plant conditions.

2. Are relied upon for safe shutdown and cooldown of the reactor under transient and postulated accident conditions.

3. Are relied upon for establishing conformance with safety limits or limiting conditions for operation that are included in the facility's technical specifications.

4. Are classified as safety-related systems or are relied upon to support or ensure the operation of safety-related systems within design limits.

5. Are assumed to function, or for which credit is taken, in the accident analysis for the facility.

6. Are used to process, store or limit the release of radioactive material.

Upon completion of the IC&R testing, preoperational tests and acceptance tests for selected nonsafety systems were performed to verify, as nearly as possible, the performance of the systems under existing operating conditions. The program included testing and verification of system operating modes to ensure that initial fuel loading, approach to criticality and subsequent power operations could be performed safely. The preoperational test phase may end at the commencement of fuel loading; however, some system tests were completed after fuel loading. These tests were conducted during the startup test phase. Special tests such as RPV Hydro, ILRT, degraded voltage and cold functionals were performed during the initial test program.

During construction and testing of Perry Unit 1 cleanliness was controlled by administrative procedures in compliance with <Regulatory Guide 1.39> and ANSI Standard N45.2.3. Nuclear Test Section (NTS) or its support organization maintained responsibility for all routine corrective and preventive maintenance after system turnover to NTS, i.e., cleaning of panels, lubricating, etc. This included all routine cleaning to remove dirt, condensed moisture or other foreign objects in electrical components (e.g., relays, switches, breakers). Maintenance activities were performed by Perry Plant Operations Department personnel or others as defined by NTS. Comparable controls will be implemented during construction and testing of Perry Unit 2.

c. Startup test phase

With the exception of a few selected startup tests, which were used to obtain pre-fuel load baseline data, the startup tests were performed beginning with fuel loading and continued through initial criticality, low power testing and power ascension testing. Startup tests ensured fuel loading was accomplished in a safe manner, confirmed the design bases, demonstrated, where practical, that the plant was capable of withstanding anticipated transients and postulated accidents, and ensured that the plant could be safely brought to rated capacity and sustained power operation. The startup test phase concluded with the completion of all applicable testing.

Design features which are installed to prevent or mitigate anticipated transients without scram (ATWS) were included in the test program.

The PNPP Test Program meets the guidelines of <Regulatory Guide 1.68> as discussed in <Section 1.8>.

14.2.1.2 Initial Test Program Objectives

The objectives of the initial test program are delineated below by test phase. To the extent practical, the objectives of the preoperational test phase were to:

a. Verify the adequacy of plant design.

b. Verify that plant construction is in accordance with design.

c. Demonstrate proper system/component response to postulated accidents and malfunctions.

d. Confirm the adequacy of plant operating and emergency procedures.

e. Familiarize the plant operating, technical and maintenance personnel with plant operation.

In addition to a continuation of the above, the objectives of the startup test phase were to:

a. Accomplish a controlled, orderly and safe initial fuel load.

b. Accomplish a controlled, orderly and safe initial criticality.

c. Conduct low power testing sufficient to ensure that design parameters are satisfied, and that safety analysis assumptions are correct or conservative.

d. Perform a controlled, orderly and safe power ascension with requisite testing, terminating at plant rated conditions.

14.2.1.3 Initial Test Program - Testing Criteria

Testing criteria, to verify design specification requirements, have been incorporated into the Test Specifications. Where FSAR test abstracts reference "design specifications," the actual criteria for testing are as specified in the acceptance criteria of the Test Specifications.

14.2.2 ORGANIZATION AND STAFFING

For Perry Unit 1, the Nuclear Test Section (NTS) was responsible for the initial checkout and run-in (IC&R) test phase and the preoperational test phase whereas the Perry Plant Technical Department was responsible for the startup test phase. NTS was a composite organization made up of CEI personnel from the Perry Plant Operations Department, other departments within CEI, and consultant personnel. NTS had the authority necessary to test the Perry Nuclear Power Plant during its phases of responsibility. NTS Test Personnel were certified to the appropriate level of ANSI N45.2.6 and qualified to ANSI N18.1 as required.

The Manager, Perry Plant Operations Department was responsible for completion of the Perry Unit 1 Initial Checkout and Run-In and Preoperational test phases and reported to the Vice-President, Nuclear Operations Division. The Nuclear Test Section (NTS) was supervised by the General Supervising Engineer, NTS who directed, controlled and coordinated the activities of five elements: Mechanical Test, Administration, Instrument and Control Test, Turnover, and Electrical Test. Each element was supervised by an Element Supervisor/Lead who directed the activities of the units within the element. The specific units were supervised by Lead Test Engineers or Unit Supervisors as determined by element needs. The GSE, NTS reported to the Manager, Perry Plant Operations Department. <Figure 14.2-2> illustrates the Nuclear Test Section Organization.

The Manager, Perry Plant Technical Department was responsible for the Perry Unit 1 Startup Test Program beginning at fuel load and continuing through the startup test phase. The Plant Operations Manager or Plant Technical Manager accepted systems from NTS after the preoperational or acceptance test results were reviewed and evaluated.

The Plant Operations Review Committee, described in <Section 13.4.1>, was organized to assist the Plant Operations/Technical Department Managers in reviewing startup tests, procedures, results and reports, and evaluating plant operating conditions. This committee began functioning prior to fuel loading, and continues during commercial operation of the plant.

The Perry Plant Operations/Technical Department supervisors were responsible for assigning plant personnel to assist NTS in performing IC&R and preoperational tests, providing technical expertise to review NTS test procedures and results as required, and to perform the Startup test phase of the Initial Test Program. The Operations Section personnel staffed the control room for preoperational tests and kept the NTS personnel informed of their operational decisions and requirements.

The plant Chemistry staff and the Radiation Protection Section were responsible for performing chemical, radio-chemical and radiation protection activities required to support testing. Specialized training required for site testing personnel in radiation protection, emergency plans and security was conducted by the Perry Plant Training Section.

The Startup Test Element had the responsibility and authority to conduct all startup testing for PNPP Unit 1 and Unit 2. The Startup Test Element was a functional organization within the Perry Plant Technical Department and was directed by the Startup Test Program Director. The

Startup Test Element was a composite organization made up of CEI and consultant personnel. The GE Site Operations Manager provided advice, assistance and consultation. The Startup Test Organization is shown in <Figure 14.2-3>. The number of Test Coordinators, Test Directors and Test Engineers varied to support testing requirements.

All members of the Startup Test Element qualified as Test Directors or Test Engineers met the requirements of ANSI N18.1-1971 as endorsed by <Regulatory Guide 1.8>. In addition, personnel involved in pipe vibration testing, as specified in plant administrative procedures, met the requirements of ANSI N45.2.6-1978.

14.2.2.1 Manager, Perry Plant Operations Department

The Manager, Perry Plant Operations Department reported to the Vice-President, Nuclear Operations Division as the final responsible authority for the NTS Test Program. He was primarily concerned with the program schedules, cost administration and budget, NTS staffing and the overall development and conduct of a satisfactory program. In the performance of his duties, he considered the suggestions of advisory groups such as the Test Program Review Committee (TPRC) of which he was the Chairman. NTS, through the GSE-NTS, reported to the Manager, Perry Plant Operations Department.

14.2.2.2 General Supervising Engineer, Nuclear Test Section (GSE, NTS)

The General Supervising Engineer, NTS was in charge of NTS and reported to the Perry Plant Operations Manager. The GSE, NTS or his alternate or designee was directly responsible for IC&R and preoperational test activities for the Perry Nuclear Power Plant. The GSE, NTS ensured that the objectives of the test program for which he was responsible were achieved with maximum assurance of safety and reliability. The GSE, NTS ensured that: the Test Program was implemented, manpower support within

NTS was coordinated, system turnovers from Nuclear Construction Administration Section (NCAS) to NTS and NTS to Perry Plant Operations Departments were completed, preoperational test procedures and results were reviewed and approved, the overall Test Schedule up to Unit 1 fuel load was generated and maintained, and guidance for resolving discrepancies and deficiencies that arose during the IC&R and preoperational test phases was provided. The GSE, NTS served as vice-chairman of the Test Program Review Committee.

14.2.2.3 General Electric Site Operations Manager

The General Electric Site Operations Manager (SOM) reported to the Manager, Perry Plant Operations Department during the IC&R and preoperational test phases of PNPP Unit 1 and reported to the Startup Test Program Director during the startup test phase. The SOM was responsible for advising and assisting in the administration and conduct of NSSS testing.

The General Electric Site Operations Manager had the following specific responsibilities:

a. Provided liaison with The General Electric Company on testing matters involving General Electric supplied equipment.

b. Reviewed preoperational and startup tests that related to General Electric NSSS systems.

c. Advised the Manager, Perry Plant Operations Department in all matters relating to the preoperational testing phases and advised the Startup Test Program Director in all matters relating to the startup testing phase.

d. Assisted and advised in data reduction, interpretation and analysis of NSSS preoperational and startup tests.

e. Provided administrative support to General Electric site personnel involved in testing and operation of General Electric supplied systems.

f. Served as a member of the Test Program Review Committee.

g. Performed other duties as assigned by the Manager, Perry Plant Operations Department or the Manager, Perry Plant Technical Department.

14.2.2.4 Test Program Review Committee (TPRC)

The Test Program Review Committee was a technical committee consisting of NTS and other support organization personnel. The TPRC was responsible for review and approval of Test Program procedures and activities which affected Preoperational Tests; releasing Preoperational Tests for performance, and review of Preoperational Test results.

The TPRC consisted of the following:

• Perry Plant Operations Department Manager -	Chairman
• General Supervising Engineer - Nuclear Test Section	Vice-Chairman
• Supervisor - Systems Engineering Response Team	Member
• General Supervising Engineer - Technical Section (Perry Plant Technical Department)	Member
• General Supervising Engineer - Operational Quality Assurance	Member (Non-Voting)

• Element Supervisor - Administrative Designee	Member/ Secretary (Non-Voting)
• GE - Site Operations Manager	Member
• Licensing Representative	Member (Non-Voting)

TPRC Voting Members were qualified to the requirements of ANSI N18.1-1971.

The TPRC Chairman and other members of the TPRC directed participation in TPRC meetings of other test personnel as required.

The Test Program Review Committee had the following functions and responsibilities:

- Reviewed and approved test procedures, procedure changes and revisions, and test results for preoperational tests and associated Initial Check-Out and Run-In Tests, where required.
- Reviewed system classifications and approved level of testing required (preoperational or acceptance).
- Reviewed the disposition of preoperational test exceptions.
- Released preoperational tests for performance.
- Assisted in resolving discrepancies and deficiencies that may have arisen during the test program.

When a system was accepted by the Perry Plant Staff, the GSE, NTS, and TPRC were relieved of responsibility for that system. Control was then administered by the Perry Plant Staff using their administrative procedures and controls.

14.2.2.5 NTS Staff

The NTS Staff consisted of the Element Supervisors and the Test Coordinators. They reported directly to the GSE, NTS and were responsible for implementation of the test program as directed by the GSE, NTS. They are described as follows:

14.2.2.5.1 Element Supervisor, Electrical Test Element

The Element Supervisor, Electrical Test Element planned, directed and controlled the electrical and initial check-out and run-in testing on all PNPP systems.

He also planned, directed and controlled acceptance and preoperational testing of PNPP Electrical systems.

14.2.2.5.2 Lead Support Test Engineer, Instrumentation and Control

The Lead Support Test Engineer/Lead System Test Engineer, Instrumentation and Control planned, directed and controlled the instrumentation and control on all PNPP systems. He also planned, directed and controlled acceptance and preoperational testing of PNPP Instrumentation and Control systems.

14.2.2.5.3 Element Supervisor, Mechanical Test

The Element Supervisor, Mechanical Test coordinated the overall PNPP system testing effort. He planned, directed and controlled the mechanical initial checkout and run-in, acceptance and preoperational testing of PNPP Balance of Plant, and the Nuclear Steam Supply Systems.

14.2.2.5.4 Element Supervisor, Administrative

The Element Supervisor, Administrative was responsible for the overall administrative effort required to support the NTS preoperational testing phase program. This included coordination of the NTS training and certification program, supervision of NTS support efforts in the areas of compliance programs, NTS records control and the preoperational/acceptance test procedures technical review. He also served as the TPRC Secretary (non-voting). He was supported in these efforts by the Unit Supervisor Procedures, the Unit Supervisor Programs, the Unit Supervisor Administrative Support, the Unit Supervisor Compliance, the Unit Supervisor Work Coordination, and the Unit Lead, Performance Evaluation Team.

14.2.2.5.5 Element Supervisor, Turnover

The Element Supervisor, Turnover was responsible for coordinating the NTS release for test and test completion process. In addition, responsibilities included supervision of the turnover process from construction to NTS and from NTS to the Perry Plant Staff.

14.2.2.5.6 Shift Test Directors

The Shift Test Directors were responsible for assisting Shift Supervisors in coordinating test and operations activities and functioned as an interface between the STES/planners and Shift Supervisors.

14.2.2.5.7 Test Coordinator

The Test Coordinator coordinated and expedited inter-system activities as required by the test program. He provided direction to control room personnel as necessary to support NTS testing.

14.2.2.6 <u>Lead Test Engineers/Lead Engineers/Unit Supervisors</u>

The Lead Test Engineers, Lead Engineers and Unit Supervisors reported to the respective staff level element supervisors. They provided direction to various personnel in conducting the test program. They are described as follows:

14.2.2.6.1 Lead Test Engineer, NSSS Unit

The Lead Test Engineer, NSSS Unit was responsible for supervising the activities of the System Test Engineers assigned to NSSS Systems. He was the General Electric Site Operations Superintendent.

He was responsible for preparation and review of NSSS test procedures and test results evaluation. He developed schedules and priorities for the Test Engineers and assisted them with test deficiency resolution.

14.2.2.6.2 Lead Test Engineer, BOP Unit

The Lead Test Engineer, BOP Unit was responsible for supervising the activities of the System Test Engineers assigned to certain Balance of Plant systems.

His duties for BOP systems were similar to those of the Lead Test Engineer, NSSS Unit. In addition, he was responsible for administration and tracking of mechanical IC&R testing and flushing programs.

14.2.2.6.3 Lead Test Engineer, Electrical Test Element

The Lead Test Engineer, Electrical Test Element was responsible for supervising the activities of Test Support Engineers/Leaders, System Test Engineers, Test Support Technicians, and craft personnel. His system duties were similar to those described for the Lead Test Engineer NSSS Unit.

14.2.2.6.4 Lead Support Test Engineer, Instrument and Control (I&C)

The Lead Instrument & Control Test Engineer was responsible for supervising the activities of the Test Support Engineers, Test Support Leaders, Test Support Technicians, and craft personnel. His system duties were similar to those described for the Lead NSSS Test Engineer.

14.2.2.6.5 Lead Systems Engineer, I&C

The Lead Systems Engineer, I&C was responsible for supervising the activities of the System Test Engineers in I&C. He was responsible for preparation and review of I&C systems test procedures and test results evaluation. He set priorities for the System Test Engineers and assisted them with test deficiency resolution.

14.2.2.6.6 Lead Engineer Planning/Scheduling

The Lead Engineer Planning/Scheduling was responsible for supervising the activities of the Planning/Scheduling Unit.

The Lead Engineer was responsible for integrated NTS test activity planning and providing information required to support the schedule.

14.2.2.6.7 Lead Test Engineer, HVAC Unit

The Lead Test Engineer, HVAC Unit was responsible for supervising the activities of the System Test Engineers assigned to HVAC systems.

He was responsible for preparation and review of HVAC testing procedures and test results evaluation. He developed schedules and priorities for the System Test Engineer and assisted them with test deficiency resolution.

14.2.2.6.8 Unit Supervisor, Administration (NTS)

The Unit Supervisor, Administration was responsible for document control, licensing interface, training and certification, and records processing.

14.2.2.6.9 Unit Supervisor, Test Specifications/Procedures (NTS)

The Unit Supervisor, Test Specifications/Procedures was responsible for software status tracking for NTS, document processing, coordinating TPRC review of test procedures as applicable and for the technical review of preoperational and acceptance tests prior to approval and review of test results when tests were completed. He was also responsible for coordinating required test specification addenda for issuance.

14.2.2.6.10 Unit Supervisor, Work Coordination

The Unit Supervisor Work Coordination was responsible for work authorization tracking, configuration control, and monitoring the master deficiency list.

14.2.2.6.11 Unit Supervisor, Turnover

The Unit Supervisor, Turnover coordinated the turnover of PNPP systems, subsystems, and components from construction to NTS for preoperational and acceptance testing and then to the Perry Plant Staff.

14.2.2.7 NTS Test Support Leader(s)

Test Support Leaders were responsible for the supervision of Test Support Engineers assigned to their subunit. Test Support Leaders reported to the Lead Test Engineer and sometimes functioned as a Test Support Engineer in addition to Test Support Leader.

14.2.2.8 NTS System Test Engineer

System Test Engineers (STE) were assigned overall responsibility for system testing within NTS. Each STE reported to a Lead Test Engineer.

On assigned systems, the STE followed construction activities, prepared test procedures, prepared system boundary identification, scheduled and planned IC&R testing, conducted preoperational and acceptance testing and evaluated test data.

14.2.2.9 NTS Test Support Engineers

NTS Test Support Engineers prepared and conducted IC&R tests, identified flushing boundaries, prepared and conducted flushing tests, and assisted STEs as needed in conducting tests.

These personnel reported to the Test Support Leaders or the Lead Test Engineers, as applicable.

14.2.2.10 NTS Test Support Technicians

These technicians worked for and performed tasks similar to those of the Test Support Engineers and System Test Engineers.

14.2.2.11 NTS Calibration Support Group

The Calibration Support Group was made up of I&C technicians whose major responsibility was with instrumentation and controls calibration support.

14.2.2.12 Startup Test Program Director

The Startup Test Program Director was responsible for supervision of the Startup Test Element and reported to the Superintendent, Technical Department. The Startup Test Program Director or the alternate or designee, was directly responsible for all Startup Test Program activities for the Perry Nuclear Power Plant. The Startup Test Program Director had complete authority to control the conduct of the Startup Test Program through acceptance and rejection of startup test procedures and results, by establishing and enforcing administrative controls and policies, and through general review and surveillance of Startup Test Program activities.

The Startup Test Program Director was responsible for preparation and approval of the startup test schedule; preparation and review of startup test procedures and results; conduct of startup testing; and, coordination of interfacing organizations in support of the Startup Test Program.

14.2.2.13 Startup Test Element Supervisor

The Startup Test Element Supervisor, under the direction of the Startup Test Program Director was responsible for startup test procedure preparation and for directing and coordinating the activities of the Test Coordinators, Test Directors, Test Engineers, and the GE Startup Test Design and Analysis personnel, for all startup tests.

14.2.2.14 Test Coordinators, Test Directors and Test Engineers

Test Coordinators were responsible for coordinating startup testing with other plant activities. Test Directors, were responsible for individual startup test conduct and coordination and preparation and analysis of startup test results. Test Engineers provided testing support as needed. Unless specified otherwise, only qualified Test Directors or Test Engineers signed off the satisfactory completion of startup test steps. When conduct of specific startup tests required more than one shift for completion, Test Directors were assigned to provide 24-hour shift coverage for these tests. These Test Directors obtained concurrence to conduct all startup tests from the Operations Unit 1 Unit Supervisor and kept the Unit Supervisor informed of the test and component status. Test Coordinators and Test Engineers were assigned “as-needed” to support the Startup Test Element Supervisor or Test Directors.

14.2.2.15 Perry Plant Operations/Technical Department Personnel

The Perry Plant Operations/Technical Departments are responsible for the operations phase of the PNPP and assumed responsibility for operation and maintenance of PNPP systems upon turnover from NTS to PPOD/PPTD. The Manager of the Perry Plant Operations/Technical Departments had the necessary supervision and personnel reporting to them to efficiently execute this responsibility, as discussed in <Chapter 13>.

During the startup testing phase, PPOD/PPTD supervisors were responsible for assigning their section personnel to support the Startup Test Program and providing technical expertise, as required, to review startup test procedures and results.

The Operations Section was responsible for the safe operation of plant systems and handling of radwaste generated during the startup testing phase. Each Test Director coordinated his efforts with the responsible Operations Unit Supervisor. During periods of high test activity, one Test Director normally was assigned Lead Test Director to assist the Test Coordinators in the performance of tests and the coordination of test activities. All system operations in support of the Startup Test Program were performed by Operations Section personnel using approved written procedures.

The Maintenance and I&C Sections were responsible for providing maintenance and repair support for the Startup Test Program to the maximum extent practical.

The Technical Section was responsible for providing technical support and services related to monitoring system performance and reactor technology in support of the Startup Test Program.

The Radiation Protection Section was responsible for all chemical, radiochemical and radiation protection services required to support the Startup Test Program.

Radiation protection, emergency plan and security training were provided to test personnel by the plant staff as required.

14.2.2.16 Plant Operations Review Committee

The Plant Operations Review Committee (PORC) is a Perry Plant Operations/Technical Department committee responsible for review of PNPP safety-related operations phase activities, as described in <Chapter 13>. During the startup test phase, this responsibility included the review of the startup test program, administrative controls contained in the Operations Manual, startup test instructions, startup test results, and startup test reports.

Based on plant system readiness, the PORC recommended approval for fuel load and all major step changes in the Startup Test Program. During the startup test phase, the Startup Test Program Director recommended, based on his concurrence, and submitted applicable startup test documents for formal PORC review.

14.2.2.17 Interfacing Organizations

14.2.2.17.1 Nuclear Construction Department

For Perry Unit 1, the Manager Nuclear Construction Department (NCD) supervised and directed construction and contractor activities including construction verification testing and assured that contractors completed systems in accordance with the integrated project schedule. Reporting to the Manager, NCD, were the GSE, Nuclear Construction Administrative Section, and the GSE, Nuclear Construction Engineering Section.

The Nuclear Construction Administrative Section was responsible for interface activities with the Nuclear Test Section and for completion of work items necessary to support test activities.

The Nuclear Construction Engineering Section was responsible for preparation of field storage maintenance procedures to be used during the test program.

14.2.2.17.2 Nuclear Licensing and Fuel Management Section

The NTS interface with Nuclear Licensing and Fuel Management Section was mainly in the area of coordinating Final Safety Analysis Report (FSAR) Change Requests that became necessary as a result of Preoperational Testing. The NTS informed the System Engineering Response Team of the requested FSAR Deviation. Ultimately, NTS was informed of the disposition of the FSAR Change Requests.

14.2.2.17.3 Gilbert Associates, Incorporated-Technical Support Services (GAI-TSS)

A group of personnel within GAI designated Technical Support Services (TSS) prepared test specifications for BOP systems. TSS also prepared drafts of Preoperational and Acceptance Test Procedures.

14.2.2.17.4 GE Plant Startup and Test Personnel (San Jose)

This group prepared NSSS Test Specifications.

14.2.2.17.5 Systems Engineering Response Team (SERT)

This team consisted of Engineers from CEI, GAI, Kaiser, GE, PPD, and others and was supervised by the Supervisor - Systems Engineering Response Team who reported to the GSE-Nuclear Construction Engineering Section. SERT was responsible to act as the interface with NTS concerning all Preoperational Test Program activities requiring Engineering response or action. In that capacity, SERT communicated with other Engineering elements such as Nuclear Design and Analysis Section, Reliability and Design Assurance, the Onsite Design Team, or GAI Power Engineering Division. The Supervisor, SERT served as a member of the TPRC.

14.2.2.17.6 Perry Plant Startup Test Unit - Electrical Test Section (ETS), Construction and Maintenance Department

Personnel from ETS were assigned to the NTS to perform specific electrical testing activities. This was achieved through the supervision of the ETS representative who received overall program direction from the Lead Test Engineer, Electrical Unit. These personnel were administratively assigned to their parent department throughout the time that they were performing ETS activities for the NTS.

14.2.2.17.7 Nuclear Quality Assurance Department (NQAD)

Under the direction of a Manager, who reported directly to the Vice President Nuclear Group, NQAD had the authority and independence to plan and direct those activities which affected the overall CEI Quality Assurance Program for the Perry Nuclear Power Plant during Unit 1 preoperational testing.

The NQAD organization consisted of the Operational Quality Section, the Construction Quality Section and the Procurement and Administration Quality Section.

The Construction Quality Section (CQS) consisted of the following functional areas of responsibilities: Instrumentation and Controls, Electrical and Mechanical/Civil. The Section reviewed work authorizations, inspected maintenance or modification activity for both PNPP Units, reviewed work procedures and completed documentation.

The Operational Quality Section (OQS) consisted of these functional areas of responsibility: Quality Audit; Operational Support and Program; and Nondestructive Examination. The Section conducted internal quality assurance audits, surveys startup testing and operations, activities and administered nondestructive examination activity.

The Procurement and Administration Quality Section (PAQS) consisted of these functional areas of responsibility: Procurement Quality; and Administration and Records. The Section provided receipt inspection for equipment and material; provided quality assurance coverage of procurement activity, including external audits of suppliers' facilities; administered tracking for nonconformance and deficiency reports; and coordinated department administrative activities.

14.2.3 TEST PROCEDURES

Administrative Procedures for completing the Preoperational Test Phase were contained in the Test Program Manual. The Test Program Manual established the methods for preparing, reviewing and controlling IC&R test procedures, preoperational test procedures, acceptance test procedures, and test administrative procedures.

14.2.3.1 Test Procedure Preparation

The Test Program Manual specified test procedure format and preparation methods. Generally, the format for preoperational and acceptance test procedures was as follows:

Section	Title
1.0	Objectives
2.0	References
3.0	Test Equipment
4.0	Limits and Precautions
5.0	Prerequisites
6.0	Test Procedure
7.0	Acceptance Criteria
8.0	Attachments--(Lineup Lists, Data Sheets, Figures and Drawings)

Test procedures were prepared using information and requirements contained in documents such as USNRC Regulatory Guides, General Electric test specifications, Gilbert Associates' design and test specifications, FSAR, technical manuals and applicable codes and standards. Final approval of the offsite generated documents was made onsite. Test specifications were used as the primary source for preparing the system test procedures.

Prior to release for test, preoperational and acceptance test procedures were reviewed and updated by system test engineers responsible for the test. These test procedures were revised as necessary using the latest design information available to complete the requirements of each section of the procedure.

The PNPP Operations Manual specifies startup test instruction format and preparation methods. Generally, the format for startup test procedures was as follows:

Section	Title
1.0	Purpose
2.0	Description
3.0	Acceptance Criteria
4.0	References
5.0	Precautions
6.0	Prerequisites and Initial Conditions
7.0	Test Equipment and Temporary Installation Instructions
8.0	Test Instructions and Analysis
9.0	Supporting Information
10.0	Attachments

Startup test instructions were the responsibility of the Startup Test Element Supervisor and were prepared by the Test Directors, Test Engineers, Plant Staff, GE, or other consultant personnel using the latest design performance information available in project drawings, vendor manuals, design criteria, test specifications, and the FSAR.

14.2.3.2 Test Procedure Review, Acceptance and Approval

Preoperational test procedures were reviewed and approved by the Test Program Review Committee (TPRC). The NTS-GSE approved all acceptance test procedures for issuance and use. The Test Program Manual specified the review/approval cycle for each type of test procedure.

The Test Program Manual and PNPP Operations Manual defined the controls for changing test procedures, documenting test changes, controlling the use of test changes and establishing the methods of test revision.

The review and approval process for startup test instructions originated with the responsible Startup Test Element Supervisor who forwarded them to reviewers within the Startup Test Element. Once comments were resolved, the Startup Test Program Director, recommended the instruction as ready for PORC review. The GE Site Operations Manager reviewed NSSS tests at this time also. Startup test instructions cycled through this process until PORC recommended approval to the Plant Operations/Technical Managers who provided final approval.

14.2.4 CONDUCT OF TEST PROGRAM

The PNPP Unit 1 test program was conducted using approved written test procedures. The administrative controls governing the conduct of the test program were established in the Test Program Manual and the PNPP Operations Manual.

When a system was acceptable, it was formally turned over to NTS along with its required turnover documentation. A jurisdictional tagging system was used to indicate component and/or system custody during testing.

Throughout the test program, the Lead Test Engineers assigned various tests to test personnel. System test personnel were responsible for planning and conducting the test in accordance with written, approved procedures according to the test schedule. Once the Test Program Review Committee or Plant Operations Review Committee had approved and issued a test procedure for use, system test personnel were responsible for ensuring that all prerequisites were satisfactorily completed and allowable exceptions noted.

An approved test schedule was issued listing testing authorized for performance during a specified time period. In general, the test schedule controlled test sequencing.

The Unit 2 electrical distribution system was completed to the extent required to insure proper operation of the Unit 1 distribution systems.

During Unit 2 testing (while Unit 1 is operating), electrical distribution of both units will be normal down through the Class 1E, 4,160 Vac distribution. Perturbations to the Unit 2 electrical lineup as required to accomplish testing will not affect Unit 1 operations or Unit 1 electrical integrity/redundancy.

For Unit 2, a preoperational test will be performed on those systems that had Unit 1 tests performed on them. Common systems will not be retested during the Unit 2 test program. The following is a list of preoperational tests that will not be repeated for Unit 2:

1.	Fuel Handling and Vessel Servicing Equipment	F11-17
2.	Fuel Pool Cooling and Cleaning system	G41
3.	Liquid Radwaste System	G50
4.	Fuel Handling Area Crane	L51
5.	Emergency Pump Area Cooling	M28
6.	Fuel Handling Building Ventilation System	M40

7. Control Complex Chilled Water System P47

8. Plant Foundation Underdrain System P72

Startup Test Number 36 will not be performed for Unit 2 as it is intended to be performed only on first of a kind GE BWR plants.

PNPP Unit 1 test data was recorded on data forms supplied with the procedure or on specially prepared data forms. Test data sheets and applicable procedural steps were signed off by the System Test Engineer. When the test was completed, the system test engineer evaluated the test data against the acceptance criteria and resolved any discrepancies in accordance with the Test Program Manual.

The Test Program Manual and PNPP Operations Manual defined controls for ensuring that plant modifications and repairs affecting systems which had already been tested were evaluated. These controls included proper review of modifications by appropriate design organizations, verification to ensure modifications or repairs were completed, and retests as necessary to ensure proper operation.

Preoperational or Acceptance test procedure changes were divided into two categories, those changing the acceptance criteria, scope or intent of the procedure and those that did not change the acceptance criteria, scope or intent of the procedure. The TPRC reviewed the changes either before the test changes were implemented for changes which affect the acceptance criteria, scope or intent of the preoperational test procedure, or after the test was completed for those changes which did not affect the acceptance criteria, scope or intent of the preoperational test procedure. Governing administrative procedures clearly defined the methods of making preoperational or acceptance test procedure changes.

Upon completion of a preoperational system test, the system was submitted to the PPOD Operations General Supervisor for review and acceptance. With the completion of the required preoperational testing of PNPP Unit 1, the Plant Operations Review Committee (PORC) recommended to the Plant Operations/Technical Managers that fuel loading and the startup test phase commence. The Plant Operations Review Committee reviewed and recommended approval of the startup test results to the Plant Technical/Operations Managers who approved the test results for each power plateau prior to further power testing.

Beginning with initial fuel loading, changes or revisions to approved startup test procedures required review and approval in accordance with Perry Plant Department administrative procedures and the Technical Specifications. Changes or revisions which did not alter the scope or intent of startup test procedure were made on the spot. The change was approved and signed by two members of plant management, at least one of whom held a senior reactor license on the affected unit. Changes or revisions, which altered the scope or intent of a startup test procedure, required after test initiation necessitated termination of affected parts of the test until review and approval was granted by the responsible organizations which had reviewed and approved the original startup test procedure.

14.2.5 REVIEW, EVALUATION AND APPROVAL OF TEST RESULTS

On completion of a Preoperational or Acceptance test on PNPP Unit 1, the system test engineer reviewed the data for completeness and compatibility with the test acceptance criteria. The test data and results were then submitted to the responsible Lead Test Engineer who reviewed them for accuracy and acceptability and submitted Preoperational test results for review by the Test Program Review Committee, and acceptance test results to the GSE-NTS for review and approval. The Test Program Review Committee reviewed preoperational test results and, if acceptable, approved the results. The acceptance test results review was as determined by the GSE-NTS and as a minimum was subject to the NTS Administrative Unit's technical review prior to approval of results by the GSE-NTS. Preoperational and Acceptance test results were then submitted as part of final system acceptance by the Perry Plant Staff. Each test procedure contained sign-offs for each stage of the review/approval processes.

Selected preoperational test results were reviewed by General Electric. NSSS Startup Test results were reviewed by General Electric.

When the acceptance criteria for a test was not met, the responsible Lead Test Engineer reviewed the results and determined the appropriate course of action in accordance with the Test Program Manual.

Startup test results were reviewed by the Test Director and the Startup Test Element Supervisor or designee and for NSSS tests, the GE Site Operations Manager. This review process was coordinated by the Startup Test Element Supervisor. The Startup Test Program Director forwarded the test results to the PORC for review and recommendation of acceptance, rejection or retesting to the Plant Operations/Technical Managers who provided final approval.

When all test results, required for each set of power test conditions, were satisfactorily reviewed within the Startup Test Organization, the Startup Test Program Director recommended to the PORC, readiness to proceed to the next startup test power plateau or test condition (test conditions as described in <Table 14.2-2> and depicted on <Figure 14.2-4>. PORC reviewed for satisfactory completion of testing and recommended readiness to proceed to the next startup test power plateau or test condition to the Plant Operations/Technical Managers who provided final approval.

Any modifications, maintenance or rework to correct deficiencies or retesting required to further define any test deficiencies or prove satisfactory resolution of deficiencies were performed in accordance with approved procedures and as directed by the PORC and the Plant Operations/Technical Managers.

14.2.6 TEST RECORDS

Preoperational and startup test procedures and component safety-related test documentation, such as completed data forms, instrument calibration data, chart recordings, photographs, etc., are retained by the Perry Records Management System in accordance with approved record retention requirements.

14.2.7 CONFORMANCE OF THE TEST PROGRAM WITH REGULATORY GUIDES

It was the intent of The Cleveland Electric Illuminating Company to conduct the Unit 1 Test Program in accordance with regulatory guides as discussed in <Section 1.8>. This intent will be maintained during the Unit 2 Test Program.

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

The Cleveland Electric Illuminating Company receives and maintains nuclear operating reports (SERs and SOERs) which describe operating and testing problems in other nuclear facilities. The NSSS supplier, General Electric, through its evolutionary BWR product line design and from the information it gathers from operating plants, has factored industry experience into its design and testing programs. The review of operating and testing experiences is accomplished on a continuing basis by reviewing information received by CEI through established channels. This information first receives a review for applicability to the Perry Nuclear Plant. If applicable, the information was assigned to the appropriate responsible section or department for further evaluation and determination of impact on the initial test program.

14.2.9 TRIAL USE OF PLANT OPERATING AND EMERGENCY PROCEDURES

As much as possible throughout the preoperational and startup test phases, test procedures utilized operating, surveillance and emergency procedures where applicable in the performance of tests. The use of these procedures was intended to accomplish the following:

a. Determine whether the specific procedure is correct or illustrate changes which may be required.

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

c. Increase the level of knowledge of plant personnel on the systems being tested.

Test procedures used these operating, surveillance and emergency procedures in several ways: the test procedure may have referenced the procedure directly; the test procedure may have extracted a series of steps from the procedure; the test procedure may have used a combination of the first two methods. The development of the plant procedures is discussed in <Section 13.5>.

14.2.10 INITIAL FUEL LOADING AND INITIAL CRITICALITY

Initial fuel loading was conducted using an approved startup test procedure. The fuel loading prerequisites provided assurances that the progress of the test program and overall condition of the unit was such that fuel could be safely and efficiently loaded to full core size. To the extent practical, cold functional testing on a plant integrated basis was completed and approved. Routine surveillance testing was within the applicable surveillance interval prior to entering an operational condition for which it was required. A startup checklist delineating items that were required to be completed prior to fuel load or initiation of specific steps after fuel load was developed. The checklist included preoperational tests, work requests, engineering change notices, nonconformance reports and retests that were to be completed.

Antimony-Berylium and Californium neutron sources, fuel loading chambers, and intermediate range and source range neutron monitoring instrumentation provided capability for neutron monitoring. Proper fuel assembly installation was verified by visual inspection. Subcriticality checks were performed by rod withdrawal for each just-loaded fuel cell as the core was loaded. A shutdown margin check was performed during fuel loading after 144 bundles were loaded, and again after fuel load was completed. Inverse multiplication plots were maintained during fuel loading. The partially loaded core was, at all times, subcritical by at least 0.38 Δ k/k with the analytically strongest rod withdrawn.

Initial criticality was achieved during the full core shutdown margin test. This test was conducted with the reactor vessel open and with the required intermediate and source range neutron monitoring instrumentation operable in a non-coincidence mode to scram on high neutron level. Criticality was achieved by withdrawing control rods in the withdrawal sequence which contained the analytically highest worth rod.

Initial fuel loading and criticality were performed using procedures developed from General Electric Company supplied test specifications. Core alterations were made with neutron instrumentation response of at least 0.7 counts per second and a signal-to-noise ratio of at least 2.0.

The Operating License, technical specifications and plant operating procedures, supplemented by startup test procedures, governed plant operation to ensure that the plant operated safely and as designed.

14.2.11 TEST PROGRAM SCHEDULE

The Test Program Schedule was a detailed precedence network schedule which used a computerized scheduling program to perform calculations. Information from the Test Program was input into the Integrated Project Schedule such that Construction and Test activities were compatible.

The general sequence showing major Testing Milestones is given in <Figure 14.2-5>. A Test Sequence Document showing detailed testing activity interface was prepared and distributed at the Perry site. This document was available for review at the Perry site during the Unit 1 Test Program.

Preoperational and acceptance testing was scheduled to be complete prior to fuel load. PNPP Unit 1 preoperational and acceptance testing was completed and the results reviewed, evaluated and approved prior to the time that a system, subsystem or component was relied on to maintain the plant in a safe condition, and prior to entering an operating condition for which a system, subsystem or component was required to be operable. For tests deferred until after fuel load, the following information and justification was provided to the NRC: (1) a list of all tests or portions of tests involved; (2) technical justification for these portions; and (3) a schedule for completion of each test.

Preoperational or acceptance tests that were completed or partially completed after fuel load were subject to the operations phase administrative controls except that the procedure did not need to be revised to accommodate any format requirements.

Perry Unit 1 completed the Initial Test Program in November 1987. Changes made were in accordance with <10 CFR 50.59> and were reported to the NRC in accordance with <10 CFR 50.59(b)> within one month.

14.2.12 INDIVIDUAL TEST DESCRIPTIONS

14.2.12.1 Preoperational Test Procedures

The following general descriptions are the objectives of each preoperational test. During the final construction phase, it was necessary to modify the preoperational test methods as operating and preoperational test procedures were developed. Consequently, methods described in the following descriptions are general, not specific.

General acceptance criteria for each preoperational test were in accordance with the design and performance requirements for equipment in those systems. The tests demonstrated the functional adequacy of the installed equipment and systems.

Testing of ECCS systems did not include operation at pump runout conditions as recommended by <Regulatory Guide 1.68>, Appendix A.1.h.(1)(c) because all ECCS operations are known to be within the capabilities of the pumps based on the system design, which prevents the pumps from being subjected to the runout condition.

Initial checkout and run-in test results were referenced in the preoperational test procedure to satisfy test specification and acceptance criteria requirements.

The following is a list of systems on which preoperational tests were performed. Test descriptions (abstracts) are provided in the indicated sections.

Master Parts List (MPL)	System Name	Reference
B21	Nuclear Boiler System	<Section 14.2.12.1.1>
B33	Reactor Recirculation System	<Section 14.2.12.1.2>

Master Parts List (MPL)	System Name	Reference
C11	Control Rod Drive System	<Section 14.2.12.1.3>
C34	Feedwater Control System	<Section 14.2.12.1.4>
C41	Standby Liquid Control System	<Section 14.2.12.1.5>
C51	Neutron Monitoring System	<Section 14.2.12.1.6>
C51	Traversing Incore Probe System	<Section 14.2.12.1.7>
C61	Remote Reactor Shutdown System	<Section 14.2.12.1.8>
C71	Reactor Protection System	<Section 14.2.12.1.9>
D17	Plant Process Radiation Monitoring System	<Section 14.2.12.1.10>
D21	Area Radiation Monitoring System	<Section 14.2.12.1.11>
D23	Containment Atmosphere Monitoring System	<Section 14.2.12.1.12>
E12	Residual Heat Removal System	<Section 14.2.12.1.13>
E21	Low Pressure Core Spray System	<Section 14.2.12.1.14>
E22	High Pressure Core Spray System	<Section 14.2.12.1.15>
E31	Leak Detection System	<Section 14.2.12.1.16>
E32	Main Steam Isolation Leakage Control System	<Section 14.2.12.1.17>
E51	Reactor Core Isolation Cooling System	<Section 14.2.12.1.18>
F42	Fuel Transfer Equipment	<Section 14.2.12.1.19>
G33, G36	Reactor Water Cleanup System	<Section 14.2.12.1.20>
G41	Fuel Pool Cooling and Cleaning System	<Section 14.2.12.1.21>
G43	Suppression Pool Makeup System	<Section 14.2.12.1.22>
G50	Liquid Radwaste System	<Section 14.2.12.1.23>
M15	Annulus Exhaust Gas Treatment System	<Section 14.2.12.1.24>
M25, M26	Control Room HVAC and Emergency Recirculation System	<Section 14.2.12.1.25>

Master Parts List (MPL)	System Name	Reference
M43	Diesel Generator Building Ventilation System	<Section 14.2.12.1.26>
N64	Offgas System	<Section 14.2.12.1.27>
P42	Emergency Closed Cooling System	<Section 14.2.12.1.28>
P45	Emergency Service Water System	<Section 14.2.12.1.29>
R42	Class 1E 125-Volt DC System	<Section 14.2.12.1.30>
R43	Standby Diesel Generator System	<Section 14.2.12.1.31>
R76	ECCS Integrated Initiation with Preferred Source of Offsite Power Available and During a Loss of Offsite Power	<Section 14.2.12.1.32>
B13	Reactor Vessel Flow Inducted Vibration Test and Visual Inspection Without Fuel	<Section 14.2.12.1.33>
P72	Plant Foundation Underdrain System	<Section 14.2.12.1.34>
M23,M24	MCC, SWGR and Misc. Area HVAC and Battery Room Exhaust System	<Section 14.2.12.1.35>
M28	Emergency Closed Cooling Pump Area Cooling System	<Section 14.2.12.1.36>
M32	ESW Pumphouse Ventilation System	<Section 14.2.12.1.37>
M36	Offgas Building Exhaust System	<Section 14.2.12.1.38>
M39	ECCS Pump Room Cooling System	<Section 14.2.12.1.39>
M40	Fuel Handling Building Ventilation System	<Section 14.2.12.1.40>
M51	Combustible Gas Control System	<Section 14.2.12.1.41>
P47	Control Complex Chilled Water System	<Section 14.2.12.1.42>
E66	Drywell Structural Integrity	<Section 14.2.12.1.44>
F11-F17	Fuel Handling and Vessel Servicing Equipment	<Section 14.2.12.1.45>

Master Parts List (MPL)	System Name	Reference
M16	Drywell Vacuum Relief System	<Section 14.2.12.1.46>
M17	Containment Vacuum Relief System	<Section 14.2.12.1.47>
P57	Safety-Related Instrument Air System	<Section 14.2.12.1.48>
R22, R23, R24, R25	Emergency AC Power Distribution	<Section 14.2.12.1.49>
C11a	Rod Control and Information System	<Section 14.2.12.1.50>
L51	Reactor Building Polar Crane	<Section 14.2.12.1.51>
L51	Fuel Handling Area Crane	<Section 14.2.12.1.52>
M11	Containment Vessel Cooling System	<Section 14.2.12.1.54>
M13	Drywell Cooling System	<Section 14.2.12.1.55>
P41	Cooling Tower Makeup Isolation System	<Section 14.2.12.1.56>
P49	Emergency Service Water Screen Wash System	<Section 14.2.12.1.57>
G51	Solid Radwaste Disposal System	<Section 14.2.12.1.58>
C22	Redundant Reactivity Control System	<Section 14.2.12.1.59>
D19	Postaccident Radiation Monitoring System	<Section 14.2.12.1.60>
N27B	Feedwater Leakage Control System	<Section 14.2.12.1.61>
P53	Penetration Pressurization System	<Section 14.2.12.1.62>
P87	Postaccident Sampling System	<Section 14.2.12.1.63>
R14A	ATWS Class 1E Uninterruptible Power Supply	<Section 14.2.12.1.64>
R71	Emergency and Essential Lighting System	<Section 14.2.12.1.65>

Master Parts List (MPL)	System Name	Reference
M15, M26, M40	Engineered Safety Features Systems Air Cleaning Units	<Section 14.2.12.1.66>
M99	Plant Environmental Conditions	<Section 14.2.12.1.67>

The Containment Structural Integrity Test is described in <Section 3.8.2.7.1>.

The Containment Integrated Leak Rate Test is described in <Section 6.2.6.1> and <Section 3.8.2.7.2>.

The Local Leak Rate Test is described in <Section 6.2.6.2> and <Section 3.8.2>.

The Drywell Leakage Test is described in <Section 6.2.6.5.1>.

14.2.12.1.1 Nuclear Boiler System Preoperational Test

a. Test Objective

To verify the ability of the Nuclear Boiler System to perform within design specification.

b. Prerequisites

1. Individual component tests are complete and have been approved.

2. Instrument calibration is complete.

3. Instrument air is available.

4. Electrical power is available.

5. Reactor vessel is available to receive water if actual level is to be checked.

6. The reactor coolant system pressure is atmospheric for the ADS valve actuations.

c. Test Procedure

1. Water level instrumentation and system operation are tested using simulated signals and by variations in actual vessel level.

2. Pressure instrumentation is checked and system operation verified using simulated signals.

3. Main steam isolation valves are tested for proper operation. Accumulator capacity is checked. MSIV closure times are measured including delays of initiation logic.

4. Main steam relief valves are tested for proper operation.

5. Nuclear steam supply shutoff system operation is verified, including containment isolation initiation logic for the following signals; RPV Low Level, High Drywell Pressure, MSL Space High Temperature, MSL High Radiation, MSL High Flow, MSL Low Pressure, Reactor Building Vent Exhaust High Radiation, and manual actuation.

6. Automatic depressurization logic functions are verified.

7. Each ADS valve is actuated five times with the associated accumulator charging air isolated.

d. Acceptance Criteria

1. Controls, alarms and computer points perform per design specification.

2. Nuclear steam supply shutoff system performs within design specification, including initiation of containment isolation for the following signals; RPV Low Level, High Drywell Pressure, MSL Space High Temperature, MSL High Radiation, MSL High Flow, MSL Low Pressure, Reactor Building Vent Exhaust High Radiation, and manual actuation.

3. Automatic depressurization logic performs within specification.

4. Main steam isolation valves perform within specification. MSIV valve operating times including delays of initiating logic are within limits of design specifications.

5. Main steam relief valves perform within specification.

6. RPV instrumentation performs in accordance with design specifications.

7. Each ADS accumulator is capable of opening the associated ADS valve five times with the drywell at atmospheric pressure and with the accumulator charging air isolated.

14.2.12.1.2 Reactor Recirculation System Preoperational Test

a. Test Objective

1. To verify proper flow path is established within the recirculation loops.

2. To verify proper operation of system equipment such as Flow Control Valves, pump suction and discharge valves, sensors, alarms, and interlocks.

3. To verify the low speed motor generator sets operate within design specifications.

4. To verify proper jet pump performance.

5. To verify proper operation of the Recirculation Flow Control System. Subsequent operation of the system during the Startup Test Phase will demonstrate that the system will control flow at operating conditions up to and including rated volumetric flow.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Demineralized water is available in the reactor vessel for recirculation.

5. The reactor vessel is available for recirculation of water.

6. Nuclear closed cooling water system is available.

c. Test Procedure

1. Proper operation of the shutoff and flow control valves is verified including the following:

   (a) Valve operating speeds.

   (b) Position indication and interlocks.

   (c) Hydraulic power unit operation.

2. Proper operation of the low speed motor generator sets is verified including the following:

   (a) Starting sequence interlocks, timing and controls.

   (b) Motor generator set protective trips and interlocks.

   (c) Verification of proper motor generator set speed, voltage and current.

3. Flow is established through the recirculation loops by operating the recirculation pumps at high and low speed.

4. Verification of proper jet pump flow and a check of jet pump vibration is made.

5. System controls, logic and annunciators, including all sensors, is checked for correct calibration, indication and function.

6. The Recirculation Flow Control System is verified capable of controlling flow within the plant operating constraints imposed during the preoperational test phase. Final fine

tuning and demonstration of Recirculation Flow Control System capabilities, up to and including full system flow at rated operating temperature and pressure, is conducted during the startup test phase.

d. Acceptance Criteria

1. Controls, annunciators and logic perform within design specification.

2. Motor generator performs within design specification.

3. Jet pumps perform within design specification.

4. Recirculation Flow Control System modulates flow within constraints and limits imposed for preoperational testing.

14.2.12.1.3 Control Rod Drive System (CRD) Preoperational Test

a. Test Objectives

1. To verify the ability of the Control Rod Drive Hydraulic Control System to perform properly.

2. To adjust flow control valves to obtain proper system parameters.

3. To compile initial system performance data to assist in future system evaluation.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration has been completed.

3. Demineralized water is available.

4. Instrument air is available.

5. Nitrogen supply is available.

6. Electrical power is available.

7. Reactor protection system is available.

8. Reactor vessel is available to receive water.

c. Test Procedure

1. The CRD hydraulic system is placed in operation utilizing the flow and pressure control stations.

2. CRD notch control is demonstrated including latching and position indication.

3. Scram testing of control rods at atmosphere is performed.

4. Scram discharge level switches and CRD position indication, alarms and interlocks are functionally tested.

5. The operation of valves from appropriate selector switches, interlocks or trip signals is functionally tested including:

   (a) Scram valves and scram solenoid pilot valves.

   (b) Backup scram pilot valves.

(c) Scram volume dump and vent valves.

(d) Direction control valves, and withdraw and insert controls.

6. Directional control valves are adjusted for proper drive speed.

7. System performance data is gathered to include:

   (a) Cooling water flows.

   (b) Total system flow.

   (c) System pressures.

   (d) Transient response of system during insertion and withdrawal operations and following scrams.

d. Acceptance Criteria

1. Control rod drive water pumps provide adequate flow and discharge pressure.

2. Control rod drive speeds and scram speeds are within preoperational test specifications.

3. Flow and pressure control stations supply water at acceptable flow and pressure to the hydraulic control units.

4. Proper rod response is achieved for all operator rod selection and motion requests.

5. Scram discharge volume capacity and level trips are within specified limits.

6. System alarms operate properly.

14.2.12.1.4 Feedwater Control System Preoperational Test

a. Test Objective

To demonstrate the ability of the Feedwater Control System to perform within design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration has been completed.

3. Electrical power is available.

4. Instrument air is available.

c. Test Procedure

Simulated signals are injected at appropriate points to verify the following:

1. The feedwater control system operates within design specifications in its various modes with normal signals.

2. System response to abnormal signals and transients is within design specifications.

3. System alarms, trips and interlocks perform within design specifications.

d. Acceptance Criteria

1. The feedwater control system performs within design specifications.

14.2.12.1.5 Standby Liquid Control System (SLCS) Preoperational Test

a. Test Objective

To demonstrate that the Standby Liquid Control System performs within design specifications.

b. Prerequisites

1. Individual component tests are completed.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Demineralized water is available.

5. Service air is available.

6. Reactor vessel is available to receive demineralized water.

c. Test Procedure

Demineralized water is used to perform the following tests:

1. System controls, interlocks, indications, and alarms are functionally tested.

2. Performance of the standby liquid control pumps is determined by pumping demineralized water to the test tank.

3. The pumps are operated in the test mode recirculating water to the test tank.

4. Each loop is manually initiated using the keylock switch to fire the explosive valve, start the injection pumps and inject demineralized water to the reactor vessel. The interlock associated with the Reactor Water Cleanup System is functionally tested.

5. Relief valve setpoints are determined.

6. Neutron absorber solution is prepared and the solution volume and concentration determined.

d. Acceptance Criteria

1. Standby liquid control pumps meet acceptable values of flow and discharge pressure.

2. System controls, alarms and interlocks operate properly.

3. Standby liquid control storage tank contains the specified neutron absorber solution volume and concentration.

4. Relief valve maximum accumulation and reset pressures are within specified values.

14.2.12.1.6 Neutron Monitoring System (NMS) Preoperational Test

a. Test Objective

To demonstrate the capability of the source range (SRM), intermediate range (IRM), local power range (LPRM), and average power range (APRM) monitoring systems to perform within the design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Rod control and information subsystem is available.

5. Reactor protection system is available.

6. The under-vessel service platform is aligned and locked to allow for unobstructed operation of SRM and IRM detector drives.

c. Test Procedure

The neutron monitoring system is functionally tested as follows:

1. Each source and intermediate range detector is positioned from its fully inserted position to its fully retracted position to demonstrate the operability of the insert/retract mechanisms.

2. Using simulated input signals, each source and intermediate range detector loop is tested to demonstrate meter indication, trip circuit operation, retract and insert permissives, associated rod block signals, and alarm operation.

3. Each LPRM channel is tested using simulated signals to its tripping, alarm or indicating function.

4. Each APRM channel is tested for its tripping, alarm or indicating function using simulated signals from the LPRM.

5. Simulated recirculation flow signals are utilized to provide the bias for varying the rod block and trip setpoints.

d. Acceptance Criteria

1. Source and intermediate range drive systems are capable of positioning each detector through its full length of travel.

2. Source range and intermediate range neutron flux level and rate circuits indicate properly.

3. Source range and intermediate range trip signals operate properly.

4. Source range and intermediate range selector switch logic and insert/retract permissives operate properly.

5. Source range and intermediate range rod block signals are generated per design.

6. The local power range neutron flux circuits operate properly and are capable of providing signals to the average power range monitor system, the process computer and to the local power range monitor system indicating meters, and auxiliary devices.

7. LPRM and APRM system trip signals operate properly.

8. Average power range power level circuits operate properly.

9. System alarms operate properly.

14.2.12.1.7 Traversing Incore Probe System (TIP) Preoperational Test

a. Test Objective

To demonstrate the capability of the Traversing Incore Probe (TIP) System to meet design requirements.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Instrument air is available.

5. Plant process computer functions for reading TIP inputs and TIP interlocks are available.

c. Test Procedure

The Traversing Incore Probe System is functionally tested as follows:

1. The system is operated in manual, automatic and hand crank modes.

2. Indexer cross-channel interlock and purging operations are conducted.

3. System manual automatic controls and alarms are actuated. The ability to override automatic functions is demonstrated.

d. Acceptance Criteria

1. The automatic and manual modes function in the correct designed sequence.

2. System drive mechanisms, including position indication, and the drive interlocks and time delays operate properly.

3. System channels, indicators and recorders operate properly.

4. The system indexing mechanism and its interlocks operate properly.

14.2.12.1.8 Remote Reactor Shutdown System Preoperational Test

a. Test Objective

1. To demonstrate that Division 1 of the Remote Shutdown System is capable of transferring functional control of selected systems, valves and indication to Division 1 remote shutdown station outside the control room.

2. To demonstrate that Division 2 of the remote shutdown system is capable of functional control of selected systems, valves and indication from Division 2 remote shutdown locations outside the control room.

b. Prerequisites

1. Individual component tests are complete.

2. Electrical power is available.

3. Instrument calibration is complete.

4. The following systems are available:

   (a) Reactor Core Isolation Cooling System

   (b) Residual Heat Removal System

   (c) Emergency Closed Cooling System

   (d) Emergency Service Water

   (e) Nuclear Boiler (safety/relief valves)

(f) Containment Atmospheric Monitoring

(g) Automatic Depressurization System (ADS)

c. Test Procedure

1. Proper operation of instruments, controls, valves, and pumps from the remote shutdown panel is functionally tested.

2. Demonstrate that remote shutdown panel operation takes precedence over control room operation. (Division 1 only)

d. Acceptance Criteria

1. Component control and status indication devices function satisfactorily from the remote shutdown panel.

2. Operation of systems from the remote reactor shutdown panel takes precedence over operation from the control room when the emergency position is selected on the remote shutdown transfer switches. (Division 1 only)

3. Division 2 remote shutdown valves can be positioned open or closed from their respective Division 2 remote control switches.

4. Division 2 remote shutdown control switches are capable of starting and stopping RHR Pump B and ESW Pump B.

5. Control transfer switches for Division 1 or control switches for Division 2 annunciate a control room alarm whenever they are placed out of the normal position.

14.2.12.1.9 Reactor Protection System (RPS) Preoperational Test

a. Test Objective

To verify the ability of the Reactor Protection System to perform within design specification.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Instrument air is available.

c. Test Procedure

1. The ability of the Reactor Protection System motor generator sets to perform within design specification is verified.

2. Proper operation of all system sensors is verified.

3. Proper operation of system logic is verified. This will include testing in all modes to verify interlocks and bypasses.

4. Response timing is conducted on all channels of each trip function as required by the technical specifications. These include the following functions: IRM, APRM, CRD scram discharge volume, MSIV closure, drywell high pressure, reactor vessel high pressure, reactor vessel low level, reactor vessel

high level, MSL high radiation, turbine control valve fast closure, turbine stop valve closure, MSIV closure, and CRD scram discharge.

Sensor response time is the elapsed time delay for the sensor to produce a tripped output state from the time that the process variable reached the trip setpoint value at the sensor input. Most electronic sensors, e.g., neutron monitoring system detectors, main steam line detectors etc., are considered to operate so fast that the response times cannot be measured and consequently the response time of these sensors is considered negligible. However, the electronics the sensors feed do contribute to the response and their response time can be measured.

The sensor trip function is performed and the lapse time measured from the initial trip to various points along the "scram chain." This measured response time is added to an allowance for instrument line delay, as appropriate, for each application.

5. Proper system operation from normal and alternate power supplies is verified.

d. Acceptance Criteria

1. System motor generator sets perform within design specification.

2. System logic and interlock functions are within design specification.

3. System time response is within design specification.

4. System operation from normal and alternate power supplies is acceptable.

14.2.12.1.10 Plant Process Radiation Monitoring System (PPRMS) Preoperational Test

a. Test Objective

To verify the ability of the Plant Process Radiation Monitoring System to perform within the design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Check sources have been installed where appropriate. All radiation monitors are tested using a check source.

4. Electrical power is available.

c. Test Procedure

Proper operation of the following subsystems is demonstrated:

1. Main Steam Line Monitors including local indicators, annunciators, recorders, and reactor protection interface.

2. Containment Ventilation Exhaust Monitors including recorders, annunciators and Nuclear Steam Supply Shutoff System interface.

3. Offgas System Monitors including pretreatment and post-treatment monitors, recorders, annunciators, sample equipment, and tripping functions.

4. Plant Underdrain System Monitors including recorders, annunciators and pump tripping functions.

5. Radwaste Liquid Effluent Monitors including recorders, annunciators, sample equipment, and tripping functions.

6. Emergency Service Water Monitors including recorders, annunciators and sample equipment.

7. Nuclear Closed Cooling Monitors including recorders, annunciators and sample equipment.

d. Acceptance Criteria

1. Process Radiation Monitoring Subsystems perform within the design specifications.

2. Process Radiation Monitor interface with the Reactor Protection System performs within the design specifications.

3. Process Radiation Monitor sample equipment performs within the design specifications.

14.2.12.1.11 Area Radiation Monitoring System (ARMS) Preoperational Test

a. Test Objective

To verify the ability of the Area Radiation Monitoring System to perform within the design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Check sources have been installed where appropriate.

4. Electrical power is available.

c. Test Procedure

1. Proper performance of control room operated channels is demonstrated including local alarms and indication, control room alarms and indication and recorders.

2. Proper performance of locally operated channels is demonstrated including local alarms and readouts.

3. Proper performance of portable units is demonstrated including alarms and indication.

d. Acceptance Criteria

Area Radiation Monitor channels perform within design specifications.

14.2.12.1.12 Containment Atmosphere Monitoring System Preoperational Test

a. Test Objectives

To verify the ability of the Containment Atmosphere Monitoring System to perform within design specification.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

c. Test Procedure

1. Proper operation of the instruments is verified.

2. Indicators, recorders and annunciators are checked for proper operation.

3. Operability of containment isolation valves is verified.

d. Acceptance Criteria

1. Instruments, indications and annunciators perform within design specification.

2. System containment isolation valves perform correctly.

14.2.12.1.13 Residual Heat Removal System (RHR) Preoperational Test

a. Test Objective

To verify the ability of the Residual Heat Removal System to perform within design specifications in various modes of operation.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Demineralized water is available in the suppression pool, the spent fuel pool and the reactor vessel.

5. The reactor vessel is available to receive water.

c. Test Procedures

1. Logic and interlock tests are performed for all modes of operation to verify proper operation. These tests are performed with the pumps locked out and include actuation from each possible source. All associated events are monitored.

2. The residual heat removal pumps are tested to verify their performance is within design specifications. Pump head flow characteristics and NPSH are checked for consistency with design specifications for the various modes of operation.

3. The system is aligned and flow established for each of the following modes or functions:

   (a) Low pressure coolant injection. A simulated automatic initiation signal is used for this test.

   (b) Suppression pool cooling.

   (c) Shutdown cooling.

   (d) Test mode.

   (e) Augmented fuel pool cooling.

4. Flow through the containment spray nozzles is verified by conducting an air-flow test using flow paths which meet or overlap the boundaries of the water-flow test paths to demonstrate that there is no blockage in the flow path.

5. Performance of the water leg pump is verified to be within design specifications.

6. Flow out of all siphon breakers associated with the augmented fuel pool cooling mode is observed.

d. Acceptance Criteria

1. Logic, interlock and alarm functions perform within design specifications.

2. RHR pumps perform within design specifications. The basis for the criteria is to assure that the pump meets the flow requirements of its ESF function as well as pump operability considerations including NPSH requirements.

3. Proper flow is established for the specified modes.

4. The water leg pump performs within design specifications.

5. All siphon breakers associated with the augmented fuel pool cooling mode are unobstructed.

14.2.12.1.14 Low Pressure Core Spray System (LPCS) Preoperational Test

a. Test Objective

To verify that the Low Pressure Core Spray System performs within design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration has been completed.

3. Electrical power is available.

4. Demineralized water is available in the suppression pool.

5. The reactor vessel is available to receive water.

c. Test Procedure

1. Controls, alarms, interlocks, and logic are checked for proper operation in all modes.

2. The low pressure core spray pump is tested to verify performance is within design specification. Pump head flow characteristics and NPSH are checked for consistency with design specifications for the various modes of operation.

3. Flow is satisfactorily established in the following modes:

   (a) Test mode with discharge flow to the suppression pool.

(b) Normal mode with discharge flow to the reactor vessel.

(c) Full flow test mode with suction and discharge to the reactor vessel.

4. Core spray pattern is verified.

5. Performance of the water leg pump is verified to be within design specification.

6. Accident conditions are simulated and times are measured from initiation signal through full injection flow from the suppression chamber or the RPV and with spray into the RPV.

d. Acceptance Criteria

1. Controls, alarms, trips, and logic perform within design specification in the modes tested.

2. System pumps perform within design specification. The basis for the criteria is to assure that the pump meets the flow requirements of its ESF function as well as pump operability considerations including NPSH requirements.

3. Satisfactory flow is established in all modes.

4. Core spray pattern is satisfactory.

5. The water leg pump performs within design specifications.

6. Time limitations are met from initiation signal to full flow conditions, for normal auxiliary power and also for emergency power including diesel generator time for starting and for reaching operating voltage.

14.2.12.1.15 High Pressure Core Spray System (HPCS) Preoperational Test

a. Test Objectives

1. High Pressure Core Spray System (excluding HPCS diesel generator)

   (a) To verify the ability of the High Pressure Core Spray System to perform within design specifications in all modes.

   (b) To verify the proper operation of all controls, interlocks, alarms, and logic (including automatic initiation).

2. High Pressure Core Spray Diesel Generator

   (a) To demonstrate that the HPCS diesel generator is capable of providing reliable electrical power during normal and simulated accident conditions.

   (b) To demonstrate the operability of the HPCS diesel generator auxiliary systems (e.g., starting air, fuel oil, jacket water, lube oil, intake air supply, and exhaust system).

b. Prerequisites

1. High Pressure Core Spray System (excluding HPCS diesel generator)

   (a) Individual component tests are complete.

(b) Instrument calibration has been completed.

(c) Electrical power is available.

(d) The suppression pool and condensate storage tank are filled above the low water level to provide suction to the pump.

(e) The reactor vessel is available to receive water.

2. High Pressure Core Spray Diesel Generator

(a) Individual component tests are complete and have been approved.

(b) Instrumentation is available, calibrated and operable.

(c) Sufficient diesel fuel is available.

(d) Engine liquid levels are sufficient to allow operation, e.g., lubrication oil and jacket water.

(e) The following systems and/or components are available:

(1) Pneumatic sources.

(2) Emergency service water.

(3) Electrical power.

(4) HPCS diesel generator room fire protection.

(5) HPCS diesel generator room ventilation.

(6) HPCS diesel generator auxiliary systems are available.

c. Test Procedure

1. High Pressure Core Spray System (excluding HPCS diesel generator)

(a) Controls, alarms and interlocks are functionally tested.

(b) System operation is conducted in all modes of operation and includes automatic transfer of pump suction from the condensate storage tank to the suppression pool for both modes of initiation (high suppression pool level and low condensate storage tank level).

(c) Pump head flow characteristics and NPSH are checked for consistency and design specifications for the various modes of operation.

(d) System performance is determined.

(e) Simulated signals are used to demonstrate emergency initiation.

(f) The water leg pump is operated to maintain a full HPCS pump discharge line.

2. High Pressure Core Spray Diesel Generator

(a) Manual and automatic operation is performed which includes operation of the auxiliary system.

(b) The largest single load and subsequently all loads are tripped from the HPCS diesel generator.

(c) The required consecutive start and load tests are performed.

(d) Full-load operation of the HPCS diesel generator is performed for at least 24 hours.

(e) The rate of fuel consumption is measured.

(f) Controls, alarms and interlocks are functionally tested.

d. Acceptance Criteria

1. High Pressure Core Spray System (excluding HPCS diesel generator)

(a) System automatic initiation operates properly.

(b) Controls affecting the transfer of the HPCS pump suction water supplies operate properly.

(c) System alarms operate properly.

(d) System flow rates are within design specifications and NPSH is within specified limits for the various modes of operation.

(e) Core spray pattern is acceptable.

(f) Automatic systems function as per design specifications including valve sequencing, cycle times and automatic initiation.

(g) The water leg pump is capable of maintaining a full HPCS pump discharge line.

2. High Pressure Core Spray Diesel Generator

(a) Auxiliary systems operate properly.

(b) HPCS diesel generator is automatically started on a simulated automatic actuation signal and attains required voltage and frequency within an acceptable time period.

(c) Specified speeds and voltages are not exceeded during required load rejections.

(d) HPCS diesel generator operates properly during the 24-hour load tests and temperatures are acceptable. This includes 2 hours at 110 percent of continuous rated load.

(e) HPCS diesel generator maintains the required voltage and frequency during the 24-hour load test and a successful start functional capability test is performed at the completion of the 24-hour load test (within approximately 5 minutes).

(f) HPCS diesel generator successfully completes the consecutive start and load tests.

(g) HPCS diesel generator synchronization and load transfer operate properly. This includes proper operation when tripped from the surveillance test mode.

(h) Electrical interlocks between the HPCS diesel generator and its associated 4.16 kV bus operate properly.

(i) The HPCS diesel generator is capable of being stopped and started manually from local and remote locations.

(j) The rate of fuel consumption is such that the 7 day fuel storage inventory requirement is met.

14.2.12.1.16 Leak Detection System (LDS) Preoperational Test

a. Test Objective

To verify the ability of the Leak Detection System to perform within the design specifications.

b. Prerequisites

1. Individual component tests have been completed.

2. Instrument calibration is complete.

3. Electrical power is available.

c. Test Procedure

1. Simulated inputs are used to verify proper operation of the following areas of leak detection:

(a) Equipment room ambient and differential temperatures.

(b) Valve stem leaks.

(c) Pool liner and bellows seal leakage.

(d) Reactor vessel head flange leakage.

(e) RCIC/RHR steam line leak detection.

(f) Reactor water cleanup leakage.

(g) Drywell and containment radwaste sump instrumentation.

(h) LPCS, RHR and HPCS line breakage detection.

(i) Main steam line breakage.

(j) Drywell air cooler leakage.

2. The operation of indicators, recorders, annunciators, and trips is verified.

3. Logic interfaces with the Nuclear Steam Supply Shutoff System are verified.

d. Acceptance Criteria

1. Leak detection equipment performs within design specification.

2. Logic interfaces with the Nuclear Steam Supply Shutoff System perform within design specification.

14.2.12.1.17 Main Steam Isolation Valve Leakage Control System Preoperational Test

a. Test Objective

To verify that the Main Steam Isolation Valve Leakage Control System performs within the design specifications.

b. Prerequisites

1. Construction is complete.

2. Individual component and instrument calibration is complete.

3. Electrical power and compressed air are available.

4. Main steam lines are drained and are available.

c. Test Procedure

1. The main steam isolation valve leakage control systems valves, blowers, heaters, and controls are operated.

2. Highest volume inboard and all outboard subsystem depressurization times are checked.

3. Inboard and outboard logic interlocks, permissives and timers are tested for proper operation in all modes.

d. Acceptance Criteria

1. Inboard MSIV-LCS heaters operate properly.

2. Inboard and outboard system timers, interlocks, permissives, and logic operate proper.

3. Inboard and outboard blowers meet applicable capacity and vacuum requirements.

4. Inboard and outboard motor-operated valves meet the specified operating times.

14.2.12.1.18 Reactor Core Isolation Cooling System (RCIC) Preoperational Test

a. Test Objective

To verify that the performance of the Reactor Core Isolation Cooling System and the testable check valve hydraulic control system are within design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Demineralized water is available in the condensate storage tank and suppression pool.

5. Auxiliary steam is available to the RCIC turbine.

6. The reactor vessel is available to receive water.

c. Test Procedure

1. Controls, alarms, trips, and interlocks are checked for proper operation.

2. Operate the reactor core isolation cooling pump and turbine and evaluate pump head and flow characteristics.

3. Flow is established on the following modes:

    (a) Suction lined up to the condensate storage tank with flow to the reactor vessel.

    (b) Suction lined up to the suppression pool with flow to the reactor vessel.

    (c) Test mode with suction from the condensate storage tank and flow back to the condensate storage tank.

4. Operate the water leg pump and evaluate the capability of the pump to fill the system.

5. Establish RCIC system operation without the aid of ac power with the exception of the RCIC dc/ac inverters.

6. Evaluate the limits of system operation with extended loss of ac power and support systems with the exception of the RCIC dc/ac inverters.

7. Exercise the testable feature of the ECCS testable check valves.

d. Acceptance Criteria

1. System controls, alarms, trips, and interlocks function properly.

2. System pumps head and flow requirements are met.

3. System flow is established satisfactorily in all modes.

4. The water leg pump adequately fills the RCIC system.

5. System startup to rated flow satisfactory without the aid of ac power with the exception of RCIC dc/ac inverters.

6. The testable check valve hydraulic control system satisfactorily opens and closes the ECCS testable check valves.

14.2.12.1.19 Fuel Transfer Equipment Preoperational Test

a. Test Objective

To verify the ability of the Fuel Transfer Equipment to perform within design specification.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Fuel storage pool is available.

5. Reactor cavity and core structure are available.

6. Refueling bridges are available.

c. Test Procedure

1. Refueling bridge logic and interlock functions are tested for proper operation.

2. Inclined fuel transfer system logic and interlock functions are tested for proper operation.

3. The inclined fuel transfer system is tested for proper operation with dummy fuel bundles.

d. Acceptance Criteria

The fuel transfer equipment performs within design specifications.

14.2.12.1.20 Reactor Water Cleanup System (RWCU) Preoperational Test

a. Test Objectives

To verify the ability of the Reactor Water Cleanup System to perform within the design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Reactor vessel water is available to the suction of the RWCU pumps.

5. Nuclear closed cooling system is available.

6. Instrument air is available.

c. Test Procedure

1. Control, logic and interlock functions are checked for proper operation.

2. Flow is established in the following paths:

   (a) To the reactor bypassing the filter/demineralizer.

   (b) To the reactor through the filter/demineralizer.

   (c) To the condenser hotwell.

   (d) To the radwaste system.

3. Filter/demineralizer operation is verified in the following modes:

   (a) Precoat

   (b) Normal operation

   (c) Hold

   (d) Backwash

d. Acceptance Criteria

1. Control, logic and interlock functions perform within design specification.

2. Filter/demineralizer operation is satisfactory.

3. Flow is satisfactorily established in all modes.

14.2.12.1.21 Fuel Pool Cooling and Cleanup System (FPCC) Preoperational Test

a. Test Objective

To verify the ability of the Fuel Pool Cooling and Cleanup System to perform within the design specifications, and to demonstrate the fuel pool gates are operable with acceptable leakage rates.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Condensate storage and transfer equipment is available.

5. Nuclear closed cooling system is available.

c. Test Procedure

1. Controls, annunciators, logic, and interlocks are tested for proper operation.

2. Fuel pool filter/demineralizer performance is verified in the following modes:

(a) Precoat

(b) Backwash

(c) Standby recirculation

(d) Normal operation

3. Flow to the spent fuel pool is established and system ability to maintain level is verified.

4. The ability of the containment isolation valves to perform within design specification is verified.

5. Fuel pool cooling and cleanup pump performance is verified to be within design specification.

6. Flow out of the all FPCC siphon breakers is observed.

7. The fuel pool gates are subjected to full hydrostatic head and leakage is determined.

d. Acceptance Criteria

1. Controls, annunciators, logic, and interlocks perform within design specification.

2. System pumps and valves perform within design specification.

3. All siphon breakers associated with the FPCC system are unobstructed.

4. Leakage past the fuel pool gates is within specified limits.

14.2.12.1.22 Suppression Pool Makeup System Preoperational Test

a. Test Objectives

To verify the ability of the Suppression Pool Makeup System to perform within design specification.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Demineralized water is available in the upper containment pool.

5. Suppression pool has sufficient volume available to accept water.

c. Test Procedure

1. System logic and interlocks are checked for proper operation.

2. Valve opening time is verified to be within design specification.

3. Flow capability for each transfer line is verified by making a timed dump.

d. Acceptance Criteria

1. System logic and interlocks perform within design specification.

2. Valve opening times are within design specification.

3. System flow capability for each transfer line is within design specification.

14.2.12.1.23 Liquid Radwaste System (LRW) Preoperational Test

a. Test Objective

1. To demonstrate the capability of the waste collector subsystem to receive, transfer and process potentially contaminated low conductivity liquid wastes.

2. To demonstrate the capability of the floor drain collector subsystem to receive, transfer and process potentially contaminated high conductivity liquid wastes.

3. To demonstrate the capability of the chemical waste subsystem to receive, transfer and process potentially corrosive liquid wastes.

4. To demonstrate the capability of the detergent waste subsystem to receive, transfer and process liquid detergent wastes.

b. Prerequisites

1. Individual component tests have been completed and approved.

2. Instrument calibration and loop checks are complete.

3. Both ac and dc electrical power are available.

4. Two-bed demineralizer system is available.

5. Service air system is available.

6. Instrument air system is available.

7. Condensate storage and transfer system is available.

8. Radwaste building ventilation system is available.

9. Proper resin is available and/or loaded as applicable.

c. Test Procedure

1. The liquid radwaste system is operated with nonradioactive waste influent.

2. Power operated valves associated with the Liquid Radwaste System are cycled manually using the control switch.

3. System pumps are operated manually using the control switch.

4. System alarms are functionally tested by using actual or simulated conditions where practical.

5. The radwaste demineralizers are backwashed, recharged and placed into operation.

6. The radwaste filters are precoated, backwashed, recirculated, and placed into operation.

7. The effluent of each filter/demineralizer is sampled.

d. Acceptance Criteria

1. System pumps and power operated valves operate properly when controlled through the programmable logic controller.

2. Flow paths are verified and flow capabilities are acceptable.

3. The waste collector and floor drain collector systems produce condensate quality water.

4. The detergent waste subsystem produces water of acceptable quality to discharge to the environment.

5. The contents of the chemical waste tanks can be mixed and neutralized before discharge for processing.

6. System alarms operate properly.

14.2.12.1.24 Annulus Exhaust Gas Treatment System (AEGTS) Preoperational Test

a. Test Objective

To demonstrate the ability of the Annulus Exhaust Gas Treatment System to function properly.

b. Prerequisites

1. Individual components test are complete.

2. Permanently installed instrumentation is properly installed, calibrated and operable.

3. Test instrumentation is available and properly calibrated.

4. Instrument air is available.

5. Clean filters may be installed.

6. Fire protection system should be operational.

c. Test Procedure

1. The AEGTS fans, heaters, dampers, interlocks, trips, permissives and controls are functionally tested. (Except response to loss of power and reset after actuation feature are tested during Loss of Offsite Power testing.)

2. The AEGT system is operated to maintain a negative pressure differential in annulus between the containment vessel and the inside of the shield building relative to the atmosphere, and the minimum flow required is determined.

3. System alarms are actuated.

4. HEPA filter and charcoal adsorber air cleaner units are tested per the requirements of <Section 6.5.1.4.2>.

d. Acceptance Criteria

1. Fan, heater and damper interlocks, trips, permissives, and controls function properly.

2. With flow to the station vent less than or equal to allowable, the annulus area is maintained at an acceptable negative pressure relative to the atmosphere.

3. System alarms operate properly.

4. Results of the HEPA filters and charcoal adsorber beds inplace efficiency testing is acceptable.

5. The relative humidity control heaters are operable.

6. The AEGT subsystems, both singularly and in combination, operate properly to maintain the annulus at an acceptable negative differential pressure with respect to atmospheric pressure.

14.2.12.1.25 Control Room Heating, Ventilating, Air Conditioning, and Emergency Recirculation Preoperational Test

a. Test Objective

To verify the ability of the Control Room Heating, Ventilating, Air Conditioning (HVAC) and Emergency Recirculation Systems to perform within design specifications.

b. Prerequisites

1. Individual component tests have been completed and are approved.

2. Permanently installed instrumentation is properly installed, calibrated and operable.

3. Instrument air is available.

4. Appropriate ac and dc power sources are available.

5. Test instrumentation is available and properly calibrated.

6. The following systems are operational:

   (a) Control Complex Chilled Water System

   (b) Adequate fire protection is available

(c) Emergency Closed Cooling System

(d) Battery Room Exhaust System

(e) Standby Diesel Generator System

(f) Nuclear Closed Cooling System

c. Test Procedure

1. Control Room HVAC

(a) Verify fan, damper and air conditioner interlocks, trips, permissives, and control functions.

(b) Verify system is automatically aligned to the proper configuration by emergency signals.

(c) Verify that the control room is maintained at a positive pressure with respect to surrounding areas.

(d) Verify operation times for isolation dampers.

(e) Verify system response to manual isolation and automatic isolation signals.

2. Emergency Recirculation

(a) Verify fan, heater, damper, and air handler interlocks, trips, permissives, and control function.

(b) Verify system is automatically activated by emergency signals.

(c) Verify that the control room envelope inleakage criteria is not exceeded.

(d) Verify system response to manual isolation and automatic isolation signals.

(e) Verify HEPA filters and charcoal absorber beds perform to meet the requirements of <Section 6.5.1.4.2>.

d. Acceptance Criteria

1. Fan, heater, damper, and air conditioner interlocks, trips, permissives, and controls function within design specifications.

2. Systems respond to emergency signals automatically in accordance with design specifications.

3. Ensure that:

   (a) The control room is maintained at a positive pressure with respect to surrounding areas in accordance with design specifications (Normal Operations).

   (b) Inleakage criteria of the control room envelope is not exceeded (Emergency Recirculation).

4. Operating times for isolation dampers are within design specifications.

5. System isolation response is within design specifications limits.

6. HEPA filters and charcoal beds function within design specification limits.

14.2.12.1.26 Diesel Generator Building Ventilation System Preoperational Test

a. Test Objective

To verify the ability of the Diesel Generator Building Ventilation System to perform within design specifications.

b. Prerequisites

1. Individual component tests are completed and have been approved.

2. Instrumentation calibration and loop checks are complete.

3. Test instrumentation is available and properly calibrated.

4. Appropriate electrical power is available.

c. Test Procedure

1. Verify fan, damper and louver interlocks, trips, permissives, and controls function properly.

2. Verify diesel generator fans and exhaust louvers start in response to their associated diesel generator starting.

3. Verify the operability of temperature controls of mixing dampers in suction ducts.

4. Verify fan flow rates meet design requirements. The system is verified capable of maintaining the area temperatures within design range by running all area loads in an actual demonstration.

d. Acceptance Criteria

1. All fan, damper and louver interlocks, trips, permissives, and controls function within design specifications.

2. Diesel generator fans and exhaust louvers start in response to their associated diesel generator starting.

3. Temperature control of suction mixing dampers meets design specifications.

4. System capacity and maximum room temperatures are within design limits.

14.2.12.1.27 Offgas System Preoperational Test

a. Test Objective

To verify the ability of the Offgas System to perform within design specification.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Instrument air is available.

5. Turbine building closed cooling system is available.

c. Test Procedure

1. Proper operation of alarms, controls and interlocks is verified.

2. Operation of mechanical equipment such as offgas vents, sampling and monitoring points is verified.

3. Manual isolation between the main condenser and offgas system is verified.

d. Acceptance Criteria

Alarms, controls and logic functions perform within design specification.

14.2.12.1.28 Emergency Closed Cooling (ECC) System Preoperational Test

a. Test Objective

To verify the ability of the Emergency Closed Cooling System to perform within design specification.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Instrument air is available.

5. Demineralized water is available.

c. Test Procedure

1. Controls, logic and interlocks are verified to perform correctly.

2. Simulated LOCA signals are used to verify proper flow paths during LOCA conditions.

3. Performance of the emergency closed cooling pumps is verified to be within design specification. Pump head flow characteristics and NPSH are checked for consistency with design specifications for the various modes of operation.

4. Fill from the demineralized water system and the Emergency Service Water System is verified.

d. Acceptance Criteria

1. Controls, logic, interlocks, and annunciators operate within design specifications.

2. Emergency closed cooling pumps perform within design specification. The basis for the criteria is to assure that the pump meets the flow requirements of its ESF function as well as pump operability considerations including NPSH requirements.

3. Proper change of flow paths occurs with receipt of LOCA signal.

14.2.12.1.29 Emergency Service Water System (ESW) Preoperational Test

a. Test Objective

To verify the ability of the Emergency Service Water System to perform within design specification.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Residual heat removal heat exchangers are available.

5. Emergency closed cooling heat exchangers are available.

6. High-pressure core spray diesel is available to receive cooling water.

7. HPCS pump room cooler is available.

8. Fire service water system is available to receive water.

9. Division 1 and Division 2 standby diesels are available to receive cooling water.

c. Test Procedure

1. Appropriate valves are tested to verify response to LOCA signals.

2. Emergency Service Water pump head and flow characteristics are checked for the various modes of operation.

3. Proper flow is established on the following loops and modes:

   (a) Residual heat removal heat exchangers.

   (b) Emergency closed cooling heat exchangers.

   (c) High-pressure core spray diesel cooling.

   (d) Fuel pool cooling and cleanup surge tank makeup.

   (e) Fire service water.

   (f) Division 1 and Division 2 standby diesels.

   (g) HPCS pump room cooler.

4. Automatic sluice gate operation is verified.

5. Alternate standpipe flow path is verified.

d. Acceptance Criteria

1. Each of the emergency service water pumps meets the flow requirements of its ESF function.

2. Proper flow is established in the modes tested.

3. Valves respond to LOCA signals.

4. Automatic sluice gate operation is satisfactorily demonstrated.

14.2.12.1.30 Class 1E 125 Volt DC System Preoperational Test

a. Test Objective

To verify the capability of each Class 1E battery to supply its safety-related load demand without support of the chargers for a specified time without dropping below minimum battery and cell voltage. To verify the capability of the battery chargers to restore the battery from the duty cycle discharge state to its fully charged state within a specified time period while supplying normal steady-state loads. To verify that each Class 1E division's dc bus can be energized independently of the other division's dc bus. To verify that the undervoltage relay and associated alarm operate within the design specification.

b. Prerequisites

1. The component testing procedures as required for this test are completed and the data is reviewed.

2. All the necessary permanently installed instrumentation is properly calibrated and operable.

3. All the necessary test instrumentation is available and properly calibrated.

4. Appropriate ac power sources available.

5. Class 1E switchgear and battery room ventilation available.

c. Test Procedure

1. Perform a service test by loading each battery with its battery duty cycle and without support of the battery charger, verify that the battery delivers the design requirements of the dc system for a specified time without dropping below minimum battery and cell voltage, and verify that the undervoltage relay and the associated alarm operate within the design specification.

2. With the battery at the duty cycle discharge state, verify that the battery charger fully charges the battery within a specified time period while supplying normal steady-state load.

3. Verify that the dc system load is consistent with battery sizing assumptions.

4. Demonstrate that each Class 1E division's dc bus can be energized independently of the other division's dc bus.

d. Acceptance Criteria

1. Each battery supports its duty cycle without support of its charger for the specified time without dropping below minimum battery and cell voltage.

2. Battery charger fully charges the battery within a specified time period from the duty cycle discharge state while supporting normal steady-state load.

3. The undervoltage relay and associated alarm operate within the design specification.

4. Each Class 1E division's dc bus can be energized independently of the other division's dc bus.

e. Battery testing is supplemented by voltage drop calculations. These calculations include both 125 Vdc control and power circuits. Battery voltage consistent with the expected operating time of the equipment is used for the calculations. Corrective actions are taken for devices determined to have less than their minimum required voltage.

14.2.12.1.31 Standby Diesel Generator Preoperational Test

a. Test Objectives

1. To demonstrate the capability of the standby diesel generator power sources.

2. To provide assurance that the system is capable of providing emergency electrical power during normal and simulated accident conditions.

3. To demonstrate the system's ability to pickup emergency loads during simulated accident conditions.

4. To demonstrate the operability of the diesel generator auxiliary systems, e.g., diesel fuel oil transfer, diesel-generator starting air supply, jacket water, and lube oil.

b. Prerequisites

1. Individual component tests are complete and have been approved.

2. Instrumentation available and properly calibrated.

3. The following system and/or components are available:

   (a) Pneumatic sources.

   (b) Emergency service water.

   (c) Electrical power.

   (d) Fire protection system in diesel generator building.

   (e) Diesel generator building ventilation.

   (f) DC power source.

4. Sufficient diesel fuel on site to perform tests.

c. Test Procedure

1. Demonstrate proper manual and automatic operation of the diesel generators and that they can start automatically upon simulated loss of ac voltage and attain the required frequency and voltage within the specified limits.

2. Demonstrate proper response and operation for design-basis accident loading sequence to design-basis load requirements, and verify that voltage and frequency are maintained within specified limits.

3. Demonstrate proper operation of the diesel generator during load shedding, load sequencing and load rejection. Include a test of the loss of the largest single load while maintaining

voltage and frequency within design limits, and a test of the complete loss of load in which overspeed limits are not exceeded.

4. Demonstrate full-load carrying capability of the diesel generators for a period of not less than 24 hours, at a load equivalent to the continuous rating of the diesel generator. Verify that voltage and frequency are maintained within design limits, that the diesel cooling systems function within design limits, and the diesel generator HVAC system maintains the diesel generator room within design limits.

5. Demonstrate functional capability at operating temperature conditions by reperforming "the automatic response" tests for Items 1 and 2 above, immediately (within 5 minutes) after completion of the 24-hour load test per Item 4 above.

6. Demonstrate the ability to:

   (a) Synchronize the diesel generators with offsite power while connected to the emergency load.

   (b) Transfer the load from the diesel generators to the offsite power.

   (c) Isolate the diesel generators and restore them to standby status.

7. Demonstrate that the rate of fuel consumption while operating at the design-basis accident load is such that the requirements for 7-day storage inventory are met for each diesel generator.

8. Demonstrate starting reliability by means of any 69/n consecutive valid starting tests without failure (per plant), where n is equal to the number of diesel generator units of the same design and size.

9. Auxiliary system instrumentation and equipment are tested using actual or simulated conditions to verify performance within design specifications.

d. Acceptance Criteria

1. System construction and operation meet design criteria.

2. Auxiliary systems function in accordance with design specifications.

3. The automatic sequence logic circuitry loads the generator in the proper sequence and time interval.

4. Verify that the required voltage and frequency are attained and maintained for a specified time period at design load.

5. Load rejection does not result in exceeding specified speeds and nominal voltage and frequency are restored within the specified time.

14.2.12.1.32 ECCS Integrated Initiation With Preferred Source of Offsite Power Available and During a Loss of Offsite Power Preoperational Test

a. Test Objective

1. Demonstrate that each Class 1E, 4.16 kV bus equipment responds to a simulated bus undervoltage condition as follows:

   (a) The standby diesel generator automatically starts, the bus properly clears and the DG output breaker automatically closes when the DG reaches rated speed and voltage.

   (b) All relaying and interlocks involved with the undervoltage condition, including shedding/sequencing of sources and loads operate properly.

   (c) Once preferred offsite power is restored, demonstrate that it can be synchronized to each 4.16 kV bus and that the DG can be unlocked and disconnected without affecting running loads.

2. Demonstrate that the diesel generators start and pick up all loads and also demonstrate the ECCS's ability to inject into the reactor pressure vessel.

3. Demonstrate the independence and redundancy of the safety-related electrical, mechanical and instrumentation of the ECCS and the standby and offsite power source.

4. Demonstrate the maintenance of the required minimal dc voltage on the 125 Vdc system during loss of offsite power.

5. Demonstrate integrated ECCS operation to a simulated LOCA signal.

   The minimum voltage demonstration is verified on a selected component basis during the IC&R test phase.

b. Prerequisites

   1. Preoperational/acceptance testing of systems as required for this test is complete and the data has been reviewed.

   2. Permanently installed instrumentation properly calibrated and operable.

   3. Necessary test instrumentation available and properly calibrated.

   4. Appropriate ac and dc power sources available.

   5. The Class 1E buses are energized from the preferred source of offsite power.

   6. Class 1E switchgear and battery room ventilation systems available.

   7. Class 1E buses are loaded with their normal plant demands.

   8. Standby diesel generators and associated systems available.

   9. Emergency pump rooms ventilation system available.

   10. Emergency service water system available.

   11. RHR system available.

12. HPCS system (including HPCS diesel generator) available.

13. LPCS system available.

14. Condensate storage tank and suppression pool water available for ECCS operation.

c. Test Procedure

1. Initiate a Class 1E, Division 1, 4 kV bus undervoltage and verify the following:

   (a) Automatic starting of the diesel generator with its associated dc system energized and its automatic connection to a properly cleared bus when the diesel generator reaches rated speed and voltage.

   (b) Proper operation of all relaying and interlocks involved with this undervoltage condition including shedding/sequencing of sources and loads.

   (c) Ability to manually operate and restore normal loads to the 4 kV, Class 1E buses.

   Repeat the above procedure for Division 2 and Division 3 Class 1E, 4 kV buses.

2. With normal power available simulate a LOCA signal and test ECCS integrated response. Test return mode ECCS loads are maintained for a period of time to verify system stability and performance.

3. With Division 1 electrical systems out-of-service, normal power available to Division 2 and Division 3, simulate a LOOP followed immediately by a LOCA and verify the following:

   (a) Automatic starting of the diesel generator with its associated dc system energized and its automatic connection to a properly cleared bus when the diesel generators reach rated speed and voltage.

   (b) Power operation of all relaying and interlocks involved with the undervoltage/LOCA condition, including shedding/sequencing of sources and loads.

   (c) That Division 2 and Division 3 equipment operating conditions can be stabilized that no adverse conditions develop to Division 2 and Division 3 equipment such as overheating, etc., that there is sufficient instrumentation operable to properly monitor and control Division 2 safety-related equipment.

   (d) Verify that isolated buses remain de-energized.

   Repeat the above procedure for Division 2 and Division 3 electrical systems out-of-service.

4. Simulate a LOOP followed immediately by LOCA, and verify that the diesel generators start simultaneously, load shedding takes place, preferred and/or alternate preferred source breakers are tripped and diesel generators accept the sequenced loads.

d. Acceptance Criteria

1. Upon loss of Class 1E, 4.16 kV bus power, the source and load breakers are tripped. The standby diesel generator starts and attains rated speed and voltage, automatically closes the output breaker within 10 seconds, and accepts restored loads as they are sequenced on the bus.

2. Upon a LOCA signal with preferred power available, the RHR/LPCI, LPCS and HPCS start within the time specified and the LOCA logic relays operate all required loads.

3. The independence and redundancy of Division 1, Division 2 and Division 3 safety-related electrical, mechanical and instrument systems are demonstrated.

4. The ECCS response to a concurrent LOOP/LOCA signal demonstrate that the standby diesel generator and HPCS diesel generator start automatically, attain rated speed/voltage, and automatically close their output breakers within 10 seconds at which time the RHR/LPCI, LPCS and HPCS start within the times specified and inject rated flow into the reactor vessel within the time specified.

5. All Class 1E 125 Vdc voltages are ≥105 Vdc throughout testing.

6. The LOOP and/or LOCA relays initiate or disconnect all required loads.

14.2.12.1.33 Reactor Vessel Flow Induced Vibration Test and Visual Inspection Without Fuel Preoperational Test

a. Test Objective

The purpose of this test is to provide needed information to verify the adequacy of the reactor internals design with respect to flow induced vibration. The recirculation system is operated at varying flow rates up to and including 100 percent rated volumetric core flow. Perry is the first GE BWR/6 238 plant and will be considered a prototype as defined in <Regulatory Guide 1.20>, and will be tested accordingly.

b. Prerequisites

1. Install and properly torque the shroud head and reactor vessel head.

2. Reactor control rod blades are removed or positioned fully withdrawn and locked out.

3. Incore instruments, neutron sources, blade guides and fuel are not installed.

4. Reactor vessel surveillance specimen holders and specimens are installed.

5. Instrument calibration is complete.

6. The Pre-Flow Test Inspection is complete.

c. Test Procedure

1. Place the system in the flow configuration specified by each test point, record the operating conditions and obtain sensor data by using the chart and magnetic tape recorders for each test point.

2. Depressurize the RPV and conduct the Post-Flow Test Inspection.

d. Acceptance Criteria

1. Minimum accumulation time at rated volumetric core flow with two recirculation pumps at balanced flow.

2. Minimum accumulation time of single loop operation for each individual recirculation loop.

3. The test points with balanced flow provide verification of the maximum volumetric flow capability in accordance with vibration criteria in the Vibration Measurement Program.

14.2.12.1.34 Plant Foundation Underdrain System Preoperational Test

a. Test Objective

1. To demonstrate that seven service pumps and two backup underdrain pumps perform within design specifications for capacity and discharge head.

2. To demonstrate that the service and backup underdrain pumps start and stop due to water level changes in their respective manholes and that when the backup pumps start a high ground water level alarm occurs.

3. To demonstrate that the pressure monitoring points indicate that the plant foundation water level has reached equilibrium below Elevation 568 feet.

4. To demonstrate that the piping is free of obstructions by performing a visual inspection of all gravity drain piping.

5. To demonstrate that water flows across the porous concrete mat and thereby establishes that the underdrain system can reduce the hydrostatic pressure on building foundations to the desired level.

6. To verify that water builds-up and draws down at the monitoring point and thereby establish that the underdrain system can, in fact, reduce the hydrostatic pressure on building foundations to the desired level.

b. Prerequisites

1. Individual component tests covered under the Initial Check-out and Run-in Test are complete and approved (This includes installation verification of pump discharge check valves).

2. Instrument calibration is complete.

3. The Fire Protection System or Service Water System is capable of supplying water into the underdrain pump manholes.

4. Electrical power is available.

5. The porous concrete and Class A fill are saturated and water level has been stabilized at Elevation 570’-0” (+12”, -0”) or 48 hours.

6. Plugs are installed in the 12" porous pipe at the north and south ends.

c. Test Procedure

1. Record the building mat piezometer readings and record prior to start of test and periodically during water level changes and equilibrium conditions.

2. Start east side pumps and establish an outflow of about 50 gpm and verify a water level decrease on the west side.

3. Feed water to the west side at a rate equal to east side outflow and establish equilibrium water level conditions on the east and west side. Make adjustments as necessary to establish a level of 566'-0" on the east side prior to establishing equilibrium. Maintain equilibrium for at least 15 minutes.

4. Repeat above Steps 1-3 at equilibrium flow conditions of 100 gpm and at additional 50 gpm increments until one of the following occurs:

    (a) West side regulating valves are fully open.

    (b) East site throttling valve is fully open.

    (c) Uniform water level on west side reaches Elevation 570'-0". The final condition should be adjusted and maintained for a minimum of 30 minutes.

5. Repeat Steps 1-4 in the opposite direction.

6. Verify that the underdrain service and backup service pumps operate within design specification for capacity and discharge head.

7. All controls, interlocks and alarms (including high ground water) are verified for proper operation.

d. Acceptance Criteria

1. The service and backup underdrain pumps perform within design specifications for capacity and discharge head.

2. The service and backup underdrain pumps start and stop automatically due to water level changes in their respective manholes and manually at their respective local control panel.

3. The pressure monitoring points indicate water level in the underdrain system reaches equilibrium below Elevation 568 feet and water flows across the porous concrete mat.

4. Visual inspection of the gravity drain piping shows no obstructions.

5. The control room panel alarm signals and computer alarm signals are received when the backup service pump and service pumps are started respectfully. High ground water level alarm occurs when the backup pump starts.

14.2.12.1.35 Motor Control Center, Switchgear, Miscellaneous Area Heating Ventilation, Air Conditioning, and Battery Room Exhaust Preoperational Test

a. Test Objective

To verify the ability of the MCC, Switchgear and Miscellaneous Area HVAC and Battery Room Exhaust Systems to perform within design specifications.

b. Prerequisites

1. Individual component tests are complete.
2. Instrument calibration and loop checks are complete.
3. Test instruments are available and calibrated.
4. Instrument air is available.
5. Electrical power is available.
6. Control Complex Chilled Water System is operational.

c. Test Procedure

1. Verify fan, damper interlocks, trips, permissives, and control functions.
2. Verify system response to manual isolation.
3. Verify system automatically activates by emergency signal.

4. Verify that system capacity is adequate to maintain the area temperatures according to design. The heat removal rate of the system is determined via standard heat balance measuring and calculation techniques.

d. Acceptance Criteria

1. Fan, damper interlocks, trips, permissives, and controls function within design specifications.

2. System isolation response is within design specifications for manual isolation signals.

3. Systems respond to emergency signals automatically in accordance with design specifications.

4. System capacity meets design requirements.

14.2.12.1.36 Emergency Closed Cooling Pump Area Air Conditioning Preoperational Test

a. Test Objective

To verify the ability of the Emergency Closed Cooling Pump Area AC System to perform within design specifications.

b. Prerequisites

1. Individual component tests are completed.

2. Instrument calibration is completed.

3. Electrical power is available.

4. Instrument air is available.

5. Control Complex Chilled Water is operational.

c. Test Procedure

1. Verify fan, interlocks, trips, and control functions.

2. Verify system responds to automatic initiate signal.

3. Verify that system capacity is adequate to maintain the area temperatures according to design. The heat removal rate of the system is determined via standard heat balance measuring and calculation techniques.

d. Acceptance Criteria

1. Fan, interlocks, trips, and controls function within design specifications.

2. System capacity meets design requirements.

14.2.12.1.37 Emergency Service Water Pumphouse Ventilation Preoperational Test

a. Test Objective

To verify the ability of the ESW Pumphouse Ventilation System to perform within design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration and loop checks are complete.

3. Test instruments are available and calibrated.

4. Electrical power is available.

c. Test Procedure

1. Verify fan, damper interlocks, trips, and control functions.

2. Verify system response to automatic initiate signal.

3. Verify fan flow rates meet design requirements. The system is verified capable of maintaining the area temperatures within design range by running all area loads in an actual demonstration.

d. Acceptance Criteria

1. Fan, interlocks, trips, and controls function are within design specifications.

2. System capacity and maximum room temperatures are within design limits.

14.2.12.1.38 Offgas Building Exhaust System Preoperational Test

a. Test Objective

To verify the Offgas Building Exhaust System performs within design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration and loop checks are complete.

3. Test instruments are available and calibrated.

4. Instrument air is available.

5. Electrical power is available.

6. Adequate fire protection is available.

c. Test Procedure

1. Verify fan, damper interlocks, trips, and control functions.

2. Verify system response during normal and automatic operation.

d. Acceptance Criteria

Fans, interlocks, trips, and controls function within design specifications.

14.2.12.1.39 Emergency Core Cooling System Pump Room Cooling System Preoperational Test

a. Test Objective

To verify the ability of the ECCS Pump Room Cooling Systems to perform within design specifications.

b. Prerequisites

1. Individual component tests are completed.

2. Electrical power is available.

3. Following systems in operation:

   (a) Emergency Service Water

   (b) Emergency Closed Cooling

c. Test Procedure

1. Verify fan interlocks, trips and control functions.

2. Verify system responds to automatic initiate signal.

3. Verify that system capacity is adequate to maintain the area temperatures according to design. The heat removal rate of the system is determined via standard heat balance measuring and calculation techniques. This is accomplished as Startup Test Number 134 as described in <Section 14.2.12.2.59>.

d. Acceptance Criteria

1. Fan, interlocks, trips, and controls function within design specifications.

2. System capacity meets design requirements.

14.2.12.1.40 Fuel Handling Building Ventilation System Preoperational Test

a. Test Objective

To verify the ability of the Fuel Handling Building Ventilation System to perform within design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration and loop checks are complete.

3. Test instruments are available and calibrated.

4. Instrument air is available.

5. Electrical power is available.

c. Test Procedure

1. Verify fan, damper interlocks, trips, and control functions.

2. Verify system responds to automatic signals.

3. Verify HEPA filters and charcoal adsorbers beds perform to meet the requirements of <Section 6.5.1.4.2>.

d. Acceptance Criteria

1. Fan, interlocks, trips, and controls function within design specifications.

2. HEPA filters and charcoal beds function within design specification limits.

14.2.12.1.41 Combustible Gas Control System Preoperational Test

a. Test Objectives

1. To demonstrate the Combustible Gas Mixing System is operable.

2. To demonstrate the Hydrogen Purge Backup System flow control is operable.

3. To demonstrate the Hydrogen Analyzer Packages provide accurate analysis of containment oxygen and hydrogen content.

4. To demonstrate the Hydrogen Recombiners are operable (actual hydrogen-oxygen recombination process is not demonstrated at this time).

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration and loop checks are complete.

3. Test instruments are available and calibrated.

4. Electrical power is available.

5. Emergency Closed Cooling System is operational.

6. Annulus Exhaust Gas Treatment System is operational.

7. RHR system is operational (for mixing compressor test only).

c. Test Procedures

1. The Combustible Gas Mixing System is operated and flow rates and pressures are determined.

2. The Hydrogen Purge Backup system flow control valve is operated under simulated accident conditions.

3. The Hydrogen Analyzer Packages are operated using known concentrations of oxygen and hydrogen and sample flow rates are determined.

4. The Hydrogen Recombiner System is operated and system flow rates are determined.

5. Systems controls and alarms are actuated.

d. Acceptance Criteria

1. The Combustible Gas Mixing System meets acceptable values of flow, temperature and pressure.

2. The purge flow control valve operates satisfactorily to limit flow below a specified maximum under simulated accident conditions.

3. The Hydrogen Analyzer Packages operate properly.

4. The Hydrogen Recombiners meet acceptable values of flow and temperature.

5. Systems’ alarms operate properly.

14.2.12.1.42 Control Complex Chilled Water System Preoperational Test

a. Test Objective

To verify the ability of the Control Complex Chilled Water System to perform within design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration and loop checks are complete.

3. Test instruments are available and calibrated.

4. Electrical power is available.

5. Nuclear closed cooling is operational.

6. Emergency closed cooling is operational.

c. Test Procedure

1. Verify the chillers, pumps and control functions.

2. Verify system response to automatic isolation/change over signals.

d. Acceptance Criteria

Chillers, pumps and controls function within design specifications.

14.2.12.1.43 (Deleted)

14.2.12.1.44 Drywell Structural Integrity

a. Test Objective

1. Measure the structural response of the drywell as it is subjected to internal pressures from atmospheric to design pressure and back to atmospheric.

2. Demonstrate that the structural responses of the principal strength elements due to these internal pressures are in conformance with the stated acceptance criteria.

b. Prerequisites

1. Unit 1 and Unit 2 Instrument Air Systems are available.

2. Unit 1 and Unit 2 Service Air Systems are available.

3. Service Water System is available.

4. Nuclear Closed Cooling Water System is available.

5. Drywell Cooling System is available.

6. The Leak Rate Test System is available to support pressurization and depressurization of the drywell.

7. Drywell Structural Integrity Test instrumentation is installed.

8. Instrument calibration is complete.

9. Electrical power is available.

10. Crack inspection areas are established.

11. Suppression Pool vents are plugged.

12. Drywell equipment hatch and personnel airlock are secured, with the personnel airlock outer door open.

13. Containment vessel is open to atmosphere.

14. Pressure sources inside the drywell are removed or vented.

c. Test Procedure

The following parameters are measured as the drywell is pressurized and depressurized in incremental steps from atmospheric pressure to design pressure back to atmospheric pressure:

1. Strain gauge readings.

2. Displacement readings.

3. Temperature.

4. Crack size.

d. Acceptance Criteria

1. Strain gauge readings are below specified values.

2. Displacements are below specified values.

3. Crack widths are less than specified values.

4. Deflection recovery is greater than a specified value.

14.2.12.1.45 Fuel Handling and Vessel Servicing Equipment

a. Test Objective

To verify the interlocks, limits, logic, and performance of the fuel handling and vessel servicing equipment.

b. Prerequisites

1. Component IC&R complete.

2. Instrument calibration complete.

3. Electrical power is available.

4. Refueling Platform is available.

5. Fuel Preparation Machine is available.

6. Fuel Racks are available.

7. Reactor Vessel is available.

c. Test Procedure

1. Interlocks, limits and logic tests are performed for all equipment operations.

2. Functional Tests are performed on the following equipment as deemed necessary (prior to use):

(a) Containment Building Fuel Preparation Machine.

(b) (Deleted)

(c) Fuel Building Fuel Preparation Machine

(d) Service (Auxiliary) Platform and Platform Support

(e) Refueling Platform

(f) Fuel Handling Platform (Fuel Building)

(g) Actuator Pole

(h) Underwater Lighting

(i) Underwater Servicing Equipment

(j) Peripheral Orifice Servicing

(k) Control Rod Assembly Servicing

(l) Instrument Servicing

(m) In-Vessel Fuel Bundle Servicing

(n) Reactor Vessel Service Tools

(o) Dryer and Separator Strongback

(p) Steam Line Plugs

(q) Head Strongback Carousel and Head Holding Pedestal

(r) New Fuel Inspection Stand

(s) Control Rod Drive Servicing Equipment

d. Acceptance Criteria

The Fuel Handling and Vessel Servicing Equipment performs within the design specifications.

14.2.12.1.46 Drywell Vacuum Relief System

a. Test Objective

To verify the ability of the Drywell Vacuum Relief System to perform within the design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electric power is available.

4. Test instruments are available and calibrated.

5. Instrument air is available.

c. Test Procedure

1. Verify performance of the controls, annunciation, logic, and interlocks.

2. Verify operating time for valve closing in response to containment isolation signal.

d. Acceptance Criteria

The Drywell Vacuum Relief System operation performs in accordance with design specifications.

14.2.12.1.47 Containment Vacuum Relief System

a. Test Objective

To verify the ability of the Containment Vacuum Relief System to perform within the design specifications.

b. Prerequisites

1. Individual component tests are complete.
2. Instrument calibration is complete.
3. Electric power is available.
4. Test instruments are available and calibrated.
5. Instrument air is available.

c. Test Procedure

1. Verify performance of the controls, annunciators, logic, and interlocks.
2. Verify operating time for valve closing in response to containment isolation signal.

d. Acceptance Criteria

The Containment Vacuum Relief System operation performs in accordance with design specifications.

14.2.12.1.48 Safety-Related Instrument Air Preoperational Test

a. Test Objective

To verify the ability of the Safety-Related Instrument Air system to perform within design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

c. Test Procedure

1. The air compressor package is verified capable of providing compressed air to pressurize the Safety-Related Instrument Air system.

2. The controls and operation of the system are verified.

3. The loss of instrument air is tested by simulating both pipe break and moisture freezing.

d. Acceptance Criteria

1. The air compressor is capable of pressurizing the receiver tank to maximum system operating pressure.

2. System pressure capability is within design specification.

3. The inline receivers are capable of maintaining the ADS accumulators properly charged for the required time period.

4. For both sudden and slow loss of air pressure, system capability is maintained.

14.2.12.1.49 Emergency AC Power Distribution Class 1E Preoperational Test

a. Test Objective

1. To demonstrate the capability of the 4.16 kV Class 1E system to provide reliable electrical service to the 4.16 kV Class 1E busses (Division 1, Division 2 and Division 3).

2. To demonstrate the capability of the 480V Class 1E load centers to provide reliable power to the connected 480V loads and motor control centers (Division 1, Division 2 and Division 3).

3. To demonstrate the capability of the 480V Class 1E motor control centers to provide reliable power to the connected 480V loads and the Class 1E power distribution panels (480/120V ac) (Division 1, Division 2 and Division 3).

4. To demonstrate divisional electrical independence of the Class 1E distribution system.

b. Prerequisites

1. 4.16 kV Class 1E Distribution

   (a) Individual component checkout and run-in tests are complete.

   (b) 13.8 kV power and 125V dc control power are available.

   (c) Loads that cannot be cycled are removed and supplied with temporary power.

2. 480V Class 1E Load Centers

   (a) Individual component checkout and run-in tests are complete.

   (b) 4.16 kV, Class 1E busses are available to energize the 480V Class 1E load centers and 125 Vdc control power is available.

   (c) Loads that cannot be cycled are removed and supplied with temporary power.

3. 480V Class 1E Motor Control Centers

   (a) Individual component checkout and run-in tests are complete.

   (b) 480V Class 1E load centers are available for energizing the 480V Class 1E motor control centers and 125V dc control power is available.

(c) Loads that cannot be cycled are removed and supplied with temporary power.

c. Test Procedures

1. 4.16 kV Class 1E Distribution

(a) The 4.16 kV Class 1E busses are energized.

(b) System alarms and controls, both manual and automatic, are actuated.

(c) Each Division's voltage is recorded while one Division is de-energized for all combinations.

2. 480V Class 1E Load Centers

(a) Breakers are operated to energize the 480V Class 1E load center and motor control centers.

(b) System alarms and controls, both manual and automatic, are actuated.

(c) Each Division's voltage is recorded while one Division is de-energized for all combinations.

3. 480V Class 1E Motor Control Centers

(a) Breakers are operated to energize the 480V Class 1E motor control centers.

(b) Systems alarms and controls, both manual and automatic are actuated.

(c) Each Division's voltage is recorded while one Division is de-energized for all combinations.

d. Acceptance Criteria:

1. 4.16 kV Class 1E Distribution

(a) System breakers operate properly.

(b) System bus voltages are acceptable.

(c) Systems alarms operate properly.

(d) Feeder breaker interlocks operate properly.

(e) Each Division is electrically independent of the other two Divisions.

2. 480V Class 1E Load Center

(a) System breakers operate properly.

(b) System bus voltages are acceptable.

(c) System alarms operate properly.

(d) Each Division is electrically independent of the other two Divisions.

3. 480V Class 1E Motor Control Centers

(a) System breakers operate properly.

(b) System bus voltages are acceptable.

(c) System alarms operate properly.

(d) Each Division is electrically independent of the other two Divisions.

14.2.12.1.50 Rod Control and Information System (RCIS) Preoperational Test

a. Test Objective

To demonstrate the capability of the Rod Control and Information System including the rod pattern controller, control circuitry and interlocks, control valves, indicators, and the reactor mode switch to meet system design requirements.

b. Prerequisites

1. Individual component tests are complete.

2. AC and dc electrical power is available.

3. Applicable portions of the annunciator system, neutron monitoring system and control rod drive hydraulic system are available to support test.

c. Test Procedure

Controls are operated and simulated signals are applied to functionally check the following:

1. Position indication at each control rod on all channels.

2. Rod position status information including rod drift and overtravel.

3. LPRM status and level information.

4. Rod assignments to gangs, groups and sequence for each channel and operational mode.

5. Actuation of all rod blocks and a representative sample of rod pattern constraints for the different modes, power levels and for all positions of the Reactor Mode Switch.

6. System response to operator requests for data display, rod selection, rod drive commands, and system mode commands.

7. Control rod drive Directional Control Valve actuation and timing sequence.

8. Control rod drive Hydraulic Control Unit status information.

9. Control rod bypass provisions.

10. System self-test and data quality checks.

11. Rod test/insert function.

12. RCIS outputs to the scram time panel.

13. CRD temperature recorder.

d. Acceptance Criteria

1. Correct rod position and rod status is properly displayed.

2. All rod blocks function properly.

3. All rod movement and a representative sample of rod pattern restraints are applied and/or removed under the specified conditions of power level and position of the Reactor Mode Switch.

4. LPRM level and status is properly displayed.

5. Rod group, gang and sequences are as specified.

6. Rod bypass provisions function properly.

7. The Directional Control Valve timing sequence is correct within specified accuracies.

8. System annunciators operate properly.

14.2.12.1.51 Reactor Building Polar Crane and Preoperational Test

a. Test Objective

1. To demonstrate interlocks, limit switches and operation of the Reactor Building Polar Crane under no load conditions.

2. To demonstrate the handling capacity of the Reactor Building Polar Crane by load testing the main and auxiliary hoists to 125 percent of the rated load.

b. Prerequisites

1. Individual Component tests are complete and approved.

2. Instrument calibration is complete.

3. Electrical power is available.

4. The hoist cables have not been reeved on the hoist drums and blocks.

5. NDE of the load hooks is successfully completed.

6. Certified test weights are available.

c. Test Procedure

1. Operation of the ladder walkway lights, bridge lights, bridge warning bell, abnormal condition warning lights, pendant limit switches, pendant, main hoist auxiliary, hoist trolley, bridge motion checkout, controls, and stop pushbutton interlock are tested.

2. The main and auxiliary hoists are reeved followed by a no load testing of hoist speed control, limit switch and position indicator operation.

3. Trolley and bridge speed controls are no load tested.

4. The main and auxiliary hoists are load tested to 125 percent of their rated load. The full range of normal bridge and trolley travel is tested with the main hoist carrying 125 percent of the rated load. The holding capacity of each hoist brake is tested by releasing the supporting redundant brake.

d. Acceptance Criteria

1. Individual component tests are satisfactorily completed.

2. Operation of the Reactor Building Polar Crane is satisfactorily demonstrated by verifying interlocks and no load testing of the bridge trolley, main and auxiliary hoists.

3. The material handling capacity of the Reactor Building Polar Crane is satisfactorily verified by load testing the main and auxiliary hoists to 125% percent of the rated load.

14.2.12.1.52 Fuel Handling Area Crane Preoperational Test

a. Test Objective

1. To demonstrate interlocks, limit switches and operation of the Fuel Handling Area Crane under no-load conditions.

2. To demonstrate the handling capacity of the Fuel Handling Area Crane by load testing the main and auxiliary hoists to 125 percent of the rated load.

b. Prerequisites

1. Individual component tests are complete and approved.

2. Instrument calibration is complete.

3. Electrical power is available.

4. The hoist cables have not been reeved on the hoist drums and blocks.

5. NDE of the load locks is successfully completed.

6. Certified test weights are available.

c. Test Procedure

1. The ladder walkway, bridge lights, bridge warning bell, abnormal condition warning lights, and pendant motion are tested.

2. The main hoist, auxiliary hoist, trolley, and bridge motion are no load tested.

3. The main hoist and auxiliary hoist are reeved followed by limit switch, position indicator and hoist speed control testing.

4. The main hoist, auxiliary hoist and stop pushbutton interlocks are tested.

5. The main and auxiliary hoists are load tested to 125 percent of their rated load. The full range of normal bridge and trolley travel is tested with the main hoist carrying 125 percent of the rated load. The holding capacity of each hoist brake is tested by releasing the supporting redundant brake.

d. Acceptance Criteria

1. Individual component tests are satisfactorily completed.

2. Operation of the Fuel Handling Area Crane is satisfactorily demonstrated by verifying interlock and no load testing of bridge, trolley, main, and auxiliary hoists.

3. The material handling capacity of the Fuel Handling area crane is satisfactorily verified by load testing main and auxiliary hoist to 125 percent of the rated load.

14.2.12.1.53 (Deleted)

14.2.12.1.54 Containment Vessel Cooling System Preoperational Test

a. Test Objective

To verify the ability of the Containment Vessel Cooling System to perform within design specification.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Containment chilled water system is available.

5. Instrument air is available.

6. Test instruments are available and calibrated.

7. System airflow balance is complete.

c. Test Procedure

1. The capability of system fans to deliver the required flow is verified by airflow measurement in all modes of operation.

2. Fan damper interlocks are verified by system actuation.

3. System alarms are verified by simulation of actuating signals.

d. Acceptance Criteria

1. Fans deliver required airflow per design requirements.

2. System interlocks perform per design requirements.

3. System alarms function per design requirements.

14.2.12.1.55 Drywell Cooling System Preoperational Test

a. Test Objective

1. To verify the Drywell Cooling fans operating parameters are within design specifications.

2. To verify the resistance to air flow across the roughing filters are within design specifications.

3. To demonstrate the auto start interlocks of standby fans function as designed.

4. To demonstrate system alarms function properly.

b. Prerequisites

1. The Initial Check-out and Run-in Test is complete.

2. Electrical power is available.

3. Nuclear Closed Cooling System is available.

4. Clean filters are installed.

5. Test instruments are available and calibrated.

c. Test Procedure

1. Actual fan operating parameters of discharge air flow rates, fan static pressures, vibrations, and motor currents/voltages are verified.

2. Actual resistance to airflow across the roughing filters is verified.

3. Auto-start of unit standby fans is verified by simulation of initiating signals.

4. Proper operation of system alarms is verified by simulation of initiating signals.

d. Acceptance Criteria

1. Fan operating parameters are as designed.

2. Differential pressure across the roughing filters are as designed.

3. Auto-start of unit standby fans perform as designed.

4. System alarms perform as designed.

14.2.12.1.56 Cooling Tower Makeup Isolation Preoperational Test

a. Test Objective

To demonstrate that the Safety-Related Cooling Tower Makeup Isolation Valves close on a simulated high water level in the Unit 1 Turbine Building under conditions of full makeup flow to the Unit 1 Cooling Tower.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Unit 1 Cooling Tower is available to accept water.

4. At least 2 service water pumps are running.

c. Test Procedure

1. Establish full makeup flow to the Unit 1 Cooling Tower with the upstream and downstream isolation valves open.

2. Manually actuate the level switch for the upstream isolation valve and verify that the valve fully closes and no water is flowing to the Unit 1 Cooling Tower.

3. Re-Open the upstream valve so that full makeup is again flowing to the Unit 1 Cooling Tower.

4. Manually actuate the level switch for the Downstream Isolation Valve and verify that the valve fully closes and no water is flowing to the Unit 1 Cooling Tower.

d. Acceptance criteria

The safety-related cooling tower makeup isolation valves close on a simulated high water level in the Unit 1 Turbine Building under conditions of full makeup flow to the Unit 1 Cooling Tower.

14.2.12.1.57 Emergency Service Water Screen Wash System Preoperational Test

a. Test Objective

To verify the ability of the Emergency Service Water Screen Wash System to perform within design specification.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Instrument Air System is available.

c. Test Procedure

1. Performance of the ESW Screen Wash pumps is verified to be within design specification. Pump head is checked for consistency with design specifications.

2. Proper system response to LOCA signals is verified.

3. Even spray from the traveling screens' spray nozzles verified.

4. Spray from the trough wash nozzles is verified.

5. Performance of the ESW Screen Wash Traveling Screens is verified to be within design specifications. Proper screen slow and fast speed travel rates are verified.

6. Proper operation of system alarms and control functions is verified.

d. Acceptance Criteria

1. ESW Screen Wash pumps meet their discharge head requirements and perform within the specified operating limits.

2. ESW Screen Wash Traveling Screens meet the required fast and slow speed travel rates.

14.2.12.1.58 Solid Radwaste Disposal System Preoperational Test

a. Test Objective

To verify the ability of the Solid Radwaste Disposal System to perform within design specifications.

b. Prerequisites

1. Individual component tests are completed and approved.

2. All permanently installed instrumentation is properly installed, calibrated and operable.

3. Electrical power sources are available.

4. Instrument Air System is available.

5. Service Air System is available.

6. Liquid Radwaste System is available.

7. Radwaste Building Ventilation System is available.

8. Condensate Storage and Transfer System is available.

c. Test Procedure

1. Demonstrate that the control functions, interlocks, permissives, and automatic operation performs under dynamic conditions.

2. Verify by demonstration that the Solid Radwaste System Waste Transfer Pump operates satisfactorily.

3. Verify by demonstration that the Solid Radwaste System remotely operated valves operate under dynamic conditions.

d. Acceptance Criteria

1. All interlocks and automatic operations perform within design specifications.

2. All system components and operations of the Solid Radwaste System perform within the design specifications.

14.2.12.1.59 Redundant Reactivity Control Systems Preoperational Test

a. Test Objective

To demonstrate the capability of the Redundant Reactivity Control System (RRCS) to mitigate the potential consequences of an Anticipated Transient Without Scram (ATWS) event.

b. Prerequisites

1. Construction is complete to the extent necessary to perform this test.

2. RRCS controls and instrumentation are calibrated and operable.

3. Electrical power is available as required.

4. The following systems are available to the extent necessary to accept RRCS logic outputs as applicable.

   (a) Reactor Recirculation System

   (b) Control Rod Drive System

   (c) Standby Liquid Level Control System

   (d) Neutron Monitoring System

   (e) Feedwater Control System

5. Communications are established as required to perform this test.

c. Test Procedure

1. Each division's logic channels and controls are initiated using simulated signals as necessary to create a trip condition, while the redundant divisional panel is out-of-service. This includes operation of the RRCS with normal power and loss of normal power.

2. All seal-ins, resets and timing functions are functionally tested.

3. The self-test system is functionally tested.

4. RRCS alarms and status indications are functionally tested.

d. Acceptance Criteria

1. Alarms and status indications operate properly per the approved drawings.

2. Seal-ins, reset features and timing functions operate properly per the approved drawings.

3. Each division of the RRCS, independently, properly initiates or demonstrates the occurrence and timing of the following events based on type of initiation signal.

(a) Recirculation Pump Trip or shift to low speed.

(b) Standby Liquid Level Control Pump Trip.

(c) Control Rod Alternate Rod Insertion.

(d) Feedwater System Runback.

(e) Nuclear Boiler System input response times as specified.

(f) Low Frequency Motor Generator Sets start and/or trip.

(g) SLC System Pump interlocks.

14.2.12.1.60 Postaccident Radiation Monitoring System Preoperational Test

a. Test Objective

To demonstrate the operability of the postaccident radiation monitoring system.

b. Prerequisites

1. Component tests and calibrations are complete to the extent necessary to perform this test for the following items:

   (a) Particulate and Iodine sampler.

   (b) TSC airborne monitor.

   (c) TSC radiation monitor.

   (d) High range monitors.

   (e) Plant effluent gaseous airborne monitors.

2. Instrument air is available.

3. Electric power is available.

4. HVAC system in the TSC is operable.

c. Test Procedure

1. The postaccident radiation monitoring system is demonstrated by the integrated operation of the channel trip unit, alarm annunciators, lights, and recorders (as applicable) for the following:

   (a) Particulate and Iodine sampler.

   (b) TSC airborne monitor.

   (c) TSC radiation monitor.

   (d) High range monitors.

   (e) Plant effluent gaseous airborne monitors.

2. System interlocks are actuated or simulated signals injected as required.

d. Acceptance Criteria

1. Sample and purge flows are within specified ranges for the particulate and Iodine sampler.

2. TSC airborne monitor indicate the specified count rate.

3. TSC area monitor failure and alarm lights perform as specified.

4. High range area monitor indicator display values agree with acceptable display values.

5. The effluent gaseous monitor system is able to receive and execute commands, as specified, from the operator via the microcomputer.

6. Interlocks function correctly as specified.

14.2.12.1.61 Feedwater Leakage Control System (FWLCS) Preoperational Test

a. Test Objectives

To demonstrate the operability of the FWLCS.

b. Prerequisites

1. System component tests and instrument calibrations are complete to the extent necessary to perform this test.

2. Electrical power is available.

3. The reactor vessel and feedwater headers are available to receive water.

4. The following valves are operable, B21-F065A and B, B21-F032A and B and B21-F059A and B.

5. LPCS and RHR waterleg headers and pumps are available.

6. The suppression pool is available to supply water to the LPCS and RHR waterleg pumps.

c. Test Procedure

1. System valve interlocks, permissives, controls, and status indications are functionally tested.

2. Seal water flow is established to each injection point from the LPCS and/or the RHR waterleg pumps as applicable.

d. Acceptance Criteria

1. The FWLC system controls, interlocks, permissives, and status indication operate properly.

2. The LPCS and RHR waterleg pumps can provide seal water to the inboard and outboard isolation seals, as applicable, using the suppression pool as a source.

14.2.12.1.62 Penetration Pressurization System Preoperational Test

a. Test Objectives

1. To determine the leak rates associated with the two Containment Air Locks, Drywell Air Lock, Containment Equipment Hatch, Drywell Equipment Hatch, and each piping penetration with expansion bellows.

2. To demonstrate the operability of all personnel air locks.

b. Prerequisites

1. The automatic leak rate monitors are operable and calibrated.

2. Electrical power and instrument air are available.

3. Instrumentation and controls are calibrated and operable to the extent necessary to perform this test.

c. Test Procedure

1. Airlock doors are operated in both the entering and exiting sequence.

2. Each automatic leakage monitor is operated.

3. The leak rate is measured for each personnel airlock, equipment hatch and piping penetration with expansion bellows.

4. Controls, alarms and indication are functionally tested.

d. Acceptance Criteria

1. Measured leak rates are less than or equal to allowable limits.

2. Airlock doors, door interlocks, door status indications, local and remote alarms, and automatic valves operate properly.

3. Automatic leak rate monitors function properly and provides alarms for excessive leak rates.

14.2.12.1.63 Postaccident Sampling System Preoperational Test

a. Test Objective

To demonstrate the operability of the postaccident sampling system.

b. Prerequisites

1. System component tests and instrument calibrations are complete to the extent necessary to perform this test.

2. Electrical power is available

3. Sampling points are available.

4. Demineralized flush water and nitrogen purge are available.

5. Liquid Radwaste Sump System is available to receive P87 panel waste.

c. Test Procedure

1. System components and status indication are functionally tested.

2. Actual sample flows are established from each sample point, analyzed as required, and compared to appropriate grab samples.

d. Acceptance Criteria

1. System sample pumps and sample return pumps provide adequate sample flows.

2. The liquid sample coolers maintain proper sample temperatures.

3. Component controls and status indication devices function properly.

4. The system is capable of obtaining process samples from all specified sampling points and the sample lines are flushed or purged as applicable.

5. The system is capable of performing and/or supporting chemical and radiochemical analysis as specified.

14.2.12.1.64 ATWS Class 1E Uninterruptible Power Supply Preoperational Test

a. Test Objective

To demonstrate proper operation of the ATWS Class 1E uninterruptible ac power system.

b. Prerequisites

1. System component test and instrument calibrations are complete to the extent necessary to perform this test.

2. DC power is available to dc distribution panels.

3. AC power is available.

c. Test Procedure

1. Operation of the Manual Bypass and Static Transfer Switches is functionally tested.

d. Acceptance Criteria

1. Division 1 and Division 2 ATWS inverters are capable of supplying power within specified limits while receiving power from the station batteries.

2. The Manual Bypass Switch associated with each inverter allows transfer and retransfer of power source without interruption of power to the supplied load.

3. Upon loss of inverter output source, the static transfer switch transfers the load to the ac Bypass Loop within specified time requirements.

4. Upon restoration of inverter output source the load is automatically transferred from the ac Bypass Loop to the inverter output without interruption of power to the load.

14.2.12.1.65 Emergency and Essential Lighting Systems Preoperational Test

a. Test Objectives

To demonstrate the ability of the essential and emergency lighting systems to provide minimum illumination levels during loss of normal lighting.

b. Prerequisites

1. Individual component initial checkout and run-in tests are complete.

2. Unit 1 and Unit 2 non-Class 1E 125 Vdc systems (R42) are available for service.

3. The non-Class 1E 480V motor control center (R24) is available for service.

c. Test Procedure

1. The essential lighting is energized from its normal source, then normal lighting is turned off and illumination levels are determined.

2. A simulated loss of power to all emergency lights is performed to verify that each emergency light comes "ON" with loss of power and turn "OFF" when power is restored. Lighting levels are determined.

3. A simulated loss of power for eight (8) hours is performed to verify that each self-contained emergency battery lighting unit comes "ON" with loss of power and goes "OFF" when power is restored. Lighting levels are determined.

4. Each of the self-contained emergency battery lighting units battery chargers is tested to verify proper operation.

d. Acceptance Criteria

1. All essential lights function properly and provide minimum illumination at equipment required for shutdown and in corridors, passageways and stairways.

2. All emergency lights automatically come "ON" during a simulated loss of power and conversely go "OFF" when power is restored. The emergency lights provide minimum illumination at equipment required for shutdown and in corridors, passageways and stairways.

3. All self-contained emergency battery lighting units automatically turn "ON" during a simulated loss of power and conversely turn "OFF" when power is restored. The

self-contained emergency battery lighting units provide minimum illumination at equipment required for shutdown and in corridors, passageways and stairways for a minimum of eight (8) hours after loss of power.

4. Each self-contained emergency battery lighting unit battery charger recharges the battery to its rated capacity or greater within acceptable time limits.

14.2.12.1.66 Engineered Safety Features (ESF) Systems Air Cleaning Units Preoperational Tests

a. Test Objective

1. To demonstrate that ESF Air Cleaning Units satisfy the Inplace Testing Criteria and the Laboratory Testing Criteria for Activated Carbon as required by <Regulatory Guide 1.52> Revision 2, with exceptions per <Table 1.8-1>.

b. Prerequisites

1. Construction activities are complete to the extent necessary to assure that the inplace leakage testing is not invalidated.

2. Testing personnel are qualified per Section 4.3 of ANSI N510-1980 prior to conducting this test.

3. Housing Leak Tests are complete per Section 6 of ANSI N510-1980.

4. Mounting Frame Pressure Leak Tests are complete per Section 7 of ANSI N510-1980.

5. The system Air Balance is complete.

6. Airflow capacity Tests are complete per Section 8.3.1 of ANSI N510-1980 except the HEPA filters, charcoal and roughing filters are not installed. Clean and dirty pressure drops are simulated.

c. Test Procedure

1. A visual inspection of the air cleaning system and all associated components is made in accordance with the provisions of Section 5 of ANSI N510-1980 before the inplace airflow distribution test.

2. The airflow distribution to each HEPA filter bank and to each charcoal adsorber is tested in accordance with the provisions of Section 8 of ANSI N510-1980.

3. The Air-Aerosol Mixing Uniformity test is completed in accordance with the provisions of Section 9 of ANSI N510-1980 prior to inplace leak tests.

4. An inplace leak test for the HEPA filter banks is performed in accordance with Section 10 of ANSI N510-1980.

5. An inplace leak test for the charcoal adsorber is tested in accordance with Section 12 of ANSI N510-1980.

6. The following conditions are documented:

   (a) The loaded activated charcoal meets the qualification and batch test results summarized in Table 5.1 of ANSI N509-1976.

   (b) Representative samples of loaded activated charcoal are contained in the sample canister.

d. Acceptance Criteria

1. The airflow distribution to the HEPA filter bank and the charcoal adsorber stage is within ±20% of the average flow through the air cleaning unit.

2. The inspection and sample parts are located and identified such that the air-aerosol mixing is acceptable (the maximum and minimum concentration readings are ≤20% of the average concentration reading) or properly designed sample or injection manifolds or multiple point sampling is used for the inplace leak tests.

3. HEPA filter bank penetration is <.05% at the air cleaning units rated airflow.

4. The charcoal adsorber stage bypass leakage through the adsorber is <.05% (i.e., penetration <.05%).

5. The visual inspection is acceptable.

6. The laboratory testing requirements of the loaded charcoal are verified acceptable.

7. Representative samples of the loaded charcoal are contained in the sample canisters and the sample canisters are installed.

14.2.12.1.67 Plant Environmental Conditions Preoperational Test

a. Test Objective

1. To demonstrate that the direction of air flow for Unit 1 and common zones is from areas of low potential radioactivity to

areas of higher potential radioactivity during plant operation, excluding containment.

2. To demonstrate the offgas building and heater bay ventilation systems exhaust fans maintain a negative pressure within the areas from which these exhaust fans take a suction.

b. Prerequisites

1. Communications are established between the control room and personnel performing the test.

2. HVAC systems preoperational and acceptance tests are complete.

3. Plant is structurally complete and in a normal operating configuration.

c. Test Procedure

1. Unit 1 and common HVAC systems are operated in their normal configurations (summer and winter modes).

2. Smoke generators are actuated at specified points in the Unit 1 and common areas and direction of airflow is observed and recorded.

3. The offgas building and heater bay ventilation areas differential pressure with respect to contiguous areas is measured.

d. Acceptance Criteria

1. Direction of air flow for Unit 1 and common zones is from areas of low potential radioactivity to areas of higher potential radioactivity.

2. The offgas building exhaust and heater bay ventilation systems exhaust fans maintain a negative differential pressure with respect to contiguous areas.

14.2.12.2 Startup Test Procedures

All tests comprising the startup test phase <Table 14.2-2> are discussed in this section. For each test, a description is provided for test objective, test prerequisites and initial conditions, test instruction and statement of test acceptance criteria, where applicable.

a. Certain tests which are not considered "Startup Tests" but which are needed to support startup testing, i.e., control system tune-ups, are performed as Periodic Test Instructions (PTI's). The intent of these PTI's is to provide optimal control system performance and response to transient conditions purposely injected by:

1. Permanently installed switches designed to inject a control signal step change, or

2. A step generator designed for adjustability, easy installation into a test circuit box installed in the control loop with the ability to pass the permanent plant control system signal from the main control room with a small bias, or

3. A ramping change in the control signal by creating a controller setpoint and feedback signal deviation in the

"Manual" mode and then placing the controller in the "Automatic" mode.

b. The PTI's are performed to support the startup testing effort and any of the three previously mentioned methods is used when initiating transient conditions throughout the performance of the following PTI's:

1. PTI-B33-P0001 - Recirculation System Tune-up

2. PTI-C34-P0001 - Feedwater Control System Tune-up

3. PTI-C85-P0001 - Pressure Control System Tune-up

4. PTI-E12-P0001 - RHR Steam Condensing Mode Tune-up

5. PTI-C11-P0001 - CRD Hydraulic System Tune-up

6. PTI-E51-P0001 - RCIC System Tune-up

c. The PTI's are in Volume 7C of the Operations Manual and are reviewed and approved in accordance with plant administrative procedures and are based on control system tune-up instructions provided by General Electric.

During startup transient testing, selected safety-related Emergency Response Information System parameters were monitored.

In describing the purpose of a test, an attempt is made to identify those operating and safety oriented characteristics of the plant which are being explored. Where applicable, a definition of the relevant acceptance criteria for the test is given and is designated either Level 1, Level 2 or Level 3.

1. Acceptance Criteria for Level 1

If a Level 1 test criterion is not satisfied, the plant is placed in a hold condition that is judged to be satisfactory and safe, based upon prior testing. Plant operating or test procedures, or the Technical Specifications, may guide the decision on the direction to be taken. Startup tests consistent with this hold condition are continued. Resolution of the problem is immediately pursued by appropriate equipment adjustments or through engineering support by offsite personnel if needed. Following resolution, the applicable test portion is repeated to verify that the Level 1 requirement is satisfied. A description of the problem resolution is included in the report documenting the successful test.

2. Acceptance Criteria for Level 2

If a Level 2 test criterion is not satisfied, plant operating or startup test plans are not necessarily altered. The limits stated in this category are usually associated with expectations of system transient performance, and whose characteristics can be improved by equipment adjustments. An investigation of the related adjustments, as well as the measurement and analysis methods, is initiated.

If all Level 2 requirements in a test are ultimately met, there is no need to document a temporary failure in the test report; unless there is an educational benefit involved. Following resolution, if equipment adjustments or corrective actions are required to fix the problems then the test is repeated to verify that the Level 2 requirement is satisfied.

If a certain controller-related Level 2 criterion is not satisfied after a reasonable effort, then the control engineers may choose to document that result with a full explanation of their recommendations. This report discusses alternatives of action, as well as the concluding recommendation, so that it can be evaluated by all related parties.

3. Acceptance Criteria for Level 3

If Level 3 performance is not satisfied, plant operating or startup test plans are not necessarily altered. The numerical limits stated in this category are associated with expectations of plant subsystem, individual component or inner control loop transient performance. Because overall system performance is a mathematical function of its individual components, one component whose performance is slightly worse than specified is accepted if a system adjustment elsewhere positively overcomes this small deficiency. Level 3 performance is not specified in fuel or vessel protective systems.

If all Level 1 and Level 2 criteria are satisfied, then it is not required to repeat the transient test to satisfy Level 3 performance. The occurrence is documented in the test report.

d. Control System Operating Modes

Specific control systems operating modes were required for the performance of various startup tests. <Table 14.2-7> provides a description of control system operating modes referenced in the startup test descriptions.

e. Plateau Instructions

A controlling instruction was written for each test plateau which identified those startup tests scheduled for each test plateau and for each test condition within these plateaus and provided a means to ensure that all outstanding items were satisfactorily completed before entering the next test condition/plateau. These plateau instructions followed the same format and approval process as the other startup tests.

14.2.12.2.1 Test Number 1 - Chemical and Radiochemical

a. Test Objective

This test collects chemical and radiochemical data for use in analyzing plant operations. During various plant conditions data is collected from the following systems: Reactor Water, Condensate, Feedwater, Control Rod Drive Water, Condensate Demineralizer, Reactor Water Cleanup, Main Steam, and Liquid Radwaste. Using established methods and approved procedures, the analysis of the samples is conducted and the results reviewed.

Chemistry data is collected prior to fuel load, prior to heatup, during heatup, power ascension, and during the “No RWCU” test. The radiation doses at selected locations on Recirculation Piping and RWCU piping are measured after plant shutdown to identify any buildup of radioactive crud in the piping.

General Chemistry data is collected at various test conditions to gain baseline data to be analyzed and used for future plant testing.

The purpose for testing the chemical and radiochemical parameters of the plant are first; to verify that chemical parameters of the reactor coolant and selected support systems meet acceptable limits and second; to determine, using approved plant procedures, the adequacy of sampling equipment and analytical procedures/techniques for sampling. Additional objectives for this test are to evaluate fuel performance, confirmation of condenser integrity, demonstrate proper steam separation-dryer operation, and to measure and calibrate certain process instrumentation.

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. The following systems are available for operation: Reactor water cleanup, condensate demineralizers, fuel pool cooling, and cleanup. Chemistry personnel are available to draw and analyze samples and sample systems are operational.

c. Test Instruction

Prior to fuel loading, samples are taken to determine initial concentrations. Subsequent to fuel loading during reactor heatup and at each major power level change, samples are taken and measurements are made to determine the chemical and radiochemical quality of reactor water, chemical quality of reactor feedwater, gaseous activities at the offgas charcoal bed inlet, and performance of filters/demineralizers. Also, if necessary, NaOH is injected into the reactor water to increase the Na-24 activity levels to aid in determining moisture carryover in the steam at the reactor exit.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. Chemical factors defined in the Operational Requirements Manual Fuel Warranty are maintained within the limits specified.

2. The activity of gaseous and liquid effluents conform to license limitations.

3. Water quality is known at all times and remains within the guidelines of the Water Quality Specifications.

Acceptance Criteria for Level 2:

1. Moisture carry-over should be less than 0.1%.

14.2.12.2.2 Test Number 2 - Radiation Monitoring

a. Test Objective

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

b. Prerequisites

The preoperational tests are complete as applicable. The appropriate instruments are calibrated. Radiation Base Point

Identifiers are placed in the specified locations. Source checks are performed on the required instruments during the previous 24 hours.

c. Test Instruction

A survey of natural background radiation throughout the plant is made prior to fuel loading. Subsequent to fuel loading, during reactor heatup and at nominal power levels of 20-25 percent, 60 percent, and 100 percent of rated power, gamma dose rate measurements, and where appropriate, neutron dose rate measurements are made at significant locations throughout the plant. All potentially high-radiation areas are surveyed.

Surveys are also performed before and after a Reactor Water Cleanup resin transfer and during transfer of the startup neutron sources through the inclined transfer tube.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

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

14.2.12.2.3 Test Number 3 - Fuel Loading

a. Test Objective

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

b. Prerequisites and Initial Conditions

Prerequisites to fuel loading are established in <Section 14.2.10> and the tests required thereby are implied in those prerequisites. The PORC reviews the recommendation to load fuel and approval to load fuel is given by the Plant Manager.

c. Test Instruction

Fuel loading commences with the loading of four fuel assemblies around the central neutron source. Loading continues per a specific loading plan until all assemblies are loaded.

During fuel loading, the fuel loading chamber's response is monitored and recorded and utilized to maintain inverse multiplication plots.

Control rod functional tests, subcriticality checks and a partial core shutdown margin demonstration are performed periodically during the loading.

The subcriticality, shutdown margin, and SRM tests performed during fuel load are considered physics tests since these tests either verify proper operation of the reactor instrumentation, or verify fundamental nuclear characteristics.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The partially loaded core is subcritical by at least 0.38 percent Δ k/k with the analytically strongest rod fully withdrawn.

14.2.12.2.4 Test Number 4 - Full Core Shutdown Margin

a. Test Objective

The purpose of this test is first to demonstrate that the reactor is subcritical throughout the first fuel cycle with any single control rod fully withdrawn and second to determine quantitatively the shutdown margin of the as-loaded core.

b. Prerequisites and Initial Conditions

The fuel loading procedure is complete. All operable Source Range and Intermediate Range Monitors are fully inserted. The reactor is subcritical and all control rods are fully inserted.

c. Test Instruction

This test is performed in the fully loaded core in the xenon-free condition during open vessel testing. The control rods are withdrawn in sequence until all Group 1 and Group 2 control rods are fully withdrawn, at which point reactor subcriticality demonstrates that required shutdown margin exists throughout the entire first cycle. Afterwards, control rod withdrawals resume until criticality is reached. At the time of criticality, the stable reactor period is determined using the Source Range Monitor (SRM) Log Count Rate meters or measured using a stop watch. With reactivity adjustments for the reactor period, moderator temperature, and the peak reactivity point in the cycle, the minimum shutdown margin for the first cycle is determined quantitatively. During the shutdown margin calculation, adjustment is made for the difference between the measured K_{eff} and the calculated K_{eff}.

This test is considered a physics test since shutdown margin is a fundamental nuclear characteristic.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The shutdown margin of the fully loaded, cold (68°F), xenon-free core occurring at the most reactive time during the cycle is at least 0.38% Δ k/k with the analytically strongest rod (or its reactivity equivalent) withdrawn. If the shutdown margin is measured at some time during the cycle other than the most reactive time, compliance with the above criteria is shown by demonstrating that the shutdown margin is 0.38% Δ k/k plus an exposure dependent increment which adjusts the shutdown margin at that time to the minimum shutdown margin.

Acceptance Criteria for Level 2:

1. Criticality occurs within ±1.0 percent Δ k/k of the predicted critical.

14.2.12.2.5 Test Number 5 - Control Rod Drive System

a. Test Objective

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

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. Fuel loading is complete for the fuel cell associated with the control rod drive to be tested. Communications are established between the control room and hydraulic control unit associated with the control rod drive to be tested.

c. Test Instruction

The CRD tests performed during the startup test program are designed as an extension of the tests performed during the preoperational CRD system tests. Thus, after it is verified that all control rod drives operate properly when installed, they are tested periodically during heatup to assure that there is no significant binding caused by thermal expansion of the core components. The control rod drive tests performed during startup testing include coupling, friction and timing tests. The timing tests check scram times, and both single and ganged rod insertion and withdrawal times. The friction tests are done by recording a differential pressure trace during control rod insertion.

The components of CRD systems are designed, fabricated, and installed to provide the stipulated scram performance at a reactor pressure of 1,085 psig, measured at the bottom head. At lower reactor pressures, scram times may not exceed those at 1,085 psig.

The timing tests are considered physics tests since reactivity addition rates are a fundamental nuclear characteristic.

	Test Conditions Reactor Pressure with Core Loaded psig (kg/cm^2)			
Action	0	600(42.2)	800(56.2)	Rated
Position Indication	all			
Insert/Withdraw				
a) Single CRD Continuous Modes	all			
b) Gang Groups Continuous Modes	all			
Coupling	all			
Friction	all			50%(3)
Cooling Water Flow Rates (Total)				1
Individual CRD Scram	all	4(1)	4(1)	all
Individual CRD scram				4(2)

Single CRD scrams are performed with the charging valve closed.

NOTES:

(1) Refers to four CRDs selected for continuous monitoring based on slow normal accumulator pressure scram times as determined from preoperational testing, or unusual operating characteristics. The "four selected CRDs" are compatible with the requirements of both the withdrawal sequence and the installed rod movement limitation systems.

(2) Scram times of the four slowest CRDs that are fully withdrawn are determined at Test Conditions 1, 6, and 8 before or during planned reactor scrams.

(3) Rods tested are chosen by the Test Director. If hot test pressure for one or more drives exceeds maximum allowable pressure, test all drives and perform corrective action on all drives exceeding maximum allowable pressure.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. Each CRD has a normal withdraw speed less than or equal to 3.6 inches per second, indicated by a full 12-foot stroke in greater than or equal to 40 seconds.

2. The scram insertion time of each control rod from the fully withdrawn position, based on opening of contacts of main scram contactor (de-energization of the scram pilot valve solenoids) at time zero, does not exceed the acceptance criteria provided in the General Electric Startup Test Specifications. This includes the limit that the total number of "slow" drives (per the General Electric Startup Test Specification) does not exceed 7.

Acceptance Criteria for Level 2:

1. Each CRD has a normal insert and withdraw speed of 3.0±0.6 inches per second, indicated by a full 12 foot stroke in 40 to 60 seconds.

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

<u>NOTE</u>: For Perry, the differential setting pressure is nominally 5 psid higher at the 00 position than at any other position due to the functioning of the spring actuated buffer piston located at the top of the drive.

3. The CRD’s total cooling water flow rate is between 0.28 and 0.34 gpm times the total number of drives.

4. For vessel pressures below 950 psig, the maximum scram time of individual fully withdrawn CRD’s complies with the criteria given in the GE Startup Test Specifications.

5. Buffer time (pickup of position indicator probe switch “52” to drop out of “52”) is not less than 10 milliseconds when scram testing at nominal accumulator conditions with the reactor open to the atmosphere and 15 milliseconds at nominal accumulator conditions with the reactor at rated pressure.

6. In the continuous ganged rod mode, the rods move together so that all rods are within two notches of all other rods.

Acceptance Criteria for Level 3:

1. Upon receipt of a simulated or actual scram signal, the Flow Control Valve (FCV) closes to its minimum position within 10 to 30 seconds.

2. The CRD system flow does not change by more than ±3.0 gpm as reactor pressure varies from atmospheric to rated pressure.

3. The decay ratio of any oscillatory controlled variable is less than 0.25 for any flow setpoint changes or for system disturbances caused by the CRD’s being stroked.

14.2.12.2.6 Test Number 6 - SRM Performance and Control Rod Sequence

a. Test Objective

The purpose of this test is to demonstrate that the neutron sources, SRM instrumentation and rod withdrawal sequences provide adequate information to achieve criticality and increase power in a safe and efficient manner.

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. The Source Range Monitor (SRM) and Intermediate Range Monitor (IRM) systems are calibrated and functionally checked. The IRM system is connected to the reactor protection system. The SRM's are in the non-coincidence scram mode.

c. Test Instruction

The SRM's are functionally tested when they are first used to monitor neutron flux. This occurs, during the fuel loading phase in conjunction with Test Number 3, Fuel Loading, and is done with the neutron sources installed and with all control rods inserted. During the functional test, the SRM's are checked to verify that the neutron signal count-to-noise count ratio is at least 2:1 and to verify a minimum count rate of 0.7 counts/second (cps) on the required operable SRM's.

During plant heatup a non-saturation check of the SRM's is performed.

Movement of rods in a prescribed sequence is monitored by the Rod Control and Information System which enforces specific rules regarding rod movement based on power level, rod sequence and rod group. Rod movement is made within the guidelines enforced by the Rod Pattern Control System.

This test is considered a physics test since it verifies proper operation of the reactor instrumentation.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. There is a neutron signal count-to-noise count ratio of at least 2 to 1 on the required operable SRM's.

2. There is a minimum count rate of 0.7 counts/second on the required operable SRM's.

14.2.12.2.7 Test Number 8 - Rod Sequence Exchange

a. Test Objective

The purpose of this test is to perform a representative sequence exchange of control rod patterns at a significant power level.

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. The rod movement sequence is available from Reactor Engineering. The Traversing Incore Probe (TIP) system is operable. The process computer is operable. Core power is reduced such that all nodal powers are at an acceptable level below operating limits for the exchange.

c. Test Instruction

Rod patterns are periodically exchanged during plant operations to more nearly equalize fuel assembly exposures. This test is performed as an example of the exchanges which are made throughout plant life, and is provided to illustrate the principles involved. It is performed as close as possible to 1,000 MWD/T core exposure. The control rod sequence exchange begins on the 100 percent load line by reducing core flow and reducing thermal power to a lower value to keep nodal powers below limits during the sequence exchange. Also, in reducing thermal power, care is taken to avoid exceeding the design limits of the core total peaking factor. The ensuing steps involve utilizing the process computer, specifically P1 and Subprograms OD-1, 2, 3, 7, 8 and 14g, followed by Average Power Range Monitor (APRM) data and extensive utilization of the TIP machines. The exchange is performed a row or column at a time.

Acceptance Criteria for Level 1:

1. Complete the exchange of one rod pattern for the complimentary pattern with continual satisfaction of all licensed core limits.

14.2.12.2.8 Test Number 10 - Intermediate Range Monitor Performance

a. Test Objective

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

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. SRM’s are in the non-coincidence scram mode (only one SRM scram signal needed to scram) prior to demonstrating IRM response to neutron flux and full-core shutdown margin. The IRM’s are fully inserted.

c. Test Instruction

Initially the IRM system is set to the values of gain determined during preoperational testing. During the initial startup all IRM’s are verified to respond to neutron flux. During the condition when the reactor power is sufficient to produce adequate counts/second on the SRM’s, SRM-IRM overlap is verified.

At a condition between reactor critical and rated temperature, the IRM range correlation adjustment is verified. During the power increase to test condition Heatup, IRM-ARPM overlap is verified. With the IRM’s fully inserted, the IRM’s are not reading near the upscale trip on the highest range when the APRM’s are reading near their downscale trip, 3 to 5 percent rated power. There is approximately one decade overlap of IRM’s with the APRM’s. If any gain adjustments are made during this verification, SRM-IRM overlap is verified again at the first opportunity. After the first LPRM calibration the IRM-APRM overlap is rechecked at the first opportunity.

This test is considered a physics test since it verifies proper operation of the reactor instrumentation.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. Each IRM channel is on scale before the SRM’s exceed their rod block setpoint. Each APRM is on scale before the IRM’s exceed their rod block setpoint.

Acceptance Criteria for Level 2:

1. Each IRM channel is adjusted so that a half decade overlap with the SRM's and one decade overlap with the APRM's are assured.

14.2.12.2.9 Test Number 11 - LPRM Calibration

a. Test Objective

The purpose of this test is to calibrate the local power range monitoring system and to verify the LPRM flux response.

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. The Traversing Incore Probe (TIP) system is operable.

Steady-state equilibrium xenon conditions are attained. Prior to the first LPRM calibration, the gain of each LPRM amplifier is set at the specified value.

c. Test Instruction

Using TIP data, the LPRM channels are calibrated to make the LPRM readings proportional to the neutron flux in the LPRM water gap at the chamber elevation. Calibration factors are obtained through the use of either an offline or a process computer calculation that relates the LPRM reading to average fuel assembly power at the chamber height.

The LPRM system is calibrated during the initial startup test program at the power levels of the various tests during the power ascent.

This test is considered a physics test since it verifies proper operation of the reactor instrumentation.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. Each LPRM reading is within 10 percent of its calculated value.

14.2.12.2.10 Test Number 12 - APRM Calibration

a. Test Objective

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

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. The LPRM system and the process computer (or other means for determining the heat balance) are operable. The APRM flow biased scram and rod block are set to the specified level. The reactor is operating at constant power and flow conditions.

c. Test Instruction

At a power level high enough to obtain an accurate heat balance, a heat balance is done periodically and after each major power level change. Each APRM channel reading is adjusted to be consistent with the core thermal power as determined from the heat balance. Before the APRM's are calibrated at power, they are set at maximum gain with reduced scram and rod block settings to provide conservatism prior to the calibration. During nuclear heatup the APRM's are calibrated using a constant heatup rate heat balance. A more accurate heat balance is performed in the power range when adequate feedwater indication is available.

This test is considered a physics test since it verifies proper operation of the reactor instrumentation.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

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

2. Technical Specification and Fuel Warranty Limits on APRM scram and rod block are not exceeded.

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

Acceptance Criteria for Level 2:

1. If the above criteria are satisfied, then the APRM channels are considered to be reading accurately if they agree with the heat balance, (to within +2, -2 percent of rated power as required by the Technical Specifications) or the value required by the Technical Specifications (based on the ratio of CMFLPD to FRTP).

14.2.12.2.11 Test Number 13 - NSSS Process Computer

a. Test Objective

The purpose of this test is to verify the performance of the NSSS Process Computer and online NSSS computer programs under plant operating conditions.

b. Prerequisites and Initial Conditions

Computer hardware is checked out and operational. The computer stored data is compared to the GE supplied NSSS data. The TIP system is operable and the reactor power distribution is constant. The control rod pattern has octant symmetry.

c. Test Instruction

The process computer system program verifications and calculational program validations at static and at simulated dynamic input conditions are preoperationally tested. Following fuel loading, during plant heatup, and the ascension to rated power, the nuclear steam supply system and the balance-of-plant system process variable values sensed by the computer as digital or analog signals are verified to be received correctly. The results of performance calculations of the nuclear steam supply system and the balance-of-plant using these variable values, are also verified correct.

The process computer to TIP interfacing and the OD-1 program are checked out at static input conditions after fuel loading and prior to the initial heatup. At Test Condition HU, the proper TIP alignment is adjusted as necessary to allow for system expansion. At steady-state power of Test Conditions 1 or 2, 3, 5, and 6, selected phases of the Dynamic System Test Case (DSTC) are performed. The DSTC checks the operation of the online NSSS programs using actual plant operating values of NSSS process variables. At Test Condition 1 or 2, operability checks of Programs OD-2, OD-9 and OD-18 are made. Data is collected using OD-12 for transmittal to General Electric NEBO for evaluation. The P1 program is tested in various symmetry modes to verify consistency.

At Test Condition 6, full power data is collected for transmittal to General Electric NEBO for evaluation. At the steady-state operating state of the various test conditions, a comparison of heat balance and core thermal limit calculations is made between the online programs and offline heat balance calculation along with the offline program BUCLE. BUCLE is used to verify core performance until the online programs are validated.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

Programs OD-1, P1 and OD-6 are considered operational when:

1. The MCPR calculated by BUCLE and these programs either:

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

   (b) For the case in which the MCPR calculated by these programs are in a different assembly than that calculated by BUCLE, for each assembly, the MCPR and CPR calculated by the two methods agree within 2%.

2. The maximum LHGR calculated by BUCLE and these programs either:

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

   (b) For the case in which the maximum LHGR calculated by these programs are in a different assembly than that calculated by BUCLE, for each assembly, the maximum LHGR and LHGR calculated by the two methods agree within 2%.

3. The MAPLHGR calculated by BUCLE and these programs either:

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

   (b) For the case in which the MAPLHGR calculated by these programs are in a different assembly than that calculated by BUCLE, for each assembly, the MAPLHGR and APLHGR calculated by the two methods agree within 2%.

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

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

14.2.12.2.12 Test Number 14 - RCIC System

a. Test Objective

The purpose of this test is to verify the proper operation of the reactor core isolation cooling (RCIC) system over its expected operating pressure range and to demonstrate reliability at power conditions and during RCIC startup.

b. Prerequisites

The preoperational tests are complete as applicable. The ERIS System is operable and the main turbine is offline for vessel injections. Temporary modifications have been made to install a test box and step generator for the specified sections.

c. Test Instruction

The RCIC system is designed to be tested in two ways: (1) by flow injection into a test line leading to the Condensate Storage Tank (CST), and (2) by flow injection directly into the reactor vessel. When testing by flow to the CST a valve is throttled to provide a pump discharge pressure at rated flow of approximately 100 psi greater than vessel pressure to simulate flow to the vessel.

The proper operation and reliability of the system is demonstrated in three basic ways: (1) by reactor vessel/CST injections in the automatic mode, (2) by inputting test signals to the speed and flow controllers and observing the stability of the loop response, and (3) by an extended operation demonstration. The injection stability tests are performed at both 150 psig and rated reactor pressure thus showing capability over the full range of required operation. Two consecutive successful vessel injections from cold conditions, which is defined as no operation for 72 hours, are required to show reliability. The cold vessel injections and stability demonstrations are performed with final controller settings.

A set of benchmark cold quick starts with flow to the CST are performed with final controller settings for comparison with future surveillance tests.

The testing is performed in a building block manner starting with operability checks using flow to the CST when reactor vessel pressure initially reaches 150 psig. Calibration data for the steam flow isolation signal is also obtained and verified.

The test sequence is summarized below:

	Action		Test Conditions
1.	Condensate storage tank injection, manual start.	A.	150 psig reactor pressure.
		B.	Rated reactor pressure, RCIC discharge 100 psi above RPV.
2.	Condensate storage injections step changes in flow for controller adjustments.	A.	Immediately after action with 1 RCIC discharge to condensate storage tank. Manual and automatic control modes.
3.	Condensate storage tank injection Hot quick start.	A.	Rated reactor pressure, RCIC discharge 100 psi above RPV.
		B.	150 psig reactor pressure, RCIC discharge 100 psi above RPV.

	Action		Test Conditions
4.	Condensate storage tank injection extended operation demonstration.	A.	Rated reactor pressure, RCIC discharge 100 psi above RPV.
5.	Reactor vessel injection, manual start, followed by stability demonstration.	A.	Rated reactor pressure. Manual and automatic modes.
		B.	150 psig reactor pressure. Manual and automatic modes.
6.	Reactor vessel injection hot quick start.	A.	Rated reactor pressure.
		B.	150 psig reactor pressure. Manual and automatic modes.
7.	Confirmatory reactor injection, <u>cold</u> quick start.	A.	Rated reactor pressure. Final RCIC controller settings.
8.	Second consecutive confirmatory reactor vessel injection, <u>cold</u> quick start.	A.	Same as 7A.
9.	Condensate storage tank injection for surveillance test base data, <u>cold</u> quick start.	A.	Rated reactor pressure, Final controller settings RCIC discharge approximately 100 psi above RPV.
		B.	150 psig reactor pressure, Final controller settings, RCIC discharge approximately 100 psi above RPV
10.	Condensate storage tank manual injection from remote shutdown panel. Followed by stability demonstration	A.	Rated reactor pressure, RCIC discharge 100 psi above RPV.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The average pump discharge flow is equal to or greater than the 100 percent rated value after 30 seconds have elapsed from automatic initiation (or RCIC manual push button start) at any reactor pressure between 150 psig and rated.

2. The RCIC turbine does not trip or isolate during auto or manual start tests.

If Level 1 Criterion No. 1 is not met, the reactor is only allowed to operate up to a restricted power level defined by <Figure 14.2-7> until the problem is resolved.

Acceptance Criteria for Level 2:

1. The turbine gland seal system is capable of preventing steam leakage to the atmosphere.

2. The delta P switches for the RCIC steam supply line high-flow isolation trip are calibrated to actuate at the value specified in the plant Technical Specifications (about 300%).

3. The speed and flow control loops are adjusted so that the decay ratio of any RCIC system related variable is not greater than 0.25.

4. In order to provide an overspeed and isolation trip avoidance margin, the transient start first and subsequent speed peaks do not exceed 5 percent above the rated RCIC turbine speed.

14.2.12.2.13 Test Number 16A - Selected Process Temperatures

a. Test Objective

The purpose of this test is to assure that the measured bottom head drain temperature corresponds to bottom head coolant temperature during normal operation, to identify any reactor operating modes that cause temperature stratification, to determine the minimum position of the flow control valves which prevent coolant temperature stratification in the reactor pressure vessel bottom head region, and to familiarize plant personnel with the temperature differential limitations of the reactor system.

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. System instrumentation is calibrated.

c. Test Instruction

The adequacy of bottom drain line temperature sensors is determined by comparing it with recirculation loop coolant temperature when core flow is approximately 100% of rated.

During initial heatup while at hot standby conditions, the bottom drain line temperature, recirculation loop suction temperature and applicable reactor parameters are monitored as the recirculation flow is slowly lowered to either minimum stable flow or the low recirculation flow control valve position, whichever is the greater. Utilizing this data it is determined whether coolant temperature stratification occurs when the recirculation pumps are on and if so, what minimum recirculation flow prevents it.

Monitoring the preceding information during planned pump trips determines if temperature stratification occurs in the idle recirculation loops or in the lower plenum when one or more loops are inactive.

Data is analyzed to determine if changes in operating procedures are required.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The reactor recirculation pumps are not started nor is flow increased unless the coolant temperatures between the steam dome and bottom head drain are within 100°F.

2. The recirculation pump in an idle loop is not started, active loop flow is not raised, and power is not increased unless the idle loop suction temperature is within 50°F of the active loop suction temperature. If two pumps are idle, the loop suction temperature is within 50°F of the steam dome temperature before pump startup.

Acceptance Criteria for Level 2:

1. During two pump operation at rated core flow, the bottom head temperature as measured by the bottom head drain line thermocouple is within 30°F of the recirculation loop temperatures.

14.2.12.2.13.1 Test Number 16B - Water Level Reference Leg Temperature

a. Test Objective

The purpose of this test is to measure the reference leg temperature at rated temperature and pressure and steady-state, and ensure recalibration of the instruments if the measured temperature is different than the value assumed during the initial calibration. Temperature data is also taken during heatup testing to verify acceptance criteria for the shutdown range water level instrumentation. The fuel range reference leg temperatures are not verified since this range is calibrated at 0 psig with saturated water and steam conditions in the reactor vessel and drywell.

b. Prerequisites and Initial Conditions

Containment and drywell cooling systems are in normal operation and the temperature in the vicinity of the reference legs is steady-state. The preoperational tests are complete as applicable and system instrumentation has been calibrated.

c. Test Procedure

To monitor the reactor vessel water level, five level instrument systems are provided. These are:

1. Shutdown Range

2. Narrow Range

3. Wide Range

4. Fuel Range

5. Upset Range

These systems are used respectively as follows:

1. Water level measurement in cold, shutdown conditions.

2. Feedwater flow and water level control functions.

3. Safety functions.

4. Postaccident indication.

5. Level indication during transients.

As clarified in the test objective, the test is done at rated temperature and pressure and under steady-state conditions and verifies that the reference leg temperature of the instrument is the value assumed during initial calibration. The atmosphere in the vicinity of the reference legs is measured. This is considered to be the temperature of the reference legs. Data taken during heatup testing is used to verify the acceptance criteria for the shutdown range level instrumentation.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. The difference between the actual reference leg temperature(s) and the value(s) assumed during initial calibration is less than that amount which results in a scale end point error of 1 percent of the instrument span for each range, excepting the fuel range water level instrumentation.

14.2.12.2.14 Test Number 17 - System Expansion

a. Test Objective

The purpose of this test is to confirm that safety-related pipe suspension systems and other systems as identified are working as designed and that the pipe is free of obstructions that could constrain free pipe movement.

b. Prerequisites and Initial Conditions

Instrumentation to monitor displacements and temperatures is installed and calibrated. All construction work and suspension system installation on the affected piping is completed, inspected, and adjusted in accordance with specifications. The ERIS system is available.

c. Test Instruction

The thermal expansion tests consist of measuring displacements and temperatures of piping during various operating modes. This is accomplished by verifying proper thermal movements of snubbers and spring hangers by direct visual monitoring during the initial heatup of the systems whose operating temperature exceeds 250°F. When radiation precludes visual monitoring, direct piping movement is verified using remote sensors. The first power level used to verify expansion is as low as practicable. Thermal movement and temperature measurements are recorded at the following test points:

1. Reactor pressure vessel heatup and hold at one intermediate temperature before reaching normal operating temperature; at this time the drywell piping and suspension are inspected for obstruction or inoperable supports;

2. Reactor pressure vessel heatup and hold at normal operating temperature;

3. Main steam and recirculation piping heatup and hold at normal operating temperature;

4. On three separate heatup/cooldown cycles, measurements are recorded at the operating and shutdown temperatures to measure possible shake down effects.

The piping considered to be within the boundary of this test is listed below:

1. Main steam: Steam lines including the RCIC piping on Line A are tested. Those portions within the scope of the test are bounded by the reactor pressure vessel nozzles and the penetration head fittings.

2. Relief valve discharge piping: The piping attached to the main steam lines and bounded by the relief valve discharge flange and the first downstream anchor are within the scope of the test.

3. Recirculation piping: The recirculation piping, bounded by the reactor pressure vessel nozzles, is within the scope of the test. The RHR suction line from the branch connection to the penetration head fitting is also monitored during the tests.

4. Small attached piping: Small branch piping attached to those portions of piping within the scope of the test is bounded by the large pipe branch connection and the first downstream

guide or anchor. Small branch pipes that cannot be monitored because of limited access are excluded from the scope of this test.

d. Acceptance Criteria

The thermal expansion acceptance criteria are based upon the actual movements being within a prescribed tolerance of the movements predicted by analysis. Measured movements are not expected to precisely correspond with those mathematically predicted. Therefore, a tolerance is specified for differences between measured and predicted movement. The tolerances are based on consideration of measurement accuracy, suspension free play, and piping temperature distribution. If the measured movement does not vary from the predictions by more than the specified tolerance, the piping is expanding in a manner consistent with predictions and is therefore acceptable. Tolerances are the same for all operating test conditions. For the locations to be monitored, actual measurements are compared with predicted displacements.

Acceptance Criteria for Level 1:

1. The Level 1 movement tolerances, which are obtained from GE and included in the test instruction, are intended to set bounds on thermal movement, which if exceeded, require that the test be placed on hold. Pipe does not necessarily converge smoothly to predicted movements with increase in operating temperature: During the first part of the test, vessel movements often move the pipe in a direction opposite of stress report predictions; the pipe also advances in a stepwise fashion due to friction constraint. Level 1 criteria discounts spurious movement measurements that result in unnecessary test holds but still maintains safe limits on movement.

To assure that the criteria is applied at relevant test conditions, the criteria is not applied before the vessel and piping temperatures are at meaningful values. In addition a voting logic is used to discount spurious movements due to instrument malfunction. If the free thermal expansion of the piping is obstructed, movement discrepancies occur at multiple locations because of coupling effects; therefore, in specified cases, if only one instrument out of a pair indicates movements are not within Level 1 criteria, that measurement is discounted as spurious.

Acceptance Criteria for Level 2:

1. Transducer alignment and Level 2 tolerances are obtained from GE and specified in the test instruction. The predicted movements for the various system operating modes are contained in the applicable piping stress reports.

Correlation of Test Data and Analysis:

The predicted movements are based on mathematical calculations that are dependent on assumed nozzle movements and temperature distributions. The measured temperatures and nozzle movements are compared with those assumed in the analysis to determine which analysis condition corresponds to the test condition. Only corresponding conditions are used to evaluate test results. If the test conditions do not correspond to any of those assumed in the analysis, the evaluating Piping Design Engineer finds it necessary to calculate movements based on measurements and compare the predicted movements with the measured movements to establish acceptability.

14.2.12.2.15 Test Number 18 - Core Power Distribution

a. Test Objective

The purpose of this test is to determine the reproducibility of the TIP system readings.

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. The TIP system and process computer are operable. The plant is operating at steady-state power and flow. The local and average power range monitor systems are operable.

c. Test Instruction

TIP reproducibility consists of a random noise component and a geometric component. The geometric component is due to variation in the water gap geometry from TIP location to location. Measurement of these components is obtained by taking repetitive TIP readings at a single TIP location, and by analyzing pairs of TIP readings taken at TIP locations which are symmetrical about the core diagonal of fuel loading symmetry.

One set of TIP data is taken at 75% power or above.

The TIP data is taken with the reactor operating with an octant symmetric rod pattern and at steady-state conditions.

The total TIP reproducibility is obtained by dividing the standard deviation of the symmetric TIP pair nodal ratios by $\sqrt{2}$. The nodal TIP ratio is defined as the nodal BASE value of the TIP in the lower right half of the core divided by its symmetric counterpart in the upper left half. The total TIP reproducibility value that is compared with the test criterion is the average value of the data sets taken.

The random noise uncertainty is obtained from successive TIP runs made at the common TIP location, with each of the TIP machines making six runs. The standard deviation of the random noise is derived by taking the square root of the average of the variances at nodal Levels 5 through 22, where the nodal variance is obtained from the fractional deviations of the successive TIP values about their nodal mean value.

The geometric component of TIP reproducibility is obtained by algebraically subtracting the random noise component from the total TIP reproducibility.

This test is considered a physics test since it verifies proper operation of the reactor instrumentation.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

None

Acceptance Criteria for Level 2:

1. The total TIP uncertainty (including random noise and geometrical uncertainties) obtained by averaging the uncertainties for all data sets is less than 6.0%.

14.2.12.2.16 Test Number 19 - Core Performance

a. Test Objective

The purposes of this test are to evaluate the core thermal power and core flow and to evaluate the following core performance parameters:

1. Maximum linear heat generation rate (MLHGR).

2. Minimum critical power ratio (MCPR).

3. Maximum average planar linear heat generation rate (MAPLHGR).

b. Prerequisites and Initial Conditions

Reactor power and recirculation flow are constant. The Local Power Range Monitor System is calibrated.

c. Test Instruction

In accomplishing the objectives of this test, the core thermal power, flow and thermal hydraulic parameters are determined by using the online NSSS computer programs or the offline computer or, for core thermal power only, by the manual heat balance method. The thermal hydraulic parameters that are evaluated are MLHGR, MCPR and MAPLHGR. The online NSSS programs are used as the primary means to obtain these parameters after it meets the acceptance criteria of Test Number 13. In the interim, prior to acceptance of these programs and during any period when they are out-of-service, the manual heat balance method and the offline computer method, Back Up Core Limits Evaluation (BUCLE), are used to determine the core performance parameters.

The data obtained as part of this instruction is analyzed onsite. The analyzed data results are compared against the test criteria.

This test is considered a physics test since the core thermal limits are a fundamental nuclear characteristic.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The maximum linear heat generation rate (MLHGR) of any rod during steady-state conditions does not exceed the limit specified by the plant technical specifications.

2. The steady-state minimum critical power ratio (MCPR) exceeds the limits specified by the plant technical specifications.

3. The maximum average planar linear heat generation rate (MAPLHGR) does not exceed the limits specified by the plant technical specifications.

4. Steady-state reactor power is limited to 3,579 MWt and values on or below the minimum of either rated thermal power or the bounding licensed load line.

14.2.12.2.17 Test Number 20 - Steam Production Startup Test

a. Test Objective

To demonstrate that the reactor steam production rate is sufficient to satisfy all appropriate warranties as defined in the contract.

b. Prerequisites and Initial Conditions

All plant instrumentation used in performing the test is calibrated. Steady-state conditions are required for the four hours preceding the test. Reactor power is constant during the test.

c. Test Instruction

Compliance with the steam output warranty is demonstrated by a steam output performance test of 100 hours duration. At two separate times during the test, when it is determined that all plant conditions are stabilized, the steam production rate is measured during a 2-hour period at conditions prescribed in the nuclear steam generating system warranty. Test instrumentation and the process computer are used to gather heat balance data. Moisture carryover is determined using radiochemical analysis.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The NSSS parameters as determined by using normal operating procedures are within the appropriate license restrictions.

   The NSSS is capable of supplying steam in an amount and quality corresponding to the final feedwater temperature and other conditions shown on the Rated Steam Output Curve in the NSSS technical description. The Rated Steam Output Curve provides the warrantable reactor vessel steam output as a function of feedwater temperature, as well as warrantable steam conditions at the outboard main steam isolation valves.

Thermodynamic parameters are consistent with the 1967 AMSE Steam Tables. Correction techniques for conditions that differ from the preceding are mutually agreed to prior to the performance of the test.

14.2.12.2.18 Test Number 21 - Core Power-Void Mode Response

a. Test Objective

The purpose of this test is to measure the stability of the core power-void dynamic response and to demonstrate that its behavior is within specified limits.

b. Prerequisites and Initial Conditions

The Steam Bypass Regulating System and Reactor Recirculation Flow Control System are sufficiently tuned up to run this test. ERIS is available. The Neutron Monitoring System is operable.

c. Test Instruction

A fast change in the reactivity balance is obtained by a pressure regulator step change (performed in Test Number 22). Both local flux and total core response is evaluated by monitoring selected LPRMS and the APRMS during the transient.

This test is considered a physics test since the core power void loop response is a fundamental nuclear characteristic.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The transient response of any system-related variable to any test input does not diverge.

Acceptance Criteria for Level 2:

1. The decay ratio for any oscillatory modes of response is less than or equal to 0.25.

14.2.12.2.19 Test Number 22 - Pressure Regulator

a. Test Objective

The purposes of this test are:

1. To demonstrate the optimum settings for the pressure control loop by analysis of the transients induced in the reactor pressure control system by means of the pressure regulator.

2. To demonstrate the takeover capability of the backup pressure regulator via simulated failure of the controlling regulator.

3. To demonstrate smooth pressure control transition between the control valves and bypass valves when reactor steam generation exceeds steam used by the turbine.

4. To demonstrate that other affected parameters are within acceptable limits during pressure regulator induced transients.

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. The ERIS system is available. The turbine generator is on line. The Pressure Control System Tuneup Procedure is complete at the applicable Test Condition.

c. Test Instruction

The pressure setpoint is decreased rapidly and then increased rapidly by about 10 psi and the response of the system is measured in each case. It is desirable to accomplish the setpoint change in less than 1 second. At specified test conditions the load limit setpoint is set so that the transient is handled by control valves, bypass valves and both. The backup regulator is tested by simulating a failure of the operating regulator so that the backup regulator takes over control.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The transient response of any pressure control system related variable to any test input does not diverge.

Acceptance Criteria for Level 2:

1. Pressure control system related variables may contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response is less than or equal to 0.25.

2. The pressure response time from initiation of pressure setpoint change to the turbine inlet pressure peak is ≤10 seconds.

3. Pressure control system deadband, delay, etc., is small enough that steady-state limit cycles (if any) produce steam flow variations no larger than ±0.5 percent of rated steam flow.

4. For all pressure regulator transients the peak neutron flux and/or peak vessel remain below the scram settings by 7.5 percent and 10 psi respectively (maintain a plot of power versus the peak variable values along the bounding license rod line).

5. The variation in incremental regulation (ratio of the maximum to the minimum value of the quantity, "incremental change in pressure control signal/incremental change in steam flow," for each flow range) meets the following:

% of Steam Flow Obtained With Valves Wide Open	Variation
0 to 85%	≤4:1
85% to 97%	≤2:1
85% to 99%	≤5:1

Acceptance Criteria for Level 3:

1. Additional dynamics of the control system, outside of the regulator compensation filters, is equivalent to a time constant no greater than 0.10 second. This also includes any dead time which may exist.

2. Control or bypass valve motion responds to pressure inputs with deadband (insensitivity) no greater than ±0.1 psi.

14.2.12.2.20 Test Number 23 - Feedwater System

14.2.12.2.20.1 Test Number 23A - Feedwater Control System

a. Test Objective

The purpose of this test is to verify that the feedwater system is adjusted to provide acceptable reactor water level control.

b. Prerequisites and Initial Conditions

Instrumentation is checked or calibrated as appropriate. The reactor water level is in its normal operating band.

c. Test Instruction

Reactor water level setpoint changes of approximately 3 to 6 inches are used to evaluate and adjust, if necessary, the feedwater control system settings for all power and feedwater pump modes. The level setpoint changes also demonstrate core stability to subcooling changes. Also, step changes are made in turbine driven feedwater pump speed and in flow control valve actuator position of the motor-driven feedwater pump to demonstrate acceptable open loop response. The response of the system is monitored and compared to the Acceptance Criteria.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The transient response of any level control system-related variable to any test input does not diverge.

Acceptance Criteria for Level 2:

1. Level control system-related variables may contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response is less than or equal to 0.25.

2. The open loop dynamic flow response of each feedwater actuator (turbine or valve) to small (<10%) step disturbances is:

(a)	Maximum time to 10% of a step disturbance	≤1.1 sec
(b)	Maximum time from 10% to 90% of a step disturbance	≤1.9 sec
(c)	Peak overshoot (% of step disturbance)	≤15%
(d)	Setting time, 100%±5%	≤14 sec

3. The average rate of response of the feedwater actuator to large (>20% of pump flow) step disturbances is between 10 percent and 25 percent rated feedwater flow/second. This average response rate is assessed by determining the time required to pass linearly through the 10 percent and 90 percent response points.

Acceptance Criteria for Level 3:

1. The dynamic response of each individual level or flow sensor is as fast as possible. Bandwidth is at least 2.0 radians/second (faster than 0.5 second equivalent time constant), except for the steam flow sensors which have a bandwidth of at least 1.0 radian/second (faster than a 1.0 second equivalent time constant)[1].

2. Vessel level, feedwater flow and steam flow sensors are installed with sufficiently short lines and proper damping adjustment so that no resonances exist[1].

3. Initial settings of the function generators should give a straight line. The function generators are adjusted so that the change in slope (actual fluid flow change divided by demand change for small disturbances) does not exceed a factor of 2 to 1 (maximum slope versus minimum slope) over the entire 20 percent to 100 percent feed flow range. Also, the function generators are used to minimize the differences between feedwater actuators (pumps and/or valves).

4. All auxiliary controls which have direct impact on reactor level and feedwater control (e.g., feedpump minimum recirculation flow valve control) are functional, responsive and stable. For example, testing demonstrates the minimum flow valve controls are fast enough to avoid pump trips and yet slower than the feedwater startup level controller to avoid possible reactor flux scram due to a cold water slug[1].

<u>NOTE</u>:

[1] Criteria may be verified prior to power ascension testing.

14.2.12.2.20.2 Test Number 23B - Loss of Feedwater Heating

a. Test Objective

The purpose of this test is to demonstrate adequate response to feedwater temperature loss.

b. Prerequisites and Initial Conditions

Reactor power is between 80 percent and 90 percent. All feedwater heaters should be in normal operation however, at least the 6A or 6B feedwater heater is in operation. Core flow is within 5 percent of rated flow. The recirculation control system is in the flux manual mode of operation. The preoperational tests are complete as applicable. Instrumentation is checked or calibrated as appropriate.

c. Test Instruction

This test simulates a high-high level in one of the Number 6 feedwater heaters by simulating a closure of the high level switch. This signal results in closure of the extraction steam supply valve and the reheater drain tank drain isolation valves which isolate all steam supplies to the heater. This event, loss of steam supply to one of the Number 6 heaters, has been analyzed to result in the largest reduction in feedwater temperature due to a single component failure or operator error.

The loss of feedwater heating is performed with the plant operating between 80 percent and 90 percent core thermal power and near rated core flow. The transient response of the plant is compared to predictions to verify the actual response is not more severe than assumed in the safety analysis. Actual reduction in feedwater inlet temperature is extrapolated to rated power to confirm it is less severe than the assumption of a 100°F loss, and the resultant MCPR is verified to be greater than the fuel thermal safety limit.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. For the feedwater heater loss test, the maximum feedwater temperature decrease due to a single failure case is ≤100°F. The resultant MCPR is greater than the fuel thermal safety limit.

2. The increase in simulated heat flux does not exceed the predicted Level 2 value by more than 2%. The predicted value is based on the actual test values of feedwater temperature change and power level.

Acceptance Criteria for Level 2:

1. The increase in simulated heat flux does not exceed the predicted value referenced to the actual feedwater temperature change and power level.

14.2.12.2.20.3 Test Number 23C - Feedwater Pump Trip

a. Test Objective

The purpose of this test is to demonstrate the capability of the automatic core flow runback feature to prevent low water level scram following the trip of one feedwater pump.

b. Prerequisites and Initial Conditions

Test Numbers 23A and 23D are complete. Reactor power and core flow are greater than or equal to 95 percent rated. The ERIS system is available and the motor-driven feed pump is operable.

c. Test Instruction

At approximately 100 percent power, one of the turbine-driven reactor feed pumps is tripped. The feedwater system responds with an auto start of the motor-driven feed pump, and the automatic recirculation runback circuit acts to reduce the power to within the capacity of the remaining feedwater pumps.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

The reactor avoids low water level scram by three inches margin from an initial water level halfway between the high and low level alarm setpoints.

14.2.12.2.20.4 Test Number 23D - Maximum Feedwater Runout Capability

a. Test Objective

The purpose of the test is to determine the maximum feedwater runout capability.

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. Instrumentation is checked or calibrated as appropriate. The ERIS system is available. The condensate-feedwater system is in its normal lineup. Feedwater Heater 6A or 6B may be bypassed, if required.

c. Test Instruction

Pressure, flow and controller data is taken at various power levels as necessary to allow the determination of the maximum feedwater runout capability. This data is compared with the FSAR values and the impact on thermal parameters determined.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The maximum speed attained does not exceed the speeds which give the following flows with the normal complement of pumps operating:

   (a) 130 percent flow at 1,080 psia dome pressure.

   (b) 130 + 0.2 (1,080 - P rated) percent NBR at P rated psia.

   NOTE: During startup testing it was determined that 143% was actually a possibility through calculation. This value has been used in subsequent Fuel Reload Analyses as included in <Appendix 15B> of the USAR. As such future testing using Test 23D methodology shall use 143% versus 130% as listed above.

Acceptance Criteria for Level 2:

1. The maximum speed is greater than the calculated speeds required to supply:

   (a) 115 percent NBR at 1,080 psia dome pressure with rated complement of pumps.

   (b) 80 percent NBR at 1,024 psia dome pressure with one feedwater pump tripped.

14.2.12.2.21 Test Number 24 - Turbine Valve Surveillance

a. Test Objective

The purpose of this test is to demonstrate acceptable procedures and maximum power levels for recommended periodic surveillance testing of the main turbine control, stop, intermediate, and bypass valves without producing a reactor scram.

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. The ERIS system is available.

c. Test Instruction

During power operations, periodic surveillance testing of the main turbine valves is required to insure functional reliability. It is desirable though not required, to perform these surveillance tests at the highest possible power level maintaining an ample margin to parametric scram setpoints.

Valve testing is performed at increasing power levels along the bounding licensed load line. First, testing is performed between 75 percent and 90 percent reactor power using main turbine control and bypass valves. Results are extrapolated to a maximum power level where the main turbine control, stop, intermediate, and bypass valve testing is performed. Using this test data, an extrapolation is performed to yield a maximum power level at which valve testing is performed while just satisfying the limits specified in the Level 2 Acceptance Criteria.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. Peak neutron flux is at least 7.5 percent below the scram trip setting. Peak vessel pressure remains at least 10 psi below the high pressure scram setting. Peak heat flux remains at least 5 percent below its scram trip point.

2. Peak steam flow in each line remains 10 percent below the high flow isolation trip setting.

14.2.12.2.22 Test Number 25 - Main Steam Isolation Valves

14.2.12.2.22.1 Test Number 25A - Main Steam Isolation Valves Function Tests

a. Test Objective

The purposes of this test are:

1. To functionally check the main steam line isolation valves (MSIVs) for proper operation at selected power levels,

2. To determine isolation valve closure times, and

3. To determine maximum power at which full closures of a single valve is performed without a scram.

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. Instrumentation is checked or calibrated as appropriate.

c. Test Instruction

At approximately 5% and greater reactor power levels, individual fast closure of each MSIV is performed to verify their functional performance and to determine closure times. The MSIV closure times are determined from the MSL isolation data. MSIV closure time equals the interval from de-energizing solenoids until the valve reaches the 90% closed position, plus a calculated time to travel the remainder of its stroke. This calculated time is based on the average speed from 10% closed position to the 90% closed position. The timing calculations use the actual positions of the 10% and 90% limit switches located on each MSIV.

To determine the maximum power level at which full individual closures is performed without a scram, actuation is performed between 40 and 65% power and used to extrapolate to the next test point between 60 and 85% power, and ultimately to the maximum power test condition with ample margin to scram.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The MSIV stroke time (t_s) is no faster than 3.0 seconds (average of the fastest valve in each steam line), and for any individual valve, 2.5 seconds $\leq t_s \leq 5$ seconds. Total effective closure time for any individual MSIV is t_{sol} plus the maximum instrumentation delay time as determined in the preoperational test and is ≤5.5 seconds.

Acceptance Criteria for Level 2:

1. During full closure of individual valves peak vessel pressure is 10 psi below scram, peak neutron flux is 7.5% below scram, and steam flow in individual lines is 10% below the isolation trip setting. The peak heat flux is 5% less than its trip point.

2. The reactor does not scram or isolate.

14.2.12.2.22.2 Test Number 25B - Full Reactor Isolation

a. Test Objective

The purpose of this test is to determine the reactor transient behavior that results from the simultaneous full closure of all MSIVs.

b. Prerequisites and Initial Conditions

The ERIS system is available and the RCIC and HPCS systems are operable. All personnel are evacuated from the primary containment. The preoperational tests are complete as applicable. Instrumentation is checked or calibrated as appropriate.

c. Test Instruction

A test of the simultaneous full closure of all MSIVs is performed at >95 percent of rated thermal power. Correct performance of the RCIC and relief valves is shown. Reactor process variables are monitored to determine the transient behavior of the system during and following the main steam line isolation. A comparison between vessel pressure behavior and safety/relief valve actuations is made to confirm the open/close setpoints and proper operation.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The positive change in vessel dome pressure occurring within 30 seconds after closure of all MSIV valves does not exceed the Level 2 criteria by more than 25 psi. The positive change in simulated heat flux does not exceed the Level 2 criteria by more than 2% of rated value.

2. Feedwater control system settings prevent flooding of the steam lines.

3. The reactor scrams to limit the severity of the neutron flux and simulated fuel surface heat flux transient.

4. The recorded MSIV full closure times meet the previously stated timing specifications (Test 25A).

5. If any safety/relief valves open, no more than one valve reopens after the first blowdown.

Acceptance Criteria for Level 2:

1. The temperature measured by thermocouples on the discharge side of the safety/relief valves return to within 10°F of the temperature recorded before the valve opens. If pressure sensors are available, they return to their initial state upon valve closure.

2. For the full MSIV closure from full power, predicted analytical results based on beginning of cycle design basis analysis, assuming no equipment failures and applying appropriate parametric corrections, are used as the basis to which the actual transient is compared. The vendor transient predictions specify the upper limits of reactor pressure and heat flux increase during the first 30 seconds following initiation of the transient. The predictions, as well as data used in parametric corrections for actual plant response, are provided in the Transient Safety Analysis Design Report (TSADR).

3. Initial action of RCIC and HPCS is automatic if low water level (L2) is reached, and system performance is within specification.

4. Total recirculation pump trip is initiated if low water level (L2) is reached. Recirculation pump power shifts to the low frequency motor generators if low water level (L3) is reached.

5. The total number of safety/relief valve opening cycles of the low-low set valve after initial blowdown does not exceed three times during the initial five minutes following isolation.

6. If the low-low set pressure relief logic functions, the open/close actions of the SRV's occur within ±15 psi and ±20 psi of their design setpoints, respectively.

14.2.12.2.22.3 Test Number 25C - Main Steamline Flow Venturi Calibration

a. Test Objective

The purpose of this test is to calibrate the main steam flow venturis at selected power levels over the entire core flow range, the final calibration taking place with the data accumulated along the 100 percent rod line.

b. Prerequisites and Initial Conditions

The preliminary calibration of the differential pressure cells associated with the flow venturis is complete. The ERIS system is available. The reactor water cleanup dump flow is zero.

c. Test Instruction

Plant data is collected during power ascension and descent along the 100 percent rod line. The accumulated data is then compared against the calibration curves and calibrated feedwater flow to verify that the steam flow indication is accurate.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. The accuracy of the main steamline flow venturi relative to the calibrated feedwater flow is at least ±5 percent of rated

flow at flow rates between 20 and 120 percent of rated. The repeatability/noise is within ±5 percent of rated flow.

14.2.12.2.23 Test Number 26 - Relief Valves

a. Test Objective

The purposes of this test are:

1. To verify that the primary system relief valves function properly (can be opened and closed manually).

2. To verify that the discharge piping contains no major blockage.

3. To verify proper seating following operation.

b. Prerequisites and Initial Conditions

The feedwater system is in the AUTO mode and RHR is operable in the suppression pool cooling mode. All safety/relief valves are in the AUTO mode. The suppression pool is operable. The preoperational tests are complete as applicable. Instrumentation is checked or calibrated as appropriate.

c. Test Instruction

The safety/relief valves provide over-pressure protection to the reactor. This test demonstrates the operability of these valves by manual cycling each relief valve from the control room and monitoring the results of the evolution. Each relief valve is cycled open for approximately 10 seconds to allow turbine valves and generator output response to stabilize. The data gathered verifies that each relief valve and its associated tailpipe contain no blockages. Tailpipe temperatures are monitored after relief valve actuation to verify each valve has reseated properly.

This test is performed twice during the program. Relief valves are actuated at low pressure (250 psig) and at Test Condition 1 or 2 (rated pressure). Core power, and therefore the steam generation rate, are maintained constant during the low pressure test. The pressure control system closes the bypass valves an amount proportional to the relief valve steam flow to maintain reactor pressure constant. The rated pressure portion of this test is performed by comparison of generator output response to relief valve operation. The change in generator output when compared to all relief valves shows any malfunction of the valve which affects flow capacity.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. There is a positive indication of steam discharge during the manual actuation of each valve.

Acceptance Criteria for Level 2:

1. Pressure control system - related variables may contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response is less than or equal to 0.25.

2. The temperature measured by thermocouples on the discharge side of the valves returns to within 10°F of the temperature recorded before the valve was opened.

3. During the 250 psig functional test, the steam flow through each relief valve does not differ by more than 10 percent from the average relief valve steam flow as measured by bypass valve position.

4. During the rated pressure test the steam flow through each relief valve, as measured by MWe, is not less than 0.5 percent of rated MWe less than the average of all the valve responses.

14.2.12.2.24 Test Number 27 - Turbine Trip and Generator Load Rejection

a. Test Objective

The purpose of this test is to demonstrate the response of the reactor and its control systems to protective trips in the turbine and generator.

b. Prerequisites and Initial Conditions

The HPCS and RCIC systems are operable. ERIS is available. The Steam Bypass and Pressure Control System is in the NORM mode of operation. The preoperational tests are complete as applicable.

c. Test Instruction

Turbine trip (closure of the main turbine stop valves within 0.1 seconds) and generator load rejection (closure of the main turbine control valves in about 0.1 to 0.2 seconds) are performed at selected power levels during the Startup Test Program. At low power levels (<40 percent), reactor protection is provided by high neutron flux and high vessel pressure scrams. At higher power levels (>40 percent), the reactor scrams by stop valve limit switch actuation or by sensing loss of control valve hydraulic fluid pressure in anticipation of valve closure. Backup scram action is provided by high neutron flux and high vessel pressure.

A generator load rejection or turbine trip is performed at low power level, such that nuclear boiler steam generation is within bypass valve capacity, to demonstrate scram avoidance. A generator load rejection is also performed at near 100% power.

Generator load rejections are initiated by opening the generator output breakers. The resultant automatic plant actions (e.g., turbine control valve fast closure, recirculation pump trip, reactor trip) are analyzed for proper response.

It should be noted that above 40 percent power, the recirculation pump trip (RPT) feature automatically trips both recirculation pumps in response to both a turbine trip and a generator trip. The transient pressure rise is limited by opening the bypass valves initially, and the safety/relief valves later, if required.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. For turbine and generator trips at power levels greater than 50 percent NBR, there is a delay of less than 0.1 second following the beginning of control or stop valve closure before the beginning of bypass valve opening. The bypass valve is opened to a point corresponding to greater than or equal to 80 percent of their capacity within 0.3 second from the beginning of control or stop valve closure motion.

2. Feedwater system settings prevent flooding of the steam line following these transients.

3. The two pump drive flow coastdown transient during the first 3 seconds is bounded by the criteria that is specified in Test 30 <Section 14.2.12.2.27>.

4. The positive change in vessel dome pressure occurring within 30 seconds after either generator or turbine trip does not exceed the Level 2 criteria by more than 25 psi.

   The positive change in simulated heat flux does not exceed the Level 2 criteria by more than 2 percent of rated value.

5. If any safety/relief valves open, no more than one valve reopens after the first blowdown.

Acceptance Criteria for Level 2:

1. There is no MSIV closure during the first three minutes of the transient and operator action is not required during this period to avoid MSIV trip. (The operator may take action as he desires after the first three minutes, including switching out of run mode. The operator may also switch out of run mode in the first three minutes if he confirms from measured data that this action does not prevent MSIV closure.)

2. The positive change in vessel dome pressure and in simulated heat flux, which occur within the first 30 seconds after the initiation of either generator or turbine trip, do not exceed the predicted values.

   (Predicted values are referenced to actual test conditions of initial power level and dome pressure and use BOL [beginning of life] nuclear data. Worst case design or technical specification values of all hardware performance are used in the prediction, with the exception of control rod insertion time and the delay from beginning of turbine control valve or stop valve motion to the generation of the scram signal. The predicted pressure and heat flux are corrected for the actual measured values of these two parameters.)

3. For the generator trip within the bypass valve’s capacity, the reactor does not scram for initial thermal power values within that bypass valve capacity.

4. The measured bypass capability (in percent of rated power) is equal or greater than that used for the FSAR analysis.

5. Low water level total recirculation pump trip, HPCS and RCIC is not initiated.

6. Recirculation low frequency MG sets take over after the initial recirculation pump trips, and (adequate vessel temperature difference) is maintained.

7. Feedwater level control avoids loss of feedwater due to high level (L8) trip during the event.

8. If the low-low set pressure relief logic functions, the open/close actions of the SRVs occur within ±15 psi and ±20 psi of their design setpoints, respectively.

9. The temperature measured by thermocouples on the discharge side of the safety/relief valves return to within 10°F of the temperature recorded before the valve was opened.

14.2.12.2.25 Test Number 28 - Shutdown From Outside the Control Room

a. Test Objective

To demonstrate that the reactor is brought from a normal initial steady-state power level to the point where cooldown is initiated and under control with reactor vessel pressure and water level controlled from outside the control room. The reactor is brought from power operation to shutdown cooling mode from outside the control room.

b. Prerequisites and Initial Conditions

A trial walkthrough of the procedure is performed. Communications are established between the control room and Unit 1 remote shutdown panel. The preoperational tests are complete as applicable. Additional personnel are available as identified in the instruction.

c. Test Instruction

The Shutdown from Outside the Control Room Test is divided into two parts. In the first part, the reactor is manually scrammed from outside of the control room. The minimum shift complement required by Technical Specifications is then used to carry out the immediate actions, per the plant instructions, to place the plant into hot standby.

In the second part of the test, the capability to cool down the plant from outside the control room is demonstrated. Additional personnel normally "on-call" and available to support the plant cooldown are utilized during this part of the test.

Throughout the test, additional personnel are available to assume control of the plant if an emergency or unsafe condition occurs which is not managed by the personnel utilizing the equipment outside of the control room.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. During a simulated control room evacuation, the reactor is brought to the point where cooldown is initiated and under control and the reactor vessel pressure and water level are controlled using equipment and controls outside the control room.

14.2.12.2.26 Test Number 29 - Recirculation Flow Control

14.2.12.2.26.1 Test Number 29A - Valve Position Control

a. Test Objective

The purpose of this test is to demonstrate the recirculation flow control system's capability while in the loop flow manual mode.

b. Prerequisites and Initial Conditions

The ERIS system is available and communications are set up between test locations. The preoperational tests are complete as applicable. All controls are checked and instrumentation calibrated as appropriate.

c. Test Instruction

The testing of the Recirculation Flow Control System follows a "building block" approach while the plant is ascending from low to high power levels. Components and inner control loops are tested first, followed by flow and power maneuvers to demonstrate outer control loop performance. This test instruction covers the performance testing of the flow control components and inner (valve position) control loop. The outer loops (flow, flux and master control loops) performance is demonstrated, after the position control loop testing, during the performance of STI-B33-029B, Recirculation Flow Control - Flow Loop. The initial testing of the flow control components is performed during the open vessel test phase, followed by the position control loop and deadband tests conducted at Test Condition 1. Subsequent valve position control testing at Test Condition 3 demonstrates satisfactory system performance with the recirculation pumps operating from the high speed power supply in support of outer control loop testing. Additionally, testing at Test Condition 3 demonstrates the neutron flux and flow biased simulated thermal power (heat flux) margin to scram during single loop flow ramps controlled by the reactor operator.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The transient response of any recirculation system-related variables to any test input does not diverge.

Acceptance Criteria for Level 2:

1. Recirculation system related variables contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response is less than or equal to 0.25.

2. Maximum rate of change of valve position is 10±1 percent/second.

3. During TC-3 while operating on the high speed (60 Hz) source, gains and limiters are set to obtain the following response.

   (a) Delay time for position demand step is:

       For step inputs of 1.0% to 5% ≤0.2 second

   (b) Response time for position demand step is:

       For step inputs of 1.0% to 5% ≤0.5 second

4. Overshoot after a small position demand input (1 to 5 percent) step is <10 percent of magnitude of input.

5. The trip avoidance margins are at least the following:

   (a) For APRM, ≥7.5%

   (b) For simulated heat flux, ≥5.0%

6. The flow control valve duty cycle in any operating mode does not exceed 0.2 percent Hz. Flow control valve duty cycle is defined as:

$$\frac{\text{Integrated Valve Movement in Percent (\% Hz)}}{\text{2 x Time Span in Seconds}}$$

Acceptance Criteria for Level 3:

1. Gains are set to give as fast a response as possible for small position demand input within the overshoot criterion (see previous Item 4) and without additional valve duty cycle.

2. Position loop deadband is <0.2 percent of full valve stroke.

14.2.12.2.26.2 Test Number 29B - Recirculation Flow Control-Flow Loop

a. Test Objective

The purposes of this test are:

1. To demonstrate the core flow system’s control capability over the entire flow control range, including both flow loop and neutron flux loop modes of operation, and

2. To determine that all electrical compensators and controllers are set for desired system performance and stability.

b. Prerequisites and Initial Conditions

The ERIS system is available and communications are established between the test stations. The pressure regulation system is tuned up. The preoperational tests are completed as applicable and all controls are checked and instrumentation calibrated as appropriate.

c. Test Instruction

Following the initial position mode tests of 29A the final adjustment of the position loop gains, flow loop gains and preliminary values of the flux loop adjustments is made on the midpower line. This is the most extensive testing of the recirculation control system. The core power distribution is adjusted by control rods to permit broader range of maneuverability. In general, the controller dials and filter devices are set to meet the maneuvering performance objectives, which maximize stability margins and to minimize equipment wear by avoiding controller overactivity.

The fast flow maneuvering adjustments are performed along a mid power rod line, and an extrapolation made to the expected results along the bounding licensed rod line.

d. Acceptance Criteria

<u>Flow Loop Criteria</u>

Acceptance Criteria for Level 1:

1. The transient response of any recirculation system-related variable to any test input does not diverge.

Acceptance Criteria for Level 2:

1. The decay ratio of the flow loop response to any test input is <0.25.

2. Flow loops are for the purpose of maintaining steady-state flow equal in the two loops. Flow loop gains are set to correct a flow imbalance in less than 25 seconds.

3. The delay time for flow demand step (≤5 percent) is 0.5 seconds or less.

4. The response time for flow demand step (≤5 percent) is 1.2 seconds or less.

5. The maximum allowable flow overshoot for step demand of ≤5 percent of rated is 6 percent of the demand step.

6. The flow demand step settling time is ≤6 seconds.

7. The flow control Auto Flow Demand Limiter is adjusted to limit the maximum core flow by limiting the flow control valve opening position.

Acceptance Criteria for Level 3:

1. Incremental gain from function generator for valve position demand input to sensed drive flow does not vary by more than 2 to 1 over the entire flow range.

<u>Flux Loop Criteria</u>

Acceptance Criteria for Level 1:

1. The flux loop response to test inputs does not diverge.

Acceptance Criteria for Level 2:

1. Flux overshoot to a flux demand step does not exceed 2 percent of rated for a step demand of ≤20 percent of rated.

2. The delay time for flux response to a flux demand step is ≤0.9 seconds.

3. The response time for flux demand step is ≤2.6 seconds.

4. The flux settling time is ≤15 seconds for a flux demand step ≤20 percent of rated.

Scram Avoidance and General Criteria

Acceptance Criteria for Level 2:

1. For any one of the above loops test maneuvers, the trip avoidance margins are at least the following:

   (a) For APRM ≥7.5 percent.

   (b) For simulated heat flux ≥5.0 percent.

Flux Estimator Test Criteria

Acceptance Criteria for Level 2:

1. Switching between estimated and actual flux does not exceed 5 times/5 minutes at steady-state.

2. During a flux step transient there is no switching to actual flux or if switching does occur, it switches back to estimated flux within 20 seconds of the start of the transient.

Flow Control Valve Duty Test Criteria

Acceptance Criteria for Level 2:

1. The flow control valve duty cycle in any operating mode tested does not exceed 0.2 percent - Hz.

14.2.12.2.27 Test Number 30 - Recirculation System

14.2.12.2.27.1 Test Number 30A - One Pump Trip

a. Test Objective

The purposes of this test are:

1. To obtain recirculation system performance data during the pump trip, flow coastdown and pump restart, and

2. To verify that the feedwater control system satisfactorily controls water level without a resulting turbine trip/scram.

b. Prerequisites and Initial Conditions

Core flow is ≥95 percent rated and the ERIS system is available. The preoperational tests are complete as applicable.

c. Test Instruction

Each recirculation pump is tripped at designated power levels while reactor operating parameters including water level, simulated heat flux and APRM level is recorded during the transient to determine that adequate margins exist with respect to the threat of a high level turbine/feedwater pump trip.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The reactor does not scram during the one pump trip recovery.

Acceptance Criteria for Level 2:

1. The reactor water level margin to avoid a higher level trip is ≥3.0 inches during the one pump trip.

2. The simulated heat flux margin to avoid a scram is ≥5.0 percent during the one pump trip for recovery.

3. The APRM margin to avoid a scram is ≥7.5 percent during the one pump trip recovery.

4. The time from zero pump speed to full pump speed is greater than 3 seconds.

14.2.12.2.27.2 Test Number 30B - RPT Trip of Two Pumps

a. Test Objective

The purpose of this test is to record and verify acceptable performance of the recirculation two-pump trip circuitry and to demonstrate satisfactory recirculation loop flow coastdown.

b. Prerequisites and Initial Conditions

Core flow is ≥95 percent NBR. ERIS is available to monitor the LPRM channels near the limiting fuel bundles. The preoperational tests are complete.

c. Test Instruction

With the reactor operating between 55 percent and 65 percent core power, a turbine control valve fast closure is simulated. The recirculation pumps automatically transfer from the 60 Hz power supply to the low frequency motor generator supply. The transient is recorded, analyzed and compared to the acceptance criteria.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The two pump drive flow coastdown transient during the first 3 seconds is bounded by the limiting curves provided by GE in the test specification.

14.2.12.2.27.3 Test Number 30C - System Performance

a. Test Objective

The purpose of this test is to record recirculation system parameters during the power test program.

b. Prerequisites and Initial Conditions

The ERIS system is available. Differential pressure transmitters specified in the procedure are adjusted. The preoperational tests are complete as applicable.

c. Test Instruction

Recirculation system parameters are recorded at several power-flow conditions and in conjunction with single-pump trip recoveries and internals vibration testing. Power-flow data is obtained during plant operations and the results verified to be consistent with expected power-flow operating characteristics.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. The core flow shortfall does not exceed 5 percent at rated power.

2. The measured core ΔP is not >0.6 psi above prediction.

3. The calculated jet pump M ratio is not <0.2 points below prediction.

4. The drive flow shortfall does not exceed 5 percent at rated power.

5. The measured recirculation pump efficiency is not >8 percent below the vendor tested efficiency.

6. The nozzle and riser plugging criteria are not exceeded.

7. The peak to peak core plate ΔP shall not exceed 3.2 psi during single loop operation.

8. The peak to peak APRM noise shall not exceed 30% of rated during single loop operation.

14.2.12.2.27.4 Test Number 30D - Test Deleted

14.2.12.2.27.5 Test Number 30E - Recirculation System Cavitation

a. Test Objective

The purpose of this test is to verify that no recirculation system cavitation occurs in the operable region of the power-flow map.

b. Prerequisites and Initial Conditions

The ERIS system is available and the recirculation flow control system is in the flux manual mode. The preoperational tests are complete as applicable.

c. Test Instruction

Both the jet pumps and the recirculation pumps cavitate at conditions of high flow and low power where NPSH demands are high and little feedwater subcooling occurs. However, the recirculation flow automatically runbacks upon sensing a decrease in subcooling (as measured by the difference between the steam and recirculation loop temperature), to lower the reactor power. The maximum recirculation flow is limited by appropriate stops which run back the recirculation flow away from the possible cavitation region. It is verified that these limits are sufficient to prevent operation where recirculation pump or jet pump cavitation is predicted to occur. With reactor power between 50 and 65 percent and core flow ≥95 percent, reactor power is reduced via control rod insertion until cavitation occurs or the interlock is reached. Also, to test the Flow Control Valve (FCV) cavitation interlock, reactor power is reduced via control rods with the FCV’s at their minimum position until FCV cavitation occurs or the interlock is reached. Additionally, the procedural limit to prevent cavitation during single loop operation will be verified by reducing reactor power via control rod insertion until cavitation occurs or the limit is reached.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. Recirculation cavitation interlock has settings adequate to prevent operation in areas of potential cavitation.

2. Cavitation shall not occur during single loop operation while operating above the procedural limit defined by the following:

$$\% \text{ Power} = 3 \times (\% \text{ core flow}) - 110$$

14.2.12.2.28 Test Number 31 - Loss of Turbine Generator and Offsite Power

a. Test Objective

The purpose of this test is to determine the reactor transient performance during the loss of the main generator and all offsite power, and to demonstrate acceptable performance of the plant electrical supply system. Loss of offsite power is maintained for sufficient time to demonstrate that necessary equipment, controls, and indications are available following loss of offsite power to remove decay heat from the core using only emergency power supplies and distribution systems.

b. Prerequisites and Initial Conditions

ECCS equipment, including diesel generators, is in "standby." The turbine has operated at ≥10 percent for at least three hours and feedwater is being controlled by the Master Level Controller. The preoperational tests are complete as applicable. Containment is evacuated. All dc electrical systems are available.

c. Test Instruction

The transient is initiated by manually tripping the main turbine simultaneously with a manual trip of the Unit 1 and Unit 2 startup supply breakers simulating a loss of offsite power. Auto start of the diesel generators is verified. The loss of auxiliary power test is performed at 20 percent to 30 percent of rated power. The proper response of reactor plant equipment, automatic switching equipment and the proper alignment of the diesel generator load are checked. Appropriate reactor parameters are recorded during the resultant transient. Offsite power is not restored for at least 30 minutes.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. Reactor protection system actions prevent violation of fuel thermal limits.

2. All safety systems, such as the Reactor Protection System, the diesel-generators, and HPCS function properly without manual assistance, and HPCS and/or RCIC system action, if necessary, keep the reactor water level above the initiation level of LPCS, LPCI, Automatic Depressurization System, and MSIV closure. Diesel generators start automatically.

3. The turbine steam bypass valves remain operable until the MSIV's are closed or until the low condenser vacuum signal closes the bypass valves.

4. If any safety/relief valves open, no more than one valve reopens after the first blowdown.

5. An MSIV isolation trip event due to RPS MG set coastdown does not occur for at least 2 seconds after the initiation of the transient.

Acceptance Criteria for Level 2:

1. Proper instrument display to the reactor operator is demonstrated, including power monitors, pressure, water level, control rod position, suppression pool temperature, and reactor cooling system status. Displays are not dependent on specially installed instrumentation.

2. If the low-low set pressure relief logic functions, the open/close actions of the SRV's occur within ±15 psi and ±20 psi of their design setpoints, respectively.

3. If safety/relief valves open, the temperature measured by thermocouples on the discharge side of the safety/relief valves returns to within 10°F of the temperature recorded before the valve was opened. If pressure sensors are available, they return to their initial state upon valve closure.

14.2.12.2.29 Test Number 33 - Drywell Piping Vibration

a. Test Objective

The purpose of this test is to verify that the main steam, recirculation, and RCIC steam piping vibration is within acceptable limits and to verify during operating transient loads that pipe stresses are within code limits.

b. Prerequisites and Initial Conditions

Strain gauges, vibration instrumentation and temperature instruments as necessary, are installed. The ERIS system is available. Instrumentation is checked or calibrated as appropriate.

c. Test Instruction

This test is an extension of Test Number 17, system expansion as described in <Section 14.2.12.2.14>, and the preoperational vibration tests. Refer to <Section 14.2.12.2.14> for piping considered within the scope of testing. Small attached piping is not subject to vibration testing.

Visual observation is performed at low power levels and in conjunction with Test Number 17. At higher power levels there is limited access due to high radiation. No visual observation is required during this phase of startup testing. Remote measurements of piping vibration are made during the following steady-state conditions:

1. Main steam flow at 20%-30% of rated;

2. Main steam flow at 45%-55% of rated;

3. Main steam flow at 70%-80% of rated;

4. Main steam flow at 98%-100% coincident with RECIRC flow at maximum;

5. RCIC turbine steam flow at 98%-100% of rated;

6. RHR suction piping at 98%-100% of rated flow in the shutdown cooling mode;

7. Recirc at minimum flow and coincident temperature;

8. Recirc at 45%-55% of rated flow and at operating temperature;

9. Recirc at 70%-80% of rated flow and at operating temperature;

10. Recirc at maximum flow and at operating temperature.

During the operating transient load testing the amplitude of displacement and number of cycles per transient of the main steam and recirculation piping are measured, and the displacements compared with acceptance criteria. Remote vibration measurements are taken during the following transients:

1. Recirculation pump start;

2. Recirculation one pump trips from maximum flow and restarts; Recirculation two pump trips from maximum flow.

3. Turbine stop valve or control valve closure at 98%-100% power;

4. Manual discharge of each SRV valve at ≥920 psig and at planned tests that result in SRV discharge.

Predicted displacements and actual measurements are compared for the locations monitored.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. Operating Transients: Level 1 limits on piping displacements and strain are supplied by the vendor. These limits are based on keeping the loads on piping and suspension components within safe limits. If any one of the transducers indicates that these movements are exceeded, the test is placed on hold.

2. Operating Vibration: Level 1 limits on piping strain and displacement are supplied by the vendor. These limits are based upon keeping piping stresses and pipe mounted equipment accelerations within safe limits. If any one of the transducers indicate that the prescribed limits are exceeded, the test is placed on hold.

Acceptance Criteria for Level 2:

1. Operating Transients: Transducers are placed near points of maximum anticipated movement. Where movement values are predicted, tolerances are prescribed for differences between measurements and predictions of strain and vibration. Tolerances are based on instrument accuracy and suspension free play.

2. Operating Vibration: Acceptable levels of operating vibration and strain are supplied by the vendor. The evaluation criteria consists of limits on vibratory displacement and strain. The limits are set based on consideration of analysis, operating experience and protection of pipe mounted components.

14.2.12.2.30 Test Number 34 - Vibration Measurement

a. Test Objective

To obtain vibration measurements on the reactor internal components to demonstrate the mechanical integrity of the system to flow-induced vibration.

b. Prerequisites and Initial Conditions

Reactor internals vibration sensors are installed and checked out. The vibration signal conditioning and data recording equipment are installed. The preoperational tests are complete as applicable.

c. Test Instruction

This test consists of measurements taken after fuel load and prior to initial nuclear heatup and at various power levels during power ascension. During non-nuclear heatup the thermal shock interlocks may be bypassed, if required, to place the recirculation pumps on fast speed.

Sensors used for the measurements are resistance wire strain gauges, linear variable differential transformers (LVDT), and accelerometers with double integrating output signal conditioning. Sensors are installed in a manner to indicate the most probable mode of vibration as indicated by analysis.

Vibration measurements are obtained for various flows up to maximum flow. Maximum flow is the highest flow at which operation is permissible, and is established by a vibrational limit or by an operational limit such as pump motor current, cavitation, core differential pressure, etc.

Vibration amplitudes and frequencies obtained from the sensors mounted on the various components are monitored and recorded. The measured amplitudes and frequencies are compared to the acceptance criteria to assure that all measured vibration amplitudes are within acceptable levels.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The peak stress intensity may exceed 10,000 psi (single amplitude) when the component is deformed in a manner corresponding to one of its normal or natural modes. But the fatigue usage factor does not exceed 1.0.

Acceptance Criteria for Level 2:

1. The peak stress intensity does not exceed 10,000 psi (single amplitude) when the component is deformed in a manner corresponding to one of its normal or natural modes. This is the low stress limit which is suitable for sustained vibration in the reactor environment for the design life of the reactor components.

14.2.12.2.31 Test Number 35 - Recirculation System Flow Calibration

a. Test Objective

The purpose of this test is to perform complete calibration of the installed recirculation system flow instrumentation.

b. Prerequisites and Initial Conditions

Core flow is greater than or equal to 90 percent (TC-3) or 95 percent (TC-6) of rated. The plant is operating at steady-state. The recirculation flow control system is in the Loop Flow Manual mode. The preoperational tests are complete as applicable. Instrumentation is checked or calibrated as appropriate.

c. Test Instruction

During the testing program at operating conditions which allow the recirculation system to be operated as would be required to achieve rated flow at rated power, the jet pump flow instrumentation is adjusted to provide correct flow indication based on the jet pump flow. After the relationship between drive flow and core flow is established, the flow biased APRM system is adjusted to match this relationship. Data is taken and then used to calibrate the jet pump flow instrumentation.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. Jet pump flow instrumentation is adjusted such that the jet pump total flow recorder provides a correct core flow indication at rated conditions.

2. The APRM flow-bias instrumentation is adjusted to function properly at rated conditions.

14.2.12.2.32 Test Number 36 - Isolated Reactor Stability

a. Test Objective

The purposes of this test are a) to demonstrate that an isolated reactor has satisfactory dynamic stability at very low power and medium-to-high-pressure conditions, and b) to determine any higher pressure operating restrictions due to isolated reactor instability.

Test Number 36 is only done on first-of-a-kind GE BWR plants. The lead BWR/4 plant was Browns Ferry-1, the lead BWR/5 plant was Tokai-2, and the lead BWR/6 plant was Grand Gulf-1. This test was therefore deleted from the Perry Startup Test Program.

b. Prerequisites and Initial Conditions

The preoperational tests are completed. Instrumentation is checked or calibrated as appropriate.

c. Test Instruction

1. To enable use of several BWR alternative operational capabilities, each reactor first demonstrates its dynamic capability in the hot isolated situation. To be able to perform a black startup without external power, or to operate the RHR system in the steam condensing mode, any operating upper boundary on isolated reactor pressure is determined. This test serves to demonstrate the reactor stability and to help define related operating procedures and limits.

2. To take transient data, the plant simulates the MSIV closed situation by closing both the main turbine stop valves and

bypass valves at about 600 psig reactor pressure. Transient data is recorded, knowing that the pressure setpoint can be quickly lowered to go on BPV control to stabilize any unexpected oscillations and thus avoid a plant trip and subsequent test delays.

3. Two dynamic disturbances are used to observe the isolation reactor transient. One is to move a control rod in and out, and the second is to trip open one BPV and reclose it. These maneuvers are performed with the reactor at very low power (less than 2 percent) and at two pressure conditions (about 600 psi and again at 895 to 940 psi). The main feedwater pumps are off and makeup water is supplied by the RCIC and/or CRD Systems. The recirculation pumps are also off and the MSIVs are opened.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

Not applicable.

Acceptance Criteria for Level 2:

1. The transient response of any system-related variable to any test input does not diverge.

2. For expected small- and medium-sized inputs or disturbances, the reactor does not diverge beyond a scram trip setting in less than 3 minutes.

3. Any steady pressure limit cycle does not exceed ±100 psi. For those limit cycles whose period is less than 10 seconds, the allowed maximum is ±20 psi.

14.2.12.2.33 Test Number 70 - Reactor Water Cleanup System

a. Test Objective

The purpose of this test is to demonstrate specific aspects of the mechanical ability of the reactor water cleanup system. (This test, performed at rated reactor pressure and temperature, is actually the completion of the preoperational testing that could not be done without nuclear heating.)

b. Prerequisites and Initial Conditions

The RWCU is operating in the mode specified in each section of the Test Instruction.

c. Test Instruction

With the reactor at rated temperature and pressure, process variables are recorded during steady-state operation in three modes as defined by the system process diagram: Blowdown, hot standby and normal. A comparison of the bottom head flow indicator and the RWCU inlet flow indicator is made.

The calibration of the bottom head flow indicator is checked. With the RWCU system taking flow from only the RPV bottom head and using the RWCU flow indicator as standard, five data points from zero to rated flow are observed and recorded by varying the flow through the appropriate valve. Hot standby flow rate in the bottom head drain line section of the RWCU is not exceeded.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. With rated process flow in the Normal and Blowdown modes, the NRHX's tube side outlet temperature does not exceed 120°F and 130°F, respectively.

2. In the "Hot Shutdown" mode (defined by the process flow diagram) the available pump NPSH is not less than 13 feet.

3. The cooling water supplied to the non-regenerative heat exchangers does not exceed 106 percent of rated flow. Rated cooling water flow corresponds to the flow rate necessary to operate the NRHX at capacity, assuming a maximum cooling water outlet temperature of 150°F. The NRHX capacity is defined by the process flow diagram.

4. Pump vibration does not exceed 2 mils peak-to-peak measured in any direction.

5. Recalibrate bottom head flow indicator against RWCU flow indicator if the deviation is greater than 25 gpm.

14.2.12.2.34 Test Number 71 - Residual Heat Removal System

a. Test Objective

The purpose of this test is to demonstrate the ability of the residual heat removal (RHR) system to:

1. Remove heat from the reactor system so that the refueling and nuclear system servicing can be performed.

2. Condense steam while the reactor is isolated from the main condenser.

b. Prerequisites and Initial Conditions

The RHR control system tuneup is performed.

c. Test Instruction

Three modes of RHR operation are addressed in this test: (1) Suppression Pool Cooling, (2) Steam Condensing, and (3) Shutdown Cooling.

The Suppression Pool Cooling Mode is performed when a temperature differential exists between the suppression pool and emergency service water. These initial conditions may be established by heating the suppression pool through various modes of operation (i.e., relief valve operation or RCIC operation). This section of the procedure is run for each RHR loop and demonstrates the system's ability to remove heat from the suppression pool.

The Steam Condensing Mode is performed in two parts. In the system performance portion (with the reactor in power operation) the heat exchanger capacity is determined, and step changes are made to heat exchanger level and pressure to demonstrate stable system response. Both simultaneous and single loop operation of the RHR system is performed during the system performance portion. In the second portion (with the final controller settings) each loop is placed into steam condensing with the reactor in an isolated condition. The Shutdown Cooling mode is performed when a sufficient amount of decay heat is present. When the reactor pressure is less than 135 psig, the RHR pumps take suction from recirculation loop B and send the water through the RHR heat exchangers. The water is then returned to the reactor. Data is recorded at regular intervals to demonstrate system operability. Each RHR loop is tested individually and with both loops operating simultaneously.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The transient response of any system-related variable to any test input does not diverge.

Acceptance Criteria for Level 2:

1. The RHR System is capable of operating in the Steam Condensing Mode at 150.4 MBTU/Hr for single heat exchanger operation. The simultaneous operation of both RHR loops and single loop operation is tested in this mode.

2. The RHR System is capable of operating in the Suppression Pool Cooling Mode. Each RHR loop is independently tested in this mode[1].

3. The RHR System is capable of operating in the Shutdown Cooling Mode. Dual loop operation and single loop operation are tested in this mode[1].

4. System-related variables may contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response is less than or equal to 0.25.

NOTE:

[1] It is demonstrated with either suction from the Reactor Vessel or Suppression Pool that each heat exchanger can remove 166.4 x 10^6 BTU/Hr when the inlet and outlet conditions in Mode B-1 of <Figure 5.4-14> exist.

14.2.12.2.35 Test Number 74 - Offgas System

a. Test Objective

The purpose of this test is to verify the proper operation of the offgas system over its expected operating parameters and to determine the performance of the activated carbon adsorbers.

b. Prerequisites and Initial Conditions

The preoperational tests are complete. Instrumentation is checked or calibrated as appropriate.

c. Test Instruction

At startup flow and again at normal flow, the pressures at selected locations are recorded and checked to see that they are within design specifications. The hydrogen analyzer, relative humidity, temperature, recombiner performance, dilution steam flow, radionuclide residence times, and pre- and after-filters are checked periodically throughout the plant startup while at steady-state conditions.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The release of radioactive gaseous and particulate effluents does not exceed the limits specified in ODCM.

2. Flow of dilution steam to the noncondensing stage does not fall below 92 percent of the specified normal value when the steam jet air ejectors are pumping.

Acceptance Criteria for Level 2:

1. The system flow, pressure, temperature, and dewpoint complies with the process data sheets. The catalytic recombiner, the hydrogen analyzer, the desiccant dryers, the activated carbon beds, and the filters are working properly during operation, i.e., there is no gross malfunctioning of these components.

14.2.12.2.36 Test Number 99 - ERIS

a. Test Objective

The purpose of this test is to verify that the BASIC ERIS and scram timing software and hardware are correctly installed and calibrated. The test also ensures that certain data needed from plant operation are incorporated into the plant specific data bases.

b. Prerequisites and Initial Conditions

The ERIS test activities, which validate the data base and calibrate the input channels, are complete.

c. Test Instruction

In order to accomplish its purpose, the test is divided into four parts.

1. Plant Specific Constant Recalculation:

This test defines those constants that need to have their values recalculated when plant operation at power allows the necessary measurements. This allows the actual final values instead of initial "best estimates" to be input to the data base.

2. Validated Parameter Verification:

   This test compares the calculated ERIS validated plant parameters with measured plant data. The comparison verifies that the processor's algorithms, plant specific constants, composed and measured point data bases are correctly set up/installed.

3. Event Target Verification:

   This test verifies that selected ERIS event markers correctly reflect actual plant conditions.

4. Scram Timing Verification:

   This test verifies that the ERIS clock accurately times to the selected notch positions and that the hardware (scram timing modules), software and data bases are compatibly set up to produce the desired results and meets the technical specification requirements.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. All ERIS validated data agrees with actual plant data within ±3 percent (of rated).

2. All ERIS validated data on the various BASIC ERIS displays (taken as near simultaneously as possible) agrees with each other within a 2σ deviation.

3. Selected BASIC ERIS event targets (e.g., safety/relief valve position, MSIV position, scram) agree with actual plant status.

4. The control rod scram timing function properly indicates selected control rod status.

5. The control rod scram timing function indicates scram times of selected rods to the appropriate notch positions to within ±.01 second of an independent measurement.

14.2.12.2.37 Test Number 100 - Integrated HVAC

a. Test Objective

To demonstrate the ability of ventilation systems to maintain specified Unit 1 and common area temperatures and relative humidity within specified limits during plant operation.

b. Prerequisites and Initial conditions

Applicable preoperational tests are complete. Ventilation systems are lined-up and operating. Outside atmospheric conditions are stable. Required test equipment is available and calibrated.

c. Test Instruction

First at a low power level (approximately 15%), and then at a high power level (approximately 100%), data is recorded to demonstrate proper operation of plant ventilation systems.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. Recorded data is compared to GAI specified temperature and relative humidity limits <Section 3.11>.

14.2.12.2.38 Test Number 113 - Service Water System

a. Test Objective

The purpose of this test is to demonstrate that the service water system can provide a sufficient amount of cooling water to the heat loads it supplies.

b. Prerequisites and Initial Conditions

The preoperational tests are complete. The plant is operating at greater than or equal to 95 percent of rated power and core flow. Specified equipment is in service to provide heat loads. The plant is at steady-state conditions. The required instruments are calibrated.

c. Test Instruction

Data is gathered to measure and verify the system performance.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. The service water system is capable of maintaining the specified heat exchangers and coolers within the temperature limits supplied in the GAI test specification.

14.2.12.2.39 Test Number 114 Emergency Closed Cooling System

a. Test Objective

To demonstrate that the emergency closed cooling system provides sufficient heat removal capability for those components specified by GAI.

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. Specified equipment is in service to provide a heat load. The supplied heat loads have achieved steady-state conditions. The required instruments are calibrated.

c. Test Instruction

With the specified equipment in operation to provide a heat load, data is recorded to ensure that this system is supplying sufficient cooling water to those components specified by GAI.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. The Emergency Closed Cooling System maintains its heat loads within the temperature limits specified by the vendor <Section 9.2.2>.

14.2.12.2.40 Test Number 115 - Nuclear Closed Cooling System

a. Test Objective

To demonstrate that the Nuclear Closed Cooling System (NCCS) provides sufficient heat removal to the heat loads it supplies.

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. The plant is operating at greater than or equal to 95 percent power and core flow. Specified equipment is in service to provide a heat load. The NCCS and associated heat loads have reached steady-state conditions. The required instruments are operable.

c. Test Instruction

Flow and temperature data are recorded to verify the acceptance criteria.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. The NCCS maintains its heat loads within the limits specified by the vendor.

14.2.12.2.41 Test Number 116 - Turbine Building Closed Cooling System

a. Test Objective

To demonstrate that the Turbine Building Closed Cooling System (TBCCS) provides sufficient heat removal to the heat loads it supplies.

b. Prerequisites and Initial Conditions

The plant is operating at greater than or equal to 95 percent rated power and core flow. Specified equipment is in operation to provide a heat load. The TBCCS and its heat loads are operating at steady-state conditions. The required instruments are operable.

c. Test Instruction

Data is collected to verify adequate system performance.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. The Turbine Building Closed Cooling System maintains its heat loads within the limits specified in the GAI Test Specification.

14.2.12.2.42 Test Number 117 - Emergency Service Water

a. Test Objective

To demonstrate that the Emergency Service Water System provides sufficient heat removal capability for those components specified by GAI.

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. Specified equipment is in service to provide a heat load. The required instruments are calibrated.

c. Test Instruction

Flow and temperature data are gathered with the maximum possible heat load on the Emergency Service Water System to verify its performance.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. The Emergency Service Water System is capable of maintaining its heat loads within the limits specified by the vendor <Section 9.2.1>.

14.2.12.2.43 Test Number 118 - Circulating Water System

a. Test Objective

To demonstrate that the Circulating Water System provides sufficient heat removal to its heat loads.

b. Prerequisites and Initial Conditions

The preoperational tests are complete. The unit is operating near 100 percent power with specified equipment in operation. The circulating water system and its heat loads have reached steady-state conditions. The required instruments are calibrated.

c. Test Instruction

Temperature and flow data is recorded and used to verify the acceptance criteria.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. The Circulating Water System maintains parameters within the specified limits.

14.2.12.2.44 Test Number 119 - Suppression Pool Cleanup System

a. Test Objective

To ensure that the Suppression Pool Cleanup System (SPCU) maintains water quality in the Suppression Pool and at the SPCU demineralizer outlet within specified limits.

b. Prerequisites and Initial Conditions

The suppression pool is filled to its normal operating level. SPCU system has been in operation at least 4 hours.

c. Test Instructions

Water samples are taken at the demineralizer influent and effluent. The samples are analyzed and the results are compared with specified limits.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. Demineralizer influent and effluent limits for conductivity, chlorides, pH and suspended solids are within vendor specified limits. Radiation levels are within specified limits.

14.2.12.2.45 Test Number 120 - Feedwater System

a. Test Objective

To demonstrate operation of the feedwater system and to demonstrate the automatic start capabilities of the motor-driven feedwater pump.

b. Prerequisites and Initial Conditions

The preoperational tests are complete. The plant is at the specified power level. Required instrumentation is calibrated.

c. Test Instruction

Various system parameters are recorded during low and high power operation, and during a feedwater pump trip, to verify proper operation of the feedwater system. The automatic start capabilities of the motor-driven feedwater pump are demonstrated during a trip of an operating turbine-driven pump in Test Number 23C, Feedwater Pump Trip.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. The feedwater system operating parameters are within tolerances as specified by the vendor.

14.2.12.2.46 Test Number 121 - Extraction Steam System

a. Test Objective

To demonstrate that the Extraction Steam System supplies steam to its heat loads.

b. Prerequisites and Initial Conditions

The preoperational tests are complete. Reactor power and core flow are at least 95 percent of rated. Temporary temperature indicators are installed at the specified test points. The required instrumentation is calibrated.

c. Test Instruction

Data (flows, temperatures, levels, etc.) is recorded to verify that the system is supplying steam to its designated loads.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. The collected data adequately demonstrates steam flow as specified by the vendor.

14.2.12.2.47 Test Number 122 - BOP Piping Expansion and Vibration

a. Test Objective

The purpose of this test is to verify transient induced pipe vibrations and steady-state vibrations are within acceptable limits, that piping/piping supports expand thermally without obstruction for selected BOP piping and that snubber and spring hanger expansion are within acceptable limits.

b. Prerequisites and Initial Conditions

The system piping tested is supported and restrained in conformance with the design drawings. Instrumentation is installed and calibrated. ERIS is operable. A qualified GAI piping engineer is available.

c. Test Instruction

During startup testing, selected system large bore piping is visually inspected for vibration. If visual inspection detects questionable vibration, the system is checked using a vibration analyzer. During initial system heatup, piping thermal movements at selected points are instrumented, monitored and recorded. Some additional pipe hangers and snubbers not instrumented are visually inspected. Visual inspection is made of selected small bore piping and instrumentation piping for vibration. Selected piping is monitored with remote sensors during steady-state and transient vibration. Clearance between piping and obstructions is monitored.

d. Acceptance Criteria

1. Acceptance Criteria for Level 1

Remotely monitored thermal expansion and steady-state vibration are within vendor limits.

2. Acceptance Criteria for Level 2

Remotely monitored piping steady-state and transient vibration are within the limitations of the vendor supplied acceptance criteria for designated portions of the BOP systems identified in the vendor Test Specification.

14.2.12.2.48 Test Number 123 - Concrete Temperature Survey

a. Test Objective

The purpose of this test is to demonstrate the ability of natural heat transfer to cool the concrete surrounding selected pipe penetrations in the secondary containment wall.

b. Prerequisites and Initial Conditions

The Annulus Exhaust Gas Treatment and the Steam Tunnel Cooling Systems are operable as required by plant operating conditions.

c. Test Instruction

The penetration concrete temperature survey test consists of measuring concrete temperatures surrounding selected main steam and reactor water cleanup suction piping penetrations through the shield building. Measurements from temperature sensors on the concrete are recorded at various power levels. The measured temperatures are compared, and proven to be acceptable with respect to the design criteria.

Temperatures are recorded during initial heatup and at each major power level during the power ascension test phase.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. The concrete temperature adjacent to the selected containment penetrations does not exceed 200°F.

14.2.12.2.49 Test Number 124 - Main and Reheat Steam System

a. Test Objective

The purpose of this test is to demonstrate that the Nuclear Steam Supply System and the Moisture Separator/Reheaters maintain a balanced steam flow to the high pressure and low pressure turbines during steady-state operations and during turbine valve testing; and to demonstrate that the appropriate valves function properly subsequent to a main turbine trip.

b. Prerequisites and Initial Conditions

The preoperational tests are complete. The main turbine is at approximately 100 percent load. The steam systems are at steady-state operating conditions.

c. Test Instructions

With the main turbine operating at approximately 100 percent steady-state load, the main turbine stop valves are exercised individually while indications are monitored. Finally, the main turbine is tripped from high power while the moisture separator/reheater system reaction is monitored. The trip is performed during one of the planned trips for other startup tests.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. Main steam flow and extraction steam temperatures are balanced as specified by the vendor. Automatic valve action occurs as designed during a trip of the main turbine.

14.2.12.2.50 Test Number 125 - Condensate System

a. Test Objective

The purpose of this test is to demonstrate proper operation of the condensate system.

b. Prerequisites and Initial Conditions

The preoperational tests are complete. Core thermal power is greater than 95 percent rated. Temporary temperature indicators are installed at the specified test points.

c. Test Instructions

Pressure, level and temperature data is recorded for various components in this system to verify satisfactory performance.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. Condensate system parameters are maintained within the limits specified by the vendor.

14.2.12.2.51 Test Number 126 - Main, Reheat Extraction and Miscellaneous Drains

a. Test Objective

The purpose of this test is to demonstrate that the drains for the first MSIV before seat drain, second MSIV before seat drain, shutoff valve before seat drain, and main steam line drains are operating properly.

b. Prerequisites and Initial Conditions

The preoperational tests are complete. Steam flow rate is within the specified range and control switches for the valves being tested are in the AUTO mode.

c. Test Instruction

During operation, temperatures are obtained from various drain lines. With the unit operating at approximately 50 percent rated steam flow, this instruction documents that the following valves close:

1. 1B21-F069, outboard MSIV’s before seat normal drain valve.

2. 1N22-F450, shutoff valve before seat normal drain valve.

The temperature in the first MSIV before seat drain line is verified to the limit specified by GAI.

d. Acceptance Criteria

Acceptance Criteria for Level 3:

1. The steam line drain temperatures are less than a specified limit for the valves specified in the procedure.

14.2.12.2.52 Test Number 127 - LP/HP Heater Drains and Vents

a. Test Objective

The purpose of this test is to demonstrate that the low pressure and high pressure heater drains and vents systems are capable of maintaining the water levels in their respective components within limits.

b. Prerequisites and Initial Conditions

The preoperational tests are complete as applicable. The condensate and feedwater systems are in normal operation. The Building Heating and Extraction Steam Systems are in normal operation.

c. Test Instruction

Heater and drain tank high and low level alarms are observed for actuation while the plant is operating. The data is used to verify the acceptance criteria.

d. Acceptance Criteria

Acceptance Criteria for Level 3:

1. The high and low pressure heater drains and vents systems satisfactorily maintain water level in the heaters and drain tanks within the specified limits.

14.2.12.2.53 Test Number 128 - Condensate Demineralizer System

a. Test Objective

The purpose of this test is to verify that the Condensate Demineralizer System provides condensate in sufficient amount and sufficient quality.

b. Prerequisites and Initial Conditions

The preoperational tests are complete. The required instruments are calibrated.

c. Test Instruction

Flow, pressure and water chemistry data is collected to verify the proper operation of this system.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. Conductivity, pH, soluble iron and copper, silica and chloride concentrations are within specified limits.

14.2.12.2.54 Test Number 129 - Steam Seal System

a. Test Objective

The purpose of this test is to demonstrate operability of the steam seal evaporator when supplied with steam from the main steam system and extraction steam system.

b. Prerequisites and Initial Conditions

The condensate and steam seal systems are in normal operation. The preoperational tests are completed. The plant is near 100 percent power for the baseline data section.

c. Test Instruction

The various level and pressure controlling valves are demonstrated operable by slowly opening and closing the bypass valve associated with each steam seal control valve to verify that the control valve automatically responds to maintain the parameter. Steam seal evaporator supply valves operation is verified by documenting automatic opening of these valves as turbine power increases.

d. Acceptance Criteria

Acceptance Criteria for Level 3:

1. The specified automatic valves perform properly. The steam seal evaporator level is maintained within proper limits. Other steam seal system parameters are within limits specified by the vendor.

14.2.12.2.55 Test Number 130 - Condenser Air Removal System

a. Test Objective

To demonstrate automatic actions of the steam jet air ejector (SJAE) air suction valves. To demonstrate that one SJAE can maintain sufficient vacuum in the condensers to operate the unit at approximately 100 percent power.

b. Prerequisites and Initial Conditions

The condenser circulating water, steam seal, main and reheat steam, condensate seal, and offgas systems are available. The preoperational tests are complete.

c. Test Instruction

The Condenser Air Removal System is tested in two ways: (1) with the main turbine generator and both feed pump turbines on the turning gear, the SJAE second stage ejector flow is established and then throttled down to verify alarm annunciator and air suction valve closure at the specified value. Flow is reestablished to verify that the air suction valves open. (2) With Unit 1 near 100 percent power and with the specified SJAE in service, the water level in the loop seal as well as the vacuum in the low pressure, intermediate pressure, high pressure and auxiliary condensers is measured to assure they meet the specified criteria.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. Each SJAE maintains condenser vacuum at the value specified by the vendor. The SJAE suction valves and alarm perform as

designed. The level control valves of the SJAE maintain the proper level of water in each intercondenser loop seal.

14.2.12.2.56 Test Number 131 - Offgas Vault Refrigeration System

a. Test Objective

The purpose of this test is to demonstrate that the Offgas Vault Refrigeration System properly cools, and maintain cooled, the main offgas process stream and the offgas charcoal vaults.

b. Prerequisites and Initial Conditions

The preoperational tests are complete. The Instrument Air, Turbine Building Closed Cooling, and Offgas Exhaust Systems are in operation. Instrumentation required for the test is calibrated.

c. Test Instruction

Pressure, temperature and airflow data is taken during offgas operation to verify that the Offgas Vault Refrigeration System is operating properly to cool its heat loads.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. The Offgas Vault Refrigeration System is capable of maintaining its heat loads within the temperature limits specified by the vendor. The specified temperature controllers modulate their associated control valves as designed.

14.2.12.2.57 Test Number 132 - Turbine Plant Sampling

a. Test Objective

To compare conductivity, dissolved oxygen, pH, and sodium concentration readings with grab sample analysis.

b. Prerequisites and Initial Conditions

The preoperational tests are completed. The Turbine Plant Sampling System has been in operation for at least one hour. Main and Reheat Steam System heat load is available.

c. Test Instruction

With the Turbine Plant Sampling System in operation, water samples are taken at various sampling stations. The results are compared with instrument indications as well as specified limits.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. Conductivity, oxygen, pH, and sodium instrumentation readouts agree with grab samples within the specified tolerances.

14.2.12.2.58 Test Number 133 - Loose Parts Monitoring System

a. Test Objective

To obtain a full range of baseline data for the Loose Parts Monitoring System (LPMS).

b. Prerequisites and Initial Conditions

The preoperational test is complete. The LPMS is lined up for manual operation.

c. Test Instruction

During steady-state operation at various power levels baseline data is taken on all 12 channels of the Loose Parts Monitoring System. This includes a cassette recording and a waveform plot for each power level. The system is placed in the manual mode of operation and, using the appropriate operating procedure for guidance, the required data is obtained.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. Baseline data is satisfactorily obtained at the specified power levels.

14.2.12.2.59 Test Number 134 - Equipment Area Cooling

a. Test Objective

The purpose of this test is to verify that the RCIC, LPCS, HPCS, and RHR “A,” “B” and “C” room coolers are capable of removing the postulated postaccident design heat loads.

b. Prerequisites

The preoperational tests are complete and the PORC has approved the test procedures and initiation of testing.

c. Test Procedure

In conjunction with the RCIC, LPCS, HPCS, and RHR "A," "B" and "C" pumps running under nuclear heat conditions, perform a heat balance on the associated room coolers and extrapolate the results to postaccident design heat load conditions.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

1. The RCIC, LPCS, HPCS, and RHR "A," "B" and "C" room coolers are capable of removing the postulated postaccident design heat loads.

14.2.12.3 Acceptance Test Procedures

Acceptance test procedures were prepared, and conducted similarly to the preoperational test procedures. The acceptance tests were reviewed and approved by the NTS-GSE and Quality Assurance overview was not required. The acceptance test review was conducted for the NTS-GSE by the same review group that performed the technical review of the preoperational tests and the NTS-GSE approved all acceptance tests procedures and revisions. The following is a partial list of systems on which acceptance tests were performed:

MPL	System Name	Reference
C85	Steam Bypass System	<Section 14.2.12.3.2>
D51	Seismic Monitoring System	<Section 14.2.12.3.3>
G61	Liquid Radwaste Sumps System	<Section 14.2.12.3.4>
M14	Containment Vessel and Drywell Purge System	<Section 14.2.12.3.5>
M21	Controlled Access HVAC System	<Section 14.2.12.3.6>

MPL	System Name	Reference
M27	Computer Room HVAC System	<Section 14.2.12.3.7>
N21	Condensate System	<Section 14.2.12.3.8>
N23	Condensate Filtration System	<Section 14.2.12.3.9>
N24	Condensate Demineralizer System	<Section 14.2.12.3.10>
N27	Feedwater System	<Section 14.2.12.3.11>
N33/N34/N35	Process Sampling System	<Section 14.2.12.3.12>
N62	Condenser Air Removal	<Section 14.2.12.3.13>
N71	Circulating Water System	<Section 14.2.12.3.14>
P41	Service Water System	<Section 14.2.12.3.15>
P43	Nuclear Closed Cooling System	<Section 14.2.12.3.16>
P44	Turbine Building Closed Cooling System	<Section 14.2.12.3.17>
P50	Containment Vessel Chilled Water System	<Section 14.2.12.3.18>
P52	Instrument Air System	<Section 14.2.12.3.19>
R50	Outside Radio Communications System	<Section 14.2.12.3.20>
R51/R52/R53	Onsite Plant Communications System	<Section 14.2.12.3.21>
R10	Normal AC Power Distribution System	<Section 14.2.12.3.22>
P46	Turbine Building Chilled Water System	<Section 14.2.12.3.23>
-	Process Computer Acceptance Test	<Section 14.2.12.3.24>

Test descriptions for the above tests are provided in the following sections. In addition, the Fire Protection System is an acceptance test with Quality Assurance requirements applied as described in <Chapter 17> for fire protection subsystems serving safety-related areas.

A general description of the Fire Protection acceptance test is as follows.

14.2.12.3.1 Fire Protection Systems Acceptance Test

a. Test Objective

To verify the ability of the Fire Protection System to perform within design specifications.

b. Prerequisites

1. The required individual component tests are complete and approved.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Instrument and service air are available.

5. The emergency service water intake structure is complete to provide suction for fire water pumps.

c. Test Procedure

1. Proper operation of alarms, controls and interlocks are functionally tested.

2. CO_2 containment isolation valves are tested to verify response to containment isolation signals.

3. The performance of the motor-driven fire pump, diesel-driven fire pump and the jockey pump are functionally tested.

4. Proper operation of the CO_2 system is functionally tested.

5. Flow paths of the Fire Protection System are functionally tested.

6. Proper operation of the seismically qualified alternate supply of water for the Fire Protection System is verified during the Emergency Service Water System preoperational test <Section 14.2.12.1.34>.

7. All tests are performed in accordance with manufacturer's recommendations and Fire Insurance Underwriters specifications.

d. Acceptance Criteria

1. Alarms, controls and logic functions perform within design specifications.

2. System containment isolation valves perform correctly.

3. All Fire Protection System pumps start and meet the head and flow requirements.

4. The CO_2 system performs within design specifications to meet the required concentration levels.

5. The Fire Protection System flow capability is within design specifications.

14.2.12.3.2 Steam Bypass and Pressure Regulation System Acceptance Test

a. Test Objective

1. To verify the capability of the Steam Bypass and Pressure Regulation System (SB & PR) to perform within design specifications.

2. To verify that the SB & PR system is initially aligned and fully functional to support integrated operation with other systems during the startup test phase.

b. Prerequisites

1. The Hydraulic Power Unit (HPU) installation is complete, flushing and hydrostatic testing is complete, and the HPU is operational.

2. Steam bypass valves are installed, electrical and hydraulic control power is available for valve operation.

3. Electrical power is available.

4. Individual instrument calibration is complete and the initial channel calibration and lineup on the SB & PR control panel is complete.

5. The Turbine Building Closed Cooling System is available.

c. Test Procedure

1. Proper operation of the HPU is verified as follows:

   (a) The hydraulic pumps are operated to determine head and flow characteristics.

   (b) Proper alarm, indication and interlock functions on the HPU are verified.

   (c) Proper hydraulic fluid flow paths, pressure and distribution to the steam bypass valves is verified.

   (d) Proper hydraulic fluid chemistry is verified.

2. Proper SB & PR instrument channel logic is verified as follows:

   (a) Proper power supply voltage, distribution, protective functions, and backup power sources are verified.

   (b) Proper system controls, indications and alarms are verified to function correctly.

   (c) Channel fault detector logic and self checking features are verified to function correctly.

   (d) System interface outputs to the Reactor Recirculation Control System and the Turbine Control System function correctly. (The Load Demand signal output to the Reactor Recirculation system is functionally checked in the Reactor Recirculation Control System preoperational test.)

3. Bypass valves are exercised to demonstrate proper speed and stroke timing, opening sequence, valve opening and closing overlap, and total valve position versus demand.

4. Integrated system tests are performed to demonstrate proper instrument setpoint alignment, interlocks, inputs, and outputs with interfacing plant equipment and components.

5. Bypass Valve versus Turbine Control Valve coordination is demonstrated during simulated turbine and generator trips.

6. Open loop dynamic tests are performed on bypass valves and control circuits to verify that system dynamic parameters initially fall within predicted values and that no divergences or instabilities exist prior to integrated operation with other plant systems. Fine tuning and optimum adjustments of system gain, lead and lag time constants, etc. are conducted during the startup test phase.

c. Acceptance Criteria

1. System indications, alarms, interlocks, and controls function as designed.

2. System instrument controls and setpoints are calibrated and adjusted to the requirements of the design specifications.

3. Bypass valves operate properly with respect to position, speed, timing, and in proper coordination with the Turbine Control Valves.

4. The Hydraulic Power Unit functions to provide cooled and cleaned fluid at the proper pressure and flow rate over the full operating range of the bypass valves.

5. The SB & PR system initial alignment results in no divergences or gross instabilities in system dynamic parameters.

14.2.12.3.3 Seismic Monitoring System Acceptance Test

a. Test Objectives

1. To verify operational capability of the system.

2. To verify operation of the system in the test modes.

b. Test Procedure

1. The Strong Motion Accelerograph System is checked as follows:

(a) The battery and power supply are checked by system operation.

(b) The accelerometer test loop is tested by placing the system in the test mode and recording the results on the system cassette recorders.

(c) The playback system is checked by printing the results of the test loop check ((b) above).

(d) The seismic switches and triggers are tested by displacing the sensors and verifying proper system and annunciator response.

c. Acceptance Criteria

1. The seismic monitoring system functions properly in the test, record and playback modes.

2. Proper annunciation is received when the seismic switches and triggers are displaced.

14.2.12.3.4 Liquid Radwaste Sump System Acceptance Test

a. Test Objective

To verify the ability of the Liquid Radwaste Sump System to perform within design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Instrument air is available.

4. Electrical power is available.

5. Water is available.

6. Main Condenser and Liquid Radwaste System are available to receive water.

c. Test Procedure

1. Sequential operating capability and level switch interlocks for sump pumps are demonstrated by filling the sumps with water, until proper response is obtained for control switch positions.

2. Pressure switch interlocks are tested by isolating discharge piping from appropriate pumps. When the pumps are in operation, the pressure switch is verified to trip the pumps on high pressure.

3. Flow is verified to appropriate receivers while the pumps are in operation.

4. The Liquid Radwaste System Flood Protection level switches and alarms are demonstrated by manually tripping the level switches and observing their alarm functions in the Main Control Room.

d. Acceptance Criteria

1. Sequence operating capability of Liquid Radwaste Sump Pumps are demonstrated.

2. System interlocks function within design tolerances.

3. Flow from Liquid Radwaste Sumps to appropriate receivers is demonstrated.

4. The Liquid Radwaste Sump System Flood Protection level switches and alarms function as designed.

14.2.12.3.5 Containment Vessel and Drywell Purge System Acceptance Test

a. Test Objectives

To verify the ability of the Containment Vessel and Drywell Purge System to perform within design specifications.

b. Prerequisites

1. Individual component testing is complete.

2. Instrument calibration and loop checks are completed.

3. Test instruments are available and calibrated.

4. Instrument air is available.

5. Electrical power is available.

c. Test Procedure

1. Proper operation of the Containment Vessel and Drywell Purge System is verified as follows:

   (a) Fan capacities are verified in intermittent mode of operation.

   (b) Fan capacities are verified in refueling mode of operation.

   (c) Proper system controls, indications and alarms are verified to function correctly.

   (d) The interlocks between the fan and the damper function correctly.

   (e) Fan automatic trip signals function correctly.

   (f) Damper alignment and operation function correctly for the different modes of operation.

d. Acceptance Criteria

1. System fans perform satisfactorily and deliver specified air quantities.

2. System instruments controls function per design requirements.

3. System interlocks function as required and designed.

14.2.12.3.6 Controlled Access HVAC System Acceptance Test

a. Test Objective

To verify the ability of the Controlled Access HVAC System to perform within design specifications.

b. Prerequisites

1. Individual component testing is complete.

2. Instrument calibration and loop checks are complete.

3. Test instruments are available and calibrated.

4. Instrument air is available.

5. Electrical power is available.

c. Test Procedure

1. Proper operation of the Controlled Access HVAC System is verified as follows.

(a) Fan capacities are verified in normal mode of operation.

(b) Proper system controls, indications and alarms are verified to function correctly.

(c) Damper alignment and operation function correctly for the different modes of operation.

(d) Fan automatic trip signals function correctly.

d. Acceptance Criteria

1. System fans perform satisfactorily and deliver specified air quantities.

2. System instrument controls function per design requirements.

3. System interlocks function as required and designed.

14.2.12.3.7 Computer Room HVAC System Acceptance Test

a. Test Objective

To verify the ability of the Computer Room HVAC System to perform within design specifications.

b. Prerequisites

1. Individual component testing is complete.

2. Instrument calibration and loop checks are complete.

3. Test instruments are available and calibrated.

4. Instrument air is available.

5. Electrical power is available.

c. Test Procedure

1. Proper operation of the Computer Room HVAC system is verified as follows:

   (a) Fan capacities are verified in normal mode of operation.

   (b) Proper system controls, indications and alarms are verified to function correctly.

   (c) Fan auto-trip and auto-start signals function correctly.

   (d) Space humidification is maintained at acceptable level.

d. Acceptance Criteria

1. System fans perform satisfactory and delivered specified air quantities.

2. System instrument controls function per design requirements.

3. System interlocks function as required and designed.

14.2.12.3.8 Condensate System Acceptance Test

a. Test Objective

1. To demonstrate that the condensate system pumps are capable of supplying the designed flow of condensate at designed head.

2. To demonstrate that the condensate system is capable of maintaining the condenser hotwell within normal operating units.

3. To operationally verify the interlocks and alarms associated with the hot surge tank.

4. To demonstrate that the NPSH available exceeds NPSH required for the condensate system pumps.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Demineralized water is available.

5. Instrument air is available.

6. The turbine building closed cooling, condensate transfer and storage and feedwater systems are available.

c. Test Procedure

1. The hotwell pumps and the condensate booster pumps are operated to verify that each pump supplies design flow at design head.

2. The hotwell level control functions are verified by varying the hotwell level.

3. The hot surge tank level instrumentation is verified relative to alarms and associated interlocks by varying the hot surge tank level.

4. The condensate system is operated at full flow and pump suction pressures are corrected for the worst case condition relative to verification of NPSH available.

d. Acceptance Criteria

1. The hotwell level control system maintains the level in the hotwell within normal operating limits.

2. The interlocks and alarms associated with the hot surge tank actuate at the design values.

3. The hotwell pumps and condensate booster pumps develop design total dynamic head when operated at design flow conditions.

4. The NPSH available exceeds the NPSH required for the condensate system pumps.

14.2.12.3.9 Condensate Filtration System Acceptance Test

a. Test Objective

1. To demonstrate the ability of the condensate filtration system to maintain condensate feedwater chemistry and proper operation of system controls.

b. Prerequisites

1. Instrumentation and controls are calibrated and operable.

2. The condensate system is operable and lined up to recirculate water to the hotwell.

3. Instrument and service air is available.

4. Electrical power is available.

5. Condensate storage and transfer is available with enough water to support this test.

6. Backwash receiving tank is available.

7. The process sampling system is available.

c. Test Procedure

1. The filter units are placed in operation and their controls are operated.

2. Effluent water purity is determined.

3. System flow rates are measured for each filter unit.

d. Acceptance Criteria

1. Each filter unit produces effluent water of the proper quality.

2. The condensate filtration bypass valve operates properly, based on flow during test conditions, to maintain specified differential pressure.

3. The online, hold and backwash process operates properly for each filter unit.

4. System controls, interlocks and alarms operate properly.

14.2.12.3.10 Condensate Demineralizer System Acceptance Test

a. Test Objective

1. To demonstrate the ability of the condensate demineralizer system to maintain condensate feedwater chemistry and the operability of the regeneration system.

b. Prerequisites

1. Instrumentation and controls are calibrated and operable.

2. The condensate system is operable and lined up to recirculate water to the hotwell.

3. Instrument and service air is available.

4. Electrical power is available.

5. Condensate storage and transfer is available with enough water to support this test.

6. Backwash rinse and regeneration receiving tanks are available.

7. The process sampling system is available.

c. Test Procedure

1. The demineralizers are placed in operation and their controls are operated.

2. Effluent water purity is determined.

3. System flow rates are measured for each demineralizer, and regeneration flow paths are exercised.

4. At least one demineralizer regeneration is performed.

d. Acceptance Criteria

1. Each demineralizer produces effluent water of the proper quality.

2. The condensate demineralizer bypass valve operates properly, based on flow during test conditions, to maintain specified differential pressure.

3. The Inservice, Standby, Resin Transfer, and Resin Regeneration Modes associated with the system operate properly.

4. The system pneumatic valves operate properly.

5. System controls and interlocks operate properly.

14.2.12.3.11 Feedwater System Acceptance Test

a. Test Objective

To demonstrate component operability and performance.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Instrument air is available.

5. The condensate system is available.

6. The turbine building closed cooling system is available.

c. Test Procedure

The feedwater system is operated under limited conditions and simulated or actual signals injected where necessary to verify the following:

1. That the feedwater booster pumps each provide the design flow, total dynamic head and have sufficient suction head available.

2. That the sealing water systems supply sealing water to all required components.

3. That all reactor feed pump oil systems supply oil as required.

4. That the feedwater booster pumps and motor-driven feed pump minimum recirculation controls are operationally verified to prevent pump overheating.

5. That the steam driven feed pump minimum flow valve operates to open and close from a simulated input.

6. That system alarms, trips, interlocks, and controls function properly.

d. Acceptance Criteria

1. The feedwater booster pumps meet design flow, total dynamic head and have sufficient suction head available.

2. The seal water injection system demonstrates to supply seal water to the feed pumps.

3. The feedwater booster and motor-driven feed pumps minimum recirculation controls operate to prevent pump overheating.

4. The steam driven feed pump minimum recirculation controls function properly.

5. That all oil pumps supply the proper oil pressures to the feedwater turbines and pumps.

6. Startup and limited operation of the reactor feed turbines have been successfully demonstrated.

7. The system alarms, trips, interlocks, and controls function properly.

14.2.12.3.12 Process Sampling System Acceptance Test

a. Test Objective

1. To demonstrate the process sampling system provides adequate process samples to the various installed analytical monitoring equipment and grab sample stations.

b. Prerequisites

1. Instrumentation and controls are calibrated and operable.

2. Electrical power is available.

3. Applicable sample cooling water is available.

4. Applicable waste receiving is available.

5. Service air is available.

c. Test Procedure

1. Each sample station is operated as available.

2. Grab samples are drawn from all grab sample points as available.

3. System alarms are actuated.

d. Acceptance Criteria

1. Sample lines are unobstructed and provide adequate sample flows.

2. Grab sample valves operate properly.

3. System alarms operate properly.

4. Sample pressures and temperatures are maintained with specified values. (Certain sample pressures, temperatures and flowrates are deferred until after fuel load such that more representative process samples are available.)

NOTE: Chemical fume hoods are tested for proper flow during the applicable HVAC test.

14.2.12.3.13 Condenser Air Removal Acceptance Test

a. Objectives

1. To demonstrate the operability of the condenser air removal system.

b. Prerequisites

1. The condensate system is operable and lined up to recirculate water to the condenser.

2. The auxiliary boilers are operable and lined up to supply sealing steam.

3. The main and auxiliary condensers are available.

4. Instruments and controls are calibrated and operable.

5. Instrument air is available.

6. Electrical power is available.

7. The Offgas Building Exhaust System is available.

8. The Turbine Building Closed Cooling Water System is available.

c. Test Procedures

1. The mechanical vacuum pumps are operated to establish an initial vacuum.

2. The mechanical vacuum pumps interlocks are functionally tested.

3. Various performance parameters are measured.

4. The condenser vacuum breakers are operated.

5. Simulated high radiation signals are used to initiate isolation.

6. The steam jet air ejectors (SJAE) intercondenser level control valves are functionally tested.

d. Acceptance Criteria

1. The mechanical vacuum pumps pull an acceptable vacuum.

2. The SJAE intercondenser level control valves maintain proper water level in the SJAE's intercondenser loop seal.

3. The system controls, interlocks and alarms operate properly.

4. The condenser vacuum pumps trip and the suction valves close on simulated high main steam line radiation.

14.2.12.3.14 Circulating Water System Acceptance Test

a. Objective

To demonstrate the ability of the circulating water system and associated condenser mechanical cleaning equipment (Amertap) to perform within design specification.

b. Prerequisites:

1. Individual component initial checkout and run-in tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Instrument air system is available.

5. Service water system is available.

6. Acid addition system is available.

7. Chlorination to circulating water system is available.

c. Test Procedure:

1. Fill the circulating water system by operating the service water system.

2. Measure circulating water pump head and flow.

3. Test condenser waterbox drain tank sump and level control.

4. Check electrical interlocks for turbine building flood protection, cooling tower basin level, pump bearing lubrication low flow, and differential pressure across Amertap strainer.

5. Verify circulating water system chemistry control for conductivity, pH and chlorine.

6. Test main condenser and auxiliary condenser mechanical cleaning equipment in NORMAL, BACKWASH and EMERGENCY BACKWASH modes.

7. Operationally verify cooling tower flow paths.

d. Acceptance Criteria

1. Circulating water pumps head and flow meet the design requirement.

2. Waterbox drain pump maintains water level in the waterbox drain tank.

3. Turbine building high water level signal automatically trips circulating water pumps and closes L.P. condenser inlet valves.

4. Circulating water pump bearing lubrication low flow prevents pump from starting.

5. Circulating water system conductivity, pH and chlorine levels are controlled.

6. Main condenser and auxiliary condenser mechanical cleaning equipment functions properly in NORMAL, BACKWASH and EMERGENCY BACKWASH modes.

7. Cooling tower flow paths are operational.

14.2.12.3.15 Service Water System Acceptance Test

a. Test Objective

To demonstrate component operability, performance and that the system can provide cooling water flows to system components.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Instrument air is available.

c. Test Procedure

The service water system is operated and simulated signals injected where necessary to verify the following:

1. That the service water pumps meet flow and total design head requirements.

2. Flow paths to heat exchangers and coolers.

3. That the service water strains backwash automatically in the proper sequence.

4. That system alarms and interlocks function properly.

d. Acceptance Criteria

1. The service water system with screens, strainers and cycle makeup in service is capable of providing cooling water flows to each of the system heat exchangers and coolers.

2. Each service water pump supplies design head and flow.

3. The strainer backwash automatically starts at the design differential pressure and the strainers sequence in the correct order.

4. The system pressure and flow alarms operate at the design setpoints.

14.2.12.3.16 Nuclear Closed Cooling System Acceptance Test

a. Test Objective

To verify the ability of the Nuclear Closed Cooling System to perform within design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Instrument air is available.

5. Demineralized water is available.

6. Service water system is available.

c. Test Procedure

1. The nuclear closed cooling pumps are operated and the system is flow balanced to provide the required cooling to the related equipment at the design pump total design head.

2. During the flow balancing operation, the capability of the throttle valves to control flow is demonstrated.

3. Demineralized water makeup to the surge tank is demonstrated.

d. Acceptance Criteria

1. System pumps head and flow requirements are met.

2. System pumps supply the required cooling water flow rates to major components supplied by the nuclear closed cooling system.

3. System valves control the flow to the related equipment.

14.2.12.3.17 Turbine Building Closed Cooling System Acceptance Test

a. Test Objective

To verify the ability of the Turbine Building Closed Cooling System to perform within design specifications.

b. Prerequisites

1. Individual component tests are complete.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Instrument air is available.

5. Demineralized water is available.

6. Service water system is available.

c. Test Procedure

1. The Turbine Building Closed Cooling Pumps are operated to demonstrate the capability to provide the required system flow rate at the design pump total design head.

2. Demonstrate demineralized water makeup flow to the surge tank.

3. Demonstrate that the surge tank high and low level alarms operate as required.

4. Demonstrate that the system low flow alarm operates as required.

5. Demonstrate the chemical addition tank flow paths.

d. Acceptance Criteria

1. Pump head and system flow requirements are met.

2. System low flow and surge tank high and low level alarms operate within design specifications.

3. Demineralized water makeup flow to the surge tank is demonstrated.

4. Chemical addition tank flow paths are demonstrated.

14.2.12.3.18 Containment Vessel Chilled Water System

a. Test Objective

To verify the ability of the Containment Vessel Chilled Water System to perform within design specifications.

b. Prerequisites

1. Individual component testing is complete.

2. Instrument calibration and loop checks are complete.

3. Test instrumentation is available and is calibrated.

4. Instrument air is available.

5. Electrical power is available.

6. Nuclear closed cooling water system is available.

7. Containment vessel cooling ventilation system is available.

8. Inservice inspection room ventilation system is available.

c. Test Procedure

1. Proper operation of the Containment Vessel Chilled Water System is verified as follows:

   (a) Chilled water pump capacities are verified for design gpm.

   (b) Containment isolation valves function correctly and operate within prescribed time.

   (c) System responds correctly to manual isolation signal.

   (d) System responds correctly to automatic isolation signal.

(e) Proper system controls, indications and alarms are verified to function correctly.

d. Acceptance Criteria

1. System pumps perform satisfactorily and deliver specified water flows.

2. System instruments control function per design requirements.

14.2.12.3.19 Nonsafety-Related Instrument Air and Loss of Instrument Air Acceptance Tests

14.2.12.3.19.1 Nonsafety-Related Instrument Air Acceptance Test

a. Test Objectives

1. Verify the instrument air (IA) system is capable of supplying air at the required flow, pressure, temperature, and dew point.

2. Verify proper operation and control for the manual and automatic modes of operation of the IA compressor.

3. Verify proper operation of redundant components.

b. Prerequisites

1. Instrument calibration complete.

2. Electric power available.

3. Required support systems are available.

4. Individual initial checkout and run-in component tests are complete.

5. Cleanliness requirements are verified during initial checkout and run-in testing.

c. Test Procedure

1. Demonstrate that the IA compressor supplies instrument air at the required design flow, pressure and temperature.

2. Demonstrate that the IA compressor functions properly in the manual and automatic modes of operation.

3. Demonstrate that the failure or loss of function of redundant components does not prevent proper operation of the others.

4. Demonstrate proper operation of the IA dryers to supply air at the required dew point.

d. Acceptance Criteria

1. IA compressor flow, pressure and temperature requirements are met.

2. IA compressor requirements for manual and automatic operation are met.

3. IA dryers air dew point requirements are met.

4. Requirements for failure or loss of function of redundant components so as to not jeopardize proper operation of the other components are met.

14.2.12.3.19.2 Nonsafety-Related Instrument Air System Loss of Instrument Air Acceptance Test

a. Test Objective

1. Upon sudden depressurization (simulated pipe break) of the instrument air supply verify that the air operated components fail from their normal operating position in a manner maintaining continued capability to provide system safety functions.

2. Upon slow depressurization (simulated pipe plugging by freezing) of the instrument air supply verify that the air operated components fail from their normal operating position in a manner maintaining continued capability to provide system safety functions.

b. Prerequisites

1. Instrument calibration and initial checkout and run-in testing is complete on pneumatic operated components to be tested.

2. The Instrument Air System and required support systems are available to supply instrument air to the components being tested.

c. Test Procedure

1. Pressurize the instrument air header.

2. Position the components being tested in the test branch to their normal operating position and record position on data sheet.

3. Isolate the instrument air branch to be tested.

4. (a) Rapidly depressurize the test branch and record the failed position of the components being tested.

   (b) Monitor system responses and interaction and record any unexpected characteristics.

5. After all the component's failed positions have been recorded, open the isolation valve to the test branch to re-pressurize.

6. If the components do not return to their normal operating position, reposition them (in the test branch) the same as in Step 2 and record position.

7. Isolate the test branch.

8. (a) Slowing depressurize the test branch and record the failed position of the components being tested.

   (b) Monitor system responses and interaction and record any unexpected characteristics.

9. Proceed to the next branch to be tested and perform Steps 1 through 8.

10. After all branches are tested, return system to the required status.

d. Acceptance Criteria

1. Upon rapid depressurization of the instrument air supply, the requirements for the air operated components to fail in the designed position are met and no unexpected system interactions are observed.

2. Upon slow depressurization of the instrument air supply, the requirements for the air operated components to fail in the designed position are met and no unexpected system interactions are observed.

14.2.12.3.20 Outside Radio Communications System Acceptance Test

a. Test Objective

To demonstrate the capability of establishing voice communications between the Perry Nuclear Power Plant and the CEI System Operations Center and the Lake County Sheriff's Office.

b. Prerequisites

1. The initial system checkout and run-in are performed and any deficiencies which would affect this test are resolved.

2. Power is available from the appropriate ac power sources.

c. Test Procedure

1. Verify that two-way voice communication is made between the Unit 1 control room and the CEI System Operation Center using the microwave equipment and the backup power pool radio service radio.

2. Verify that two-way voice communications is made between the Central Security Office and the Lake County Sheriff’s Office.

3. Verify that the microwave equipment performs on the stand-by transmitter and receiver when the primaries are in a simulated failure mode.

4. Verify that the microwave and radio equipment functions when the normal ac is interrupted.

d. Acceptance Criteria

1. Each outside radio communication system is capable of providing two-way communication.

2. The radio and microwave communication system is capable of functioning upon loss of ac power to the equipment at the Perry Nuclear Power Plant.

14.2.12.3.21 Onsite Plant Communications Systems Acceptance Test

a. Test Objective

1. To verify the operation of the Intra-Plant Communication System by testing handset stations, speakers for proper operation and ability to achieve sound pressure levels over ambient levels.

2. To verify operation of Maintenance and Calibration Communication System by testing headsets, jack stations and the control of the patch panel.

3. To verify the capability of the Exclusion Area Paging System to broadcast a prerecorded or spoken message over the exclusion area.

b. Prerequisites

1. The initial system checkout and run-in are performed and any deficiencies which would affect this test are resolved.

2. Power is available from the appropriate ac power sources.

c. Test Procedure

1. With the Intra-Plant Communication System energized, perform the following tests:

(a) Verify page throughout plant.

(b) Verify page of each handset and appropriate muting of speakers.

(c) Verify each party line position for proper operation.

(d) Verify that sound pressure levels are increased to overcome ambient noise.

(e) Verify that the radiation emergency alarm and fire alarm are broadcasted by the primary and backup tone generator.

2. With the Maintenance and Calibration Communications System energized, perform the following tests:

(a) Verify that each portable headset works properly.

(b) Verify that each jack station operates properly by achieving audible communications.

(c) Verify that each power supply operates properly by achieving audible communication.

3. With the Exclusion Area Paging System energized, perform the following tests:

(a) Verify that the Exclusion Area Paging System broadcasts a pre-recorded and live spoken message.

(b) Verify that the Exclusion Area Paging System is capable of producing a clearly distinguishable message along the exclusion area boundary and at a level sufficient to be perceived above projected operational noise levels within the exclusion area.

d. Acceptance Criteria

1. The operation of the page and party line of each handset is verified on the Intra-Plant Communication System.

2. The sound pressure levels are sufficient to be perceived over ambient levels when using the Intra-Plant Communication System.

3. The operation of the emergency alarms of the Intra-Plant Communication System perform in both the primary and back-up modes.

4. The operation of the headsets, jack stations and power supplies provide audible communications for the Maintenance and Calibration System.

5. The operation of the Exclusion Area Paging System produces a clearly distinguishable message along the exclusion area boundary and at a level sufficient to be perceived above projected operational noise levels within the exclusion area.

14.2.12.3.22 Normal AC Power Distribution System Acceptance Test

a. Test Objective

To demonstrate that the integrated power system performs as designed, under load conditions, to a loss of power.

b. Prerequisites

1. The initial checkout test phase, <Section 14.2.1.1a>, using generic component test procedures as required for this test are complete and the data is reviewed.

2. Instrument and relay calibration complete.

3. The Unit 1 Power Distribution System is loaded. (13.8 kV, 4 kV, 480V and 120V Power Distribution.)

c. Test Procedure

1. All busses and load centers are loaded.

2. Simulate loss of unit auxiliary transformer feeds (generator).

3. Simulate loss of Unit 1 startup transformer.

4. Simulate loss of inter-bus transformer “B”.

5. Simulate loss of inter-bus transformer “C”.

6. Note all anomalies and perturbations.

d. Acceptance Criteria

1. All transfers occur as designed:

(a) 13.8 kV Busses L11 and L12 to startup source on generator trip.

(b) 13.8 kV L10 to the Unit 2 startup transformer on startup transformer trip.

(c) 4.16 kV Bus H11 or H12 to the inter-bus transformer normally feeding Bus H12 or H11.

14.2.12.3.23 Turbine Building Chilled Water System Acceptance Test

a. Test Objective

To verify the ability of the Turbine Building Chilled Water System to perform within design specifications.

b. Prerequisites

1. Individual Component Testing is complete.

2. Instrument Calibration and Loop Checks are complete.

3. Test Instrumentation is available and is calibrated.

4. Instrument Air is available.

5. Electrical Power is available.

6. Nuclear Closed Cooling Water System is available.

7. Demineralized Water is available.

8. Turbine Building, Turbine Power Complex and Steam Tunnel Ventilation Systems are available.

c. Test Procedure

1. Proper operation of the Turbine Building Chilled Water System is verified as follows:

(a) Chilled water pump capacities are verified for design GPM.

(b) Proper system controls, indications, alarms, and interlocks are verified to function correctly.

(c) Ventilation coil supply temperature is verified for design temperature during component testing.

d. Acceptance Criteria

1. System pumps perform satisfactorily and deliver specified flows.

2. System instruments control function per design requirements.

14.2.12.3.24 Process Computer Acceptance Test

a. Test Objective

To demonstrate the proper operation of computer input/output logic, including operator displays.

b. Prerequisites

1. Computer systems installed and operational.

2. Electrical power is available.

3. Computer software for input/output channels is operable to the extent necessary for performance of this test.

c. Test Procedure

1. Input signals are either simulated at the Input/Output cabinet or transmitted by installed instrumentation.

2. Output signals are either monitored at the Input/Output cabinet or by actuation of field devices.

d. Acceptance Criteria

1. The computer responds correctly to input signals.

2. Computer outputs operate properly.

3. Operator displays are satisfactory.

14.2.12.4 Special Test Procedures

Special tests were those tests which did not fall clearly into the preoperational or startup test categories. For example: they may have begun during the preoperational test phase and continued through the startup test phase. The following general descriptions define the objectives for each special test.

14.2.12.4.1 Special Test Number 1 - System Vibration Special Test

a. Test Objective

The purpose of this test is to verify transient induced pipe vibrations and steady-state vibrations are within acceptable limits for BOP piping designated as follows:

1. ASME Code Class 1, 2 and 3 piping systems.

2. High energy piping systems inside Seismic Category I Structures.

3. High energy portions of systems whose failure could reduce the functioning of Seismic Category I plant features to an unacceptable level.

4. Seismic Category I portions of moderate energy piping systems located outside containment.

   NOTE: Due to the system characteristics and/or infrequent use of some of the above systems, the requirement for vibrational testing selected portions may be waived by the engineer.

b. Prerequisites

The system piping to be tested is supported and restrained in conformance with the design drawings. Test equipment is available and calibrated. A Qualified Piping Engineer of Gilbert Commonwealth, Inc. is present to witness the test.

c. Test Procedure

During preoperational, acceptance and other system testing, the system piping is visually inspected for vibration. If visual inspection detects questionable vibration, the system is checked using a vibration monitor.

d. Acceptance Criteria

1. Piping steady-state and transient vibrations for BOP piping identified in the Test Objective, as a result of cyclic vibration in the range of 10^8 to 10^9 cycles is limited to 1/2 of the fatigue endurance limit, at 10^6 cycles, as defined in the ASME Code Appendix I. For those piping systems which the plant life cycle vibrations are expected to be 10^6 cycles or less, stress limits of the ASME Code Appendix I are applied.

2. The total stress due to dynamic loading, plus all other combined stresses, do not exceed ASME Section III or ANSI B.31.1 allowable stresses, as applicable.

14.2.12.4.2 Special Test Number 2 (Deleted)

(See Startup Test 123, <Section 14.2.12.2.48>)

14.2.12.4.3 Special Test Number 3 - System Thermal Expansion Test

a. Test Objectives

The purpose of this test is to verify that designated piping/piping supports of selected systems, or applicable portions thereof, can expand without obstruction during hot functional testing.

b. Prerequisites

The system piping to be tested is supported and restrained in conformance with the latest design drawings. No obstruction to pipe movement exists other than designed.

c. Test Procedure

During a non-nuclear heatup of the selected systems, piping and pipe supports are visually inspected for thermal growth.

d. Acceptance Criteria

1. The thermal growth of the selected systems, or applicable portions thereof, is unobstructed by obstacles other than designed piping supports.

2. Snubbers do not become fully extended or retracted.

3. Spring hangers are not unloaded or have not reached the end of their available movement range.

14.2.12.4.4 Special Test 4 - Reactor Pressure Vessel and Connecting Piping Hydrostatic Test

a. Test Objective

The purpose of this test is to satisfy the requirements for a System Hydrostatic Test in accordance with the ASME Code, Section III, Division I, for all field installed piping and components connected to the Reactor Pressure Vessel.

b. Prerequisites

1. The Reactor Pressure Vessel field installation is complete with the exception of field installed internals.

2. Field installation of all piping systems directly connected to the Reactor Pressure Vessel to the outermost containment isolation valve is complete and adequately supported for the test.

3. The Reactor Pressure Vessel and connecting piping are filled with demineralized water.

4. The Reactor Pressure Vessel metal temperatures are greater than 100°F prior to pressurization.

c. Test Procedure

The Reactor Pressure Vessel is filled with demineralized water after completion of flushing. The Reactor Vessel closure head is installed and the studs tensioned. The Residual Heat Removal System is utilized to heat the Reactor Pressure Vessel to a temperature greater than 100°F. The system is then pressurized to a minimum pressure of 1,563 psig. This test pressure is held for a minimum of ten (10) minutes and then reduced to 1,250 psig. The system is then inspected for leakage.

d. Acceptance Criteria

1. The system is subjected to a minimum test pressure of 1,563 psig for at least ten (10) minutes.

2. The system is inspected for leakage at a minimum pressure of 1,250 psig in accordance with the ASME Code.

<TABLE 14.2-1>

DELETED

TABLE 14.2-2

STARTUP TESTS

STI NO.	TEST NAME	COLD TEST OF OPEN RPV	HEAT UP	TEST CONDITIONS[1][5] 1	2	3	4	5	6	7	8
1	Chemical & Radiochemical[2]	X	X	X	X	X		X	X		OR X
2	Radiation Measurements[2]	X	X	X		X			X		
3	Fuel Loading	X									
4	Full Core Shutdown Margin	X									
5	CRD	X	X	X					X		X
6	SRM Perf. & Control Rod Seq.	X	X								
8	Rod Sequence Exchange								X		
10	IRM Performance	X	X	X	OR X						
11	LPRM Calibration		X	X		X			X		
12	APRM Calibration		X	X	X	X		X	X		
13	Process Computer	X	X	X	OR X	X		X	X		
14	RCIC		X	X	OR X	OR X		OR X			
16A	Selected Process Temperatures		X			X	X		X		

TABLE 14.2-2 (Continued)

STI NO.	TEST NAME	COLD TEST OF OPEN RPV	HEAT UP	TEST CONDITIONS[1][5] 1	2	3	4	5	6	7	8
16B	Water Level Reference Leg Temperature		X						X		
17	System Expansion		X OR	X							
18	Core Power Distribution								X		
19	Core Performance			X	X	X	X		X	X	X
20	Steam Production								X		OR X
21	Core Power-Void Mode Response									X	
22	Pressure Regulator			X	X	X			X	X	X
23	FW System										
23A	Feedwater Control		X OR	X	X	X		X	X	X	X
23B	Loss of Feedwater Heating								X		
23C	Feedwater Pump Trip								X		
23D	Maximum Feedwater Runout Capability							X	X		
24	Turbine Valve Surveillance									X	X

TABLE 14.2-2 (Continued)

STI NO.	TEST NAME	COLD TEST OF OPEN RPV	HEAT UP	TEST CONDITIONS[1][5] 1	2	3	4	5	6	7	8
25	Main Steam Isolation Valves										
25A	MSIV Functional Test		X		X OR	X				X	X
25B	Full Reactor Isolation										X
25C	Main Steamline Flow Venturi Calibration								X		
26	Relief Valves:		X	X OR	X						
27	Turbine Stop Valve Trip and Generator Load Rejection				X	X			X		
28	Shutdown From Outside Control Room[3]			X							
29	Recirculation Flow Control System:										
29A	Valve Position Control	X		X		X					X
29B	Recirc. Flow Control					X			X		X
30	Recirc. System:										
30A	One Pump Trip					X			X		

TABLE 14.2-2 (Continued)

STI NO.	TEST NAME	COLD TEST OF OPEN RPV	HEAT UP	TEST CONDITIONS[1][5] 1	2	3	4	5	6	7	8
30B	RPT Trip of Two Pumps					X					
30C	System Performance					X	X		X		X
30D	Test Deleted										
30E	Recirculation System Cavitation				X	X		OR X			
31	Loss of T-G Offsite Power				X						
33	Drywell Piping Vibration		X	X	X	X		X	X		X
34	RPV Internals Vibration		X			X	X	X	X	X	X
35	Recirc. Sys. Flow Calibration					X			X		
36	Isolated Reactor Stability[4]		X								
70	Reactor Water Cleanup System		X	X		X	OR X				
71	Residual Heat Removal System			X	OR X				X		X
74	Offgas System		X	X					X		
99	ERIS	X	X	X		X		OR X	X		X

TABLE 14.2-2 (Continued)

STI NO.	TEST NAME	COLD TEST OF OPEN RPV	HEAT UP	TEST CONDITIONS[1][5] 1	2	3	4	5	6	7	8
100	Integrated HVAC			X					X		
113	Service Water								X		
114	Emergency Closed Cooling Water			X							
115	Nuclear Closed Cooling Water								X		
116	Turbine Building Closed Cooling Water		X	X					X		
117	Emergency Service Water			X							
118	Circulating Water								X		
119	Suppression Pool Cleanup	X		X OR	X						X
120	Feedwater			X					X		
121	Extraction Steam								X		
122	BOP Piping Expansion and Vibration		X	X	X			X	X		X
123	Concrete Temp. Survey		X	X		X			X		
124	Main and Reheat Steam								X		X

TABLE 14.2-2 (Continued)

STI NO.	TEST NAME	COLD TEST OF OPEN RPV	HEAT UP	TEST CONDITIONS[1][5] 1	2	3	4	5	6	7	8
125	Condensate								X		
126	Main, Reheat Extraction and Miscellaneous Drains					X			X		
127	LP/HP Heaters Drains and Vents								X		
128	Condensate Filters/ Demineralizers								X		
129	Steam Seal		X			X			X		
130	Condenser Air Removal		X						X		
131	Offgas Vault Refrigeration								X		
132	Turbine Plant Sampling								X		
133	Loose Parts Monitoring System		X	X	X	X	X	X	X	X	X
134	Equipment Area Cooling			X							

NOTES:

(1) See <Figure 14.2-4> for Test Conditions region map.

(2) Portions of these tests are performed prior to commencing fuel loading to obtain baseline data.

TABLE 14.2-2 (Continued)

NOTES: (Continued)

(3) The cooldown portion of this test may be performed at a later test condition due to insufficient decay heat.

(4) This test is not performed since Perry is not the lead BWR-6 plant <Section 14.2.12.2.32.a.>.

(5) An "OR" indicates that all scheduled testing is performed at either or both test conditions.

<TABLE 14.2-3>

<TABLE 14.2-4>

<TABLE 14.2-5>

<TABLE 14.2-6>

DELETED

TABLE 14.2-7

CONTROL SYSTEM OPERATING MODES

- The Pressure Control System has only a single operating mode and, therefore, is generally not mentioned as a unique condition under the test condition description.
- The Feedwater Control System is in the three element mode during most tests, except as specifically noted such as in a portion of the feedwater controller testing.
- Unless otherwise specified the recirculation system is in the Flow Command Mode of operation.
- In all cases the abbreviation NORM indicates that reactor systems are in the mode that is appropriate to the power and flow conditions of the test.
- Since operating modes of the recirculation flow control system can vary from test to test a description of each mode is given below.

Load Control M/A Station	Flux Control M/A Station	Flow Control M/A Station	Description of the Operational Mode
Manual	Manual	Manual	Local Position Command Mode Operation (POS) The individual valve position command is from the manual control signal at the individual flow control loop M/A station.
Manual	Manual	Automatic	Combined Flow Command Mode Operation (FLO) The total drive flow control is from the manual control signal at the flux control loop M/A station.
Manual	Automatic	Automatic	Flux Command Mode Operation (FLX) The neutron flux command is from the manual control signal at the load control M/A station.