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14.0 INITIAL TEST PROGRAM*

14.1 SPECIFIC INFORMATION TO BE INCLUDED IN PRELIMINARY SAFETY ANALYSIS REPORTS

This section is not applicable to the Shearon Harris Nuclear Power Plant.

14.2 SPECIFIC INFORMATION TO BE INCLUDED IN FINAL SAFETY ANALYSIS REPORT

14.2.1 SUMMARY OF TEST PROGRAM AND OBJECTIVES

14.2.1.1 Test Program Objectives

The Shearon Harris Nuclear Power Plant's Initial Test Program is based upon the requirements of 10 CFR 50.34, Section XI of 10 CFR 50, Appendix B, and NRC Regulatory Guide 1.68. The program includes the period from completion of construction and release to the Startup Unit for testing (on a system or equipment basis) through the completion of the Power Ascension Test Program.

The Initial Test Program is designed to provide the necessary assurance that the facility can be operated in accordance with design requirements and in a manner that will not endanger the health and safety of the public by satisfying the following objectives:

a) To provide assurance that the system performs in accordance with the design.

b) To train and familiarize the plant operating and technical staff in the operation of the facility.

c) To assure that the plant operating and emergency procedures are proven adequate, to the extent practicable, during the performance of the program.

d) To assure the program is accomplished with adequate numbers of qualified personnel.

e) To provide adequate and administrative controls to govern the program.

14.2.1.2 Test Program Phases

Carolina Power & Light's SHNPP Initial Test Program is conducted in three sub-programs; the Component Testing & Initial Operation Program, the Preoperational Test Program, and the Power Ascension Test Program.

a) Component Testing & Initial Operation Program - This program begins upon jurisdictional transfer (Release for Test) of an individual structure, component, or system from Construction to Startup. The primary objective of this program is to satisfy all prerequisites prior to performing preoperational testing on an individual system. Checkout testing is performed under the direction of the responsible Start-up Engineer.

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*Further information is contained in the TMI appendix.

The checkout tests verify that components and systems are ready for preoperational testing. This program includes, in general, such tests/checks as: instrument calibration, electrical continuity and megger checks as necessary, pump and motor rotation and vibration checks, hydrostatic testing, cleaning, and flushing.

b) Preoperational Test Program - This program begins upon completion of component testing on individual systems or subsystems and includes successful completion of hot functional testing of the Reactor Coolant System. The primary objective of preoperational testing is to verify that specific equipment and systems perform in accordance with design and safety requirements prior to initial core loading. The preoperational tests which are performed are described in Section 14.2.12. These tests are written and directed by the SHNPP Startup Unit and reviewed and approved by appropriate personnel in the design and operating organizations when applicable.

c) Power Ascension Test Program - This program begins with initial core loading after receipt of the plant's operating license. The program also encompasses initial criticality, zero power operation and ascension to full power, and the 100-hour warranty run to commercial operation inclusive. Primary objectives of this program are to verify nuclear parameters of the reactor and the ability of the plant to operate without endangering the public health and safety. Secondary objectives are to ensure safe and efficient operation of the plant and to detect any design deficiencies. These tests are written and directed by the Power Ascension Test Engineer and approved by appropriate personnel in the design, and operating organizations when applicable.

14.2.2 ORGANIZATION AND STAFFING

The Startup Unit is responsible for scheduling and executing the component testing, initial operation, and preoperational testing phases of the Initial Test Program. The Technical Support Unit is responsible for scheduling and executing the Power Ascension Test Program. This includes coordinating the various groups having start-up responsibilities, preparation of necessary test procedures, and directing the tests performed. The Startup Unit reports to the Manager - Startup and Test, who is responsible to the Vice President - Harris Nuclear Project through the General Manager - Harris Plant Operations for startup activities. The Technical Support Unit reports to the Manager - Technical Support who is responsible to the Plant General Manager - Harris Plant Operations through the Assistant Plant General Manager.

Various organizations and their start-up responsibilities are discussed below:

14.2.2.1 SHNPP Plant Staff

The plant staff participates to the extent possible in the Initial Test Program. Areas in which the staff will directly participate are as follows:

a) Operating Plant Equipment - The plant operations staff is responsible for operating plant equipment as required to support the testing program. Operations personnel shall be assigned to perform equipment lineups, take data, clear equipment, and operate equipment for Start-up Engineers directing tests.

b) Maintaining Plant Equipment - The plant maintenance personnel are responsible for maintaining plant equipment after equipment release to Startup from Construction.

c) Preparing Operating and Maintenance Procedures and Instructions - The various plant groups prepare their sections of the Plant Operating Manual. This manual contains the necessary plant operating, maintenance, and administrative procedures for the plant. These procedures are approved and used to the extent possible during the Initial Test Program.

d) Performing Component Testing and Calibration - The plant maintenance staff performs initial checkout, testing, and calibration of equipment using approved plant maintenance instructions under the Start-up Engineer's direction.

e) Performing Preoperational Testing - On a selective basis, members of the plant's technical staff are assigned to the Startup Unit to perform as Startup Engineers.

f) Performing Power Ascension Testing - The plant staff Technical Support Unit is responsible for the Power Ascension Testing portion of the Initial Test Program.

14.2.2.2 CP&L Startup Unit

The SHNPP Startup Unit is responsible for the component testing, initial operation, and preoperational testing phases of the Initial Test Program, including directing and coordinating groups having startup responsibilities. The Manager - Startup and Test is responsible for directing the Startup Unit. He will also interface with the other participating groups to ensure that responsibilities are carried out in a timely manner to support the startup schedule. Responsibilities and authority of the Plant Startup organization are as follows:

a) Manager - Startup and Test

   1) Supervise the activities of the Startup Unit through the Startup Supervisors.

   2) Prepare and update the startup schedule.

   3) Assign overall test responsibility to the Startup Supervisors.

   4) Review and approve requests for vendor assistance as recommended by the Startup Unit.

   5) Review and approve/recommend approval of test procedures, test procedure modifications, and test data in accordance with the Startup Manual instructions.

   6) Review and recommend approval of startup requests for construction and engineering modifications or changes required during the test program.

   7) Issue periodic progress reports and work schedules for the Startup Unit.

   8) Issue special reports concerning startup activities as deemed necessary.

   9) Review progress of startup activities with contractors, vendors, and company management.

10) Maintain liaison with the plant management, keeping them informed of the test program status, and coordinate with them the activities of plant personnel assigned to startup activities in conjunction with their training program.

11) Represent the Startup Unit on interdepartmental and inter-organizational committees associated with the test program.

12) Maintain liaison with contractors and vendors to coordinate their activities relating to the test program.

13) Responsible for the preparation and maintenance of the Startup Manual.

14) Accept Release for Tests and Final System Turnovers from HPCS.

b) Startup Supervisor

1) Assign a cognizant Startup Engineer for each test identified to be required on assigned systems, and periodically review test assignments to maintain an even distribution of work load.

2) Supervise the activities of and provide guidance to the Startup Engineers reporting to him and assure that their operations are conducted in accordance with SHNPP Startup Manual instructions.

3) Supervise the preparation of test procedures as assigned to the individual Engineer.

4) Provide technical guidance and assistance in the preparation of test procedures.

5) Recommend plant scheduling changes as necessary to support the testing effort.

6) Review and recommend approval of test procedures, test procedure modifications, and test data in accordance with the Startup Manual procedures.

7) Recommend approval of and schedule vendor representative assistance.

8) Recommend changes in plant design and/or construction to facilitate testing, operation, and maintenance.

9) Review periodic progress reports and work schedules.

10) Assist in the preparation of special reports concerning startup activities when required.

c) Start-up Engineer

1) Conduct all work assignments in accordance with the Startup Manual and other Startup procedures/instructions.

2) Prepare and recommend for approval-assigned test procedures.

3) Conduct all assigned tests and prepare test reports.

4) Review engineering drawings and documents and prepare requests for construction and engineering changes to facilitate both operation and maintenance.

5) Recommend approval of system Release For Tests.

6) Define system and subsystem Release For Test boundaries.

7) Conduct an inspection of assigned systems prior to system Release For Test and Final System Turnover acceptance and recommend the acceptance of systems from HPCS for testing or turnover.

8) Coordinate and supervise activities of personnel assigned to support the test program.

14.2.2.3 Ebasco Services, Inc.

Ebasco Services, under the direction of CP&L is the architect-engineer for the SHNPP. As the design organization, they may participate in resolution of engineering-design problems discovered during checkout and testing.

14.2.2.4 Westinghouse Electric Corporation

Westinghouse on-site personnel will provide technical assistance and act as technical liaison with the Westinghouse design organizations to resolve problems within Westinghouse scope. The Westinghouse Site Manager shall review and recommend approval of all NSSS test procedures.

14.2.2.5 Personnel Qualifications

Personnel qualifications are discussed in Chapter 13.

14.2.2.6 CP&L Power Ascension Test Subunit

The SHNPP Power Ascension Test Subunit is responsible for the Power Ascension Test Program, including preparation of test procedures and coordinating all groups having power ascension responsibilities. The Power Ascension Test Program Director is responsible for directing the day to day administration of the Power Ascension Test Subunit. He will also interface with the other participating organizations to ensure that responsibilities are carried out in a timely manner to support the Power Ascension Test Sequence. The Power Ascension Test Program Director is responsible to the Manager - Technical Support.

14.2.3 TEST PROCEDURES

14.2.3.1 Preoperational Tests

The preoperational test procedures are those procedures required to demonstrate, to the extent practical, the capability of structures, systems, and components, to meet their design criteria to support fuel loading. These procedures are written by the responsible SHNPP Startup

Engineer. The Startup Engineer utilizes the system/component design documents, FSAR, Architect Engineer supplied design criteria, applicable codes and standards, and the NRC Regulatory Guides in preparing the procedures.

In general test procedures written to implement the test abstracts in this chapter are designated Preoperational Tests and are formatted and approved as such. However, specific test abstracts included in this chapter that perform hydrostatic testing will be implemented through hydro test procedures which meet the format and approval requirements of the SHNPP Startup Manual and the ASME Quality Assurance Manual.

To ensure that procedures and test results demonstrate the capability of each system to perform its design basis, the preoperational test procedures and results are reviewed and approved by a Joint Test Group (JTG). Approval shall be by unanimous concurrence of the JTG members which include a representative from the Startup Unit, Operations Unit, and Harris Plant Engineering Section. The JTG may meet and act as a committee or may review and approve written submittals at the discretion of the members. As of July 1, 1987 the startup test program was considered to be complete. The JTG was no longer required.

14.2.3.2 Power Ascension Tests

The Power Ascension Tests consist of those tests performed during and following fuel loading. These include fuel loading, pre-critical tests, initial criticality, low power testing, and power ascension tests that confirm design bases and anticipated plant operation. The test specifications are provided by Westinghouse and the procedures written under the direction of the Manager - Technical Support.

Since Power Ascension Tests are performed following fuel loading and under requirements of the Technical Specifications and Plant Operating Manual, procedure approvals are different than approvals for preoperational tests. Procedures will be reviewed and approval recommended by representatives of the Technical Support Group and Westinghouse (NSSS only). Final approval will be by the Manager-Operations. The Plant Nuclear Safety Committee will review the completed test results and recommend ascension to the next testing plateau.

14.2.3.3 Procedure Format

Format for the test procedures is established by the SHNPP Startup Manual. Test procedures will contain the following information as applicable: (Not necessarily in the order listed below)

1.0 Purpose/Objective

This consists of a brief description of the test performance parameters and characteristics to be verified. It should include the purpose for which the procedure is intended.

2.0 Acceptance Criteria

Contains the general qualitative acceptance criteria against which success or failure will be judged.

3.0 References

References include all supporting information required to perform the test and used to develop the test procedure.

4.0 Test Equipment and Personnel

Contains a list of test equipment that will be required to perform the test. This would include special recorders, test panels, gauges, temporary test instruments, etc. Any special personnel needed and their required qualifications should be included.

5.0 Precautions

Special precautions, which are needed for safety of personnel or equipment to ensure a reliable test, are highlighted and clearly described in the test procedure. These precautions may include limitations to be observed during testing and possible problems to watch for. If appropriate, precautions are repeated in the text before the step to which they apply.

6.0 Prerequisites and Initial Conditions

Each test for the operation of a system, normally requires that certain activities be performed first, e.g. completion of construction, construction and/or preliminary tests, instrument calibration, component checkout, relief valves set, valve and electrical lineups completed, etc. These independent actions serve to establish the initial conditions required to begin the Test Procedure Section.

7.0 Test Procedure

Detailed step by step instructions in the degree of detail necessary for performing a required function or task are provided. Data is recorded in the procedure itself if possible. Steps to ensure the system is restored to normal configuration are provided.

8.0 Checkoff and Data Sheets

8.1 Valve Lineup Sheets (Preoperational Tests Only)

These sheets specify the initial position of all valves in the system being tested.

8.2 Electrical Lineup Sheets (Preoperational Tests Only)

These sheets specify the initial position of all circuit breakers, switches, and electrical controls associated with the system being tested.

8.3 Data Sheets

Any data sheets used shall be placed in this section.

14.2.4 CONDUCT OF THE TEST PROGRAM

14.2.4.1 Administrative Controls

Administrative control of the SHNPP Test Program is maintained by use of approved "official" test procedures. A Start up Engineer directs each preoperational test and Power Ascension Test Engineer directs each power ascension test. Each verifies by procedure sign off that the test has been satisfactorily completed. These signed off procedures will be maintained to document the program.

The signed off individual procedures assure that the required prerequisites have been met prior to proceeding with the next phase of the test program.

Prerequisites prior to performing power ascension testing are:

a) All preoperational tests listed in Section 14.2.12 should be completed to the satisfaction of Westinghouse and CP&L. Any test exceptions are documented on an Exception List and approved by the General Manager - Harris Plant prior to commencing the Power Ascension Test Program.

b) Plant system operation verification is completed to the satisfaction of CP&L and Westinghouse.

c) The NRC has issued a Unit Operating License.

d) Individual Power Ascension Test prerequisites are verified complete. (See 14.2.12 for general prerequisites).

14.2.4.2 Maintenance/Modification Procedure

Prior to system release for test acceptance by Startup, all preventive maintenance is performed by Nuclear Plant Construction Department in accordance with their procedures. After the system has been released to Startup, the plant's maintenance staff is responsible for preventive and routine plant maintenance. These programs are established and operated in accordance with the CP&L Maintenance Management Program. To ensure personnel safety and system integrity, any maintenance performed on the system must be initiated thru and controlled by the startup engineer and shift foreman.

Other work which is required after Release For Tests have been accepted includes clearing exceptions and installing design changes or modifications. In order to assure necessary startup retesting is completed, this type of work is controlled. The startup engineer must sign off that work has been completed and the necessary retesting has been accomplished. Design or engineering changes requested by the Startup Unit or by anyone other than the originating design organization are submitted and approved using the appropriate Startup Manual Procedure.

14.2.4.3 Test Performance

The Startup Engineer or Power Ascension Engineer directs the tests and verifies that tests are performed using approved procedures only. If during the test execution the procedure is found to be incorrect, the Startup

Engineer or Power Ascension Engineer is responsible for obtaining the necessary revision approval prior to proceeding with that portion of the test procedure.

All revisions are approved prior to test acceptance in the same manner as the original procedure. Revisions may be temporarily approved by CP&L approving authority on the original procedure to allow the testing to continue. However, temporary revisions must be approved in the same manner as the original procedure prior to acceptance and final approval of the test.

14.2.5 REVIEW, EVALUATION, AND APPROVAL OF TEST RESULTS

14.2.5.1 Preoperational Tests

Upon completing the preoperational test, the Startup Engineer reviews the test results and writes a test report. The test report addresses any exceptions or deficiencies and recommendations to correct these, if necessary. The completed preoperational test procedure, results, and test report is then recommended for approval and approved in the same manner as the original procedure.

The preoperational test phase is considered complete when all necessary tests as outlined in Section 14.2.12 have been completed, results approved, and all outstanding preoperational test exceptions have been resolved or the program is declared complete. As of July 1, 1987 the startup program was considered complete. All remaining test exceptions have been transferred to the Technical Support Unit for resolution utilizing POM procedures.

14.2.5.2 Power Ascension Tests

As portions of the Power Ascension Test Procedures are completed during power ascension testing, the results will be reviewed against the acceptance criteria. At completion of testing at a power level, the results will be reviewed and recommendation to proceed to the next power level will be given by the Plant Nuclear Safety Committee, the Manager-Technical Support and Manager Operations. Approval to proceed to the next power level is given by the General Manager-Harris Plant Operations.

Upon completion of a Power Ascension Test procedure, a report will be written on each procedure results and any outstanding exceptions. The completed procedures, results, and test report will then be recommended for approval and approved by the Test Program Development Engineer, the Test Program Director, the Manager-Technical Support, PNSC Chairman and General Manager-Harris Plant Operations.

14.2.6 TEST RECORDS

The records of the individual preoperational and power ascension tests are completed and filed for the life of the plant. The original copies of completed test procedures with the associated data, including analysis and results of preoperational tests, initial fuel loading, low power tests,

and high power tests prior to commercial operation will be maintained in accordance with Carolina Power & Light Company's administrative procedures as described in Section 17.3.2.15.

14.2.7 CONFORMANCE OF TEST PROGRAMS WITH REGULATORY GUIDES

The following applicable regulatory guides will be used as guidance in development of the initial test program:

a) Regulatory Guide 1.20, Rev. 2, May, 1976, Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing.

Reg. Position	Clarifications/Exceptions
C.3.1	CP&L commits to the inspection program 3.1.3 which shall be done by NSSS vendor after Hot Functional Testing. NSSS vendor shall use vendor inspection procedure and transmit final data to CP&L for plant storage. No CP&L procedure applies.

b) Regulatory Guide 1.37, Rev. 0, March, 1973, Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water Cooled Nuclear Plants.

c) Regulatory Guide 1.41, Rev. 0, March, 1973, Preoperational Testing of Redundant On Site Electric Power Systems to Verify Proper Load Group Assignments.

d) Regulatory Guide 1.52, Rev. 2, March, 1978, Design, Testing, and Maintenance Criteria for Post-Accident Engineered - Safety - Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light Water-Cooled Nuclear Power Plants.

e) Regulatory Guide 1.68, Rev. 2, August, 1978, Initial Test Programs for Water Cooled Nuclear Power Plants with the following clarifications/exceptions:

Reg. Position	Clarifications/Exceptions
A.1.a.(2)(i)	Reactor Coolant System Relief Valves (Pressurizer Safety Valves) will be vendor tested simulating ambient normal air temperature of containment and normal loop seal temperature water. The relief valves will be set in place just prior to Hot Functional Testing. No CP&L test to be written.
Appendix A; 1.m.4	Full operational testing of the Manipulator Crane may be conducted using the Dummy Fuel Assembly with Dummy RCCA.
Appendix A; A.2.f	Reactor Coolant System flow coastdown measurements will be performed after initial criticality.
Appendix A; A.2.h	Testing of traversing incore monitors will be conducted after initial criticality.

Appendix A; C.1 The following clarifications/exceptions are taken to Appendix A of Reg. Guide 1.68:

Major power level testing plateaus will be established at approximately 30, 50, 75, and 100% of rated thermal power. Some testing may be performed at the 90% power level. Refer to specific test summaries.

The following tests will not be conducted based on SHNPP being a standard Westinghouse three-loop plant with a typical first core fuel design and CP&L's responsiveness to NRC, INPO, and CP&L concerns over tests which needlessly place the plant in abnormal operating configurations which may lead to severe radial power tilts (reference: letter from CP&L to NRC on October 3, 1985, Serial: NLS 85 291, Control Rod Reactivity Worth and Pseudo Rod Ejection Tests).

4.c. Low-Power Pseudo-Rod Ejection Test.

5.e. Greater than 10% Power Pseudo-Rod Ejection Test.

5.f. Fifty Percent Power, Highest Worth Rod Fully Inserted Test.

5.i. Control Rod Misalignment Detection Demonstration (normally satisfied through performance of 5.f.). A procedure based on the use of the SHNPP standard Westinghouse incore instrumentation system has been developed and will be exercised with data obtained from the incore power distribution map at 50% power. This exercise will establish the ability of the procedure to detect the existence of a misaligned rod equal to or less than the Technical Specification limit.

5.a. Power reactivity coefficients will be determined at approximately 50 and 90% of rated thermal power. Additional tests are not required due to SHNPP standard fuel design and lower power test inaccuracies.

5.d. The capabilities of Westinghouse three-loop plants to control axial xenon oscillations have been repeatedly demonstrated through CP&L and other utilities' routine power maneuvers and non-routine maneuvers as encountered during incore/ excore calibrations. SHNPP will demonstrate its capabilities to control axial xenon oscillations throughout the course of the Power Ascension Testing, particularly through recovery from the incore/excore calibration at 75% power, and the various load swing tests. A generic procedure on how to control xenon oscillations will be available to the operations staff.

5.h. Rod scram time data will not be recorded during scrams that occur in the startup phase, since installing data recorders will

require violation of technical specifications that concern operability of the digital rod position indication system. Rod scram time data will be taken during cold and hot zero power testing.

5.h.h. Step load changes of approximately 10% will be made from steady state power levels of approximately 30, and 75 percent power.

Appendix A; 4.1

During Hot Functional Testing, secondary plant conditions (rated temperature & pressure) are identical to those at Hot Zero Power (557°F, 1100 psia). Therefore, MSIV operability and stroke times will be demonstrated at low power by testing during HFT (without fuel loaded). This will remove any problems with primary excursions with fuel loaded.

Appendix A; 5.u

Shearon Harris Main Steam Isolation valves 2MS-V1SA-1, 2MS-V2SB-1, 2MS-V3SA-1 were manufactured by Rockwell International Flow Control Division for Westinghouse Electric Corporation. Each valve was designed to operate under normal conditions of 1,300 psia and 600°F. Each MSIV was tested at these conditions prior to being shipped from the factory. At 25% power secondary conditions are approximately 1075 psia and 550°F. These are well within the range of the vendor test. Operability of the MSIVs will be tested at 100% power using the "test mode". This ensures valve and actuator operation. In this condition, each MSIV is exercised from the full open position to a 90% open position then returned to the full open position.

This test will be performed during Hot Functional Testing (100% closing and stroke times) (see 1.68 Section 4L).

Appendix A; 5.mm

In a PWR, this test is not limiting and is similar to a test to be performed as part of the start up program. As noted in SHNPP FSAR, 15.2.4, inadvertent closure of the MSIVs would result in a complete loss of steam flow similar to but less severe than the turbine trip. The response time of the MSIV is considerably slower than that of the turbine stop valves (5 seconds vs. 0.1 seconds). Therefore, the plant response to a turbine trip initiated from a cause other than MSIV closure will be more severe than that caused by an MSIV closure.

A Turbine Trip from 100% Power Test will be conducted, and since the Turbine Trip Test is more severe, performance of MSIV closure is redundant and provides no additional data concerning plant response capability.

Appendix A; 5.nn

Regulatory Guide 1.68, Appendix A, Section 5.nn specifies a power ascension test to "demonstrate that dynamic response of the plant is in accordance with design for the case of full load rejection." It also specifies opening of the generator output

breakers via a method which will maximize turbine overspeed and to align the plant's electrical distribution system for normal full power operation. It would appear that the primary consideration of this test is turbine overspeed. It is important to note that turbine overspeed was addressed by the ACRS for SHNPP. To resolve this issue, CP&L submitted its turbine overspeed test procedure to the NRC along with additional information via letters dated November 21, 1986 and December 5, 1986. This information was accepted by the NRC Staff and the ACRS to close out the turbine overspeed issue. The testing committed to in CP&L's letters has been successfully completed; therefore, turbine overspeed is not a consideration for the generator loss of load test.

In its current configuration, the SHNPP is capable of a safe shutdown following opening of the generator output breakers; however, it is not expected to be able to run back to house loads. The expected response of the plant is that a reactor trip will occur on low low steam generator level shortly after initiating a load rejection. The low steam generator level indication occurs because of an expected pressure spike occurring in the steam lines affecting the level transmitters. Since the turbine will trip on the reactor trip, and since the fast bus transfer from the main generator to offsite power is defeated when the test is initiated by the opening of the main generator output breakers, a loss of offsite power to the plant will occur. This will result in trip of all reactor coolant pumps and a startup of both diesel generators to re-energize the safety busses. The plant will stabilize in Mode 3 in natural circulation. The capability of the plant to successfully respond in this manner has already been demonstrated during the power ascension test program (reference FSAR 14.2.12.2.21, Loss of Offsite Power Test Summary; FSAR 14.2.12.2.26, Natural Circulation Test Summary; FSAR 14.2.12.2.19, Turbine Trip from 100 Percent Power Test Summary). The integrated plant response, as described above, is nearly identical to a loss of offsite power, which was performed at the 10 percent power plateau. This expected plant response is such that the plant is well within analyzed conditions. Therefore, it is concluded that in the event of an inadvertent opening of the generator output breakers, the plant will shut down safely.

f) Regulatory Guide 1.68.2, Rev. 1, July, 1978, Initial Startup Test Program to Demonstrate Remote Shutdown Capability for Water Cooled Nuclear Power Plants.

g) Regulatory Guide 1.68.3, Rev. 0, April, 1982, Preoperational Testing of Instrument and Control Air Systems.

h) Regulatory Guide 1.79, Rev. 1, September, 1975, Preoperational Testing of Emergency Core Cooling Systems for Pressurized Water Reactors with the following clarifications/exceptions:

Reg. Position	Clarifications/Exceptions
C.1.b.(2)	The capability to realign valves for recirculation shall be tested for the plant. Test of a recirculation sump to demonstrate vortex control, acceptable pressure drops across suction lines and valves, and adequate NPSH will be conducted for the plant by model tests. CP&L will verify by appropriate physical examination and flow demonstration test that recirculation sump suction lines are not obstructed and that valves are properly installed.
C.1.c.(1)	Blowdown will be into the open reactor vessel at ambient pressure. This condition will allow the rapid accumulator dump which is necessary for evaluation of the system performance. Accumulator pressure will be less than normal operation pressure.
C.1.c.(3)	Initial RCS pressure for this test will be greater than the normal accumulator precharge pressure but less than the normal RCS operating pressure. Flow will be injected through a test line from the hydro pump and will not come from the accumulator discharge.

i) Regulatory Guide 1.68.3, April, 1982, Preoperational Testing of Instrument and Control Air Systems.

j) Regulatory Guide 1.95, Revision 1, January, 1977, Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release.

k) Regulatory Guide 1.140, Revision 1, October, 1979, Design, Testing, and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light - Water - Cooled Nuclear Power Plants.

l) Regulatory Guide 1.108, Revision 1, August, 1977, Periodic Testing of Diesel Generator Units Used as On-site Electric Power Systems at Nuclear Power Plants.

14.2.8 UTILIZATION OF REACTOR OPERATING AND TESTING EXPERIENCE DEVELOPMENT OF TEST PROGRAMS

The CP&L SHNPP Initial Test Program will utilize information gained from operating and testing experience in other similar nuclear plants. This information is used to provide guidance in developing test procedures and schedules and to alert personnel to potential problem areas in the testing program.

The development of this program for utilizing testing and operating experience is the responsibility of the Superintendent - Start-Up with the direct implementation of the program being delegated to the Start-Up Supervisor.

Information regarding operating and testing experiences will be obtained from NRC Licensee Event Report summaries. These reports are reviewed by the start-up organization to identify adverse trends or special testing which should be included in the test program.

The operating experience program consists of an initial review to be conducted prior to the conduct of preoperational tests and an ongoing review during the remainder of the test program. The initial review examines pertinent operating data and abnormal events on similar plants which occurred during a period of two years prior to the review. The review is conducted so as to allow sufficient time for data to be analyzed and incorporated in test procedures. Any new information will be reviewed on a regular basis during the test program so as to address current testing problems.

14.2.9 TRIAL USE OF PLANT OPERATING AND EMERGENCY PROCEDURES

The plant procedures that are used or referenced during the preoperational and start-up test programs are plant operating procedures and instructions, maintenance procedures, chemistry procedures, radiation protection procedures, and emergency instructions.

The adequacy of plant operating and emergency procedures is checked to the maximum extent possible during the preoperational and power ascension test programs. Where plant conditions meet the prerequisites of a plant procedure, the plant procedure is followed during preoperational and power ascension testing. Where plant conditions do not meet the prerequisites of the plant procedure, then applicable portions of the plant procedure are referenced or incorporated in the preoperational and/or power ascension procedure. This will assure that these procedures are correct, safe, and usable when the plant is ready for commercial operation.

Plant procedures are prepared by plant personnel with assistance of other qualified personnel. The procedure is tested and revised, as necessary, during on-site training of plant personnel and the performance of preoperational and power ascension test programs.

14.2.10 INITIAL FUEL LOAD AND INITIAL CRITICALITY

Fuel loading begins when prerequisite system tests and operations are satisfactorily completed and the facility operating licenses are obtained. Upon completion of fuel loading, the reactor upper internals and pressure vessel head are installed and additional mechanical and electrical tests are performed. The purpose of this phase of activities is to prepare the system for nuclear operation and to establish that design requirements necessary for operation are achieved. The core loading and post loading tests are described below.

14.2.10.1 Initial Fuel Load

The overall responsibility and direction for initial core loading is exercised by the General Manager - Harris Plant. The overall process of initial core loading is, in general, directed from the operating floor of the Containment Building. Procedures for the control of personnel and the maintenance of containment security are established prior to fuel loading.

The as-loaded core configuration is specified as part of the core design studies conducted in advance of Unit startup.

The core is loaded in the reactor vessel and submerged in water containing enough dissolved boric acid to maintain a calculated core effective multiplication factor of 0.90 or lower. The fuel transfer tube is flooded, but the remainder of the refueling cavity is dry during initial core loading. Core moderator chemistry conditions (particularly boron concentration) are prescribed in the core loading procedure document and are verified periodically by chemical analysis of moderator samples taken prior to and during core loading operation.

Core loading instrumentation consists of two permanently installed source range (pulse type) nuclear channels, two temporary incore source range channels, and a third temporary channel which can be used as a spare. The permanent channels are monitored in the Control Room by licensed operators; the temporary channels are installed in the Containment Building and are monitored by reactor engineering personnel. At least one permanent channel is equipped with an audible count rate indicator. Both unit channels have the capability of displaying the neutron flux level on strip chart recorders. The temporary channels indicate on rate meters with a minimum of 1 channel recorded on a strip chart recorder. Minimum count rates of two counts per second, attributable to core neutrons, are required on at least two of the four (i.e., 2 temporary and 2 permanent source range detectors) available nuclear source channels at all times following installation of the first source.

The temporary fuel loading source range detectors and the permanently installed source range channels will be calibrated prior to fuel loading. The calibration is performed using a portable neutron source with provisions for positioning the source near the detectors. The neutron response of each detector must be checked following any delay in the fuel loading of eight hours or longer.

Temporary neutron sources are introduced into the core at appropriate specified points in the core loading program to ensure a neutron population corresponding to a minimum count rate of 2 counts/sec for adequate monitoring of the core.

Fuel assemblies together with inserted components (control rod assemblies, burnable poison inserts, source spider, or thimble plugging devices) are placed in the reactor vessel one at a time according to a previously established and approved sequence which was developed to provide reliable core monitoring with minimum possibility of core mechanical damage. The core loading procedure documents include a detailed tabular check sheet which specified inserts from its initial position in the storage racks to its final position in the core. Multiple checks are made of component serial numbers and types at successive transfer points to guard against possible inadvertent exchanges or substitutions of components, and at least 2 fuel assembly status boards are maintained throughout the core loading operation.

An initial nucleus of eight assemblies, the first of which contains an activated neutron source, is the minimum source-fuel nucleus which permits subsequent meaningful inverse count rate monitoring. This initial nucleus is determined by calculation and previous experience to be markedly subcritical ($k_{eff} \leq 0.90$) under the required conditions of loading.

Each subsequent fuel addition is accompanied by detailed neutron count rate monitoring to determine that the just loaded fuel assembly does not excessively increase the count rate and that the extrapolated inverse count ratio is not decreasing for unexplained reasons. The results of each loading step are evaluated by CP&L and its technical advisors before the next prescribed step is started.

Criteria for safe loading require that loading operations stop immediately if:

a) An unanticipated increase in the neutron count rates by a factor of 2 occurs on all responding nuclear channels during any single loading step after the initial nucleus of 8 fuel assemblies is loaded (excluding anticipated change due to detector and/or source movement).

b) The neutron count rate on any individual nuclear channel increases by a factor of five during any single loading step after the initial nucleus of 8 fuel assemblies is loaded (excluding anticipated changes due to detector and/or source movements).

An alarm in the Containment and Control Room is coupled to the source range channels with a set-point at five times the count rate on either channel. This alarm automatically alerts the loading operation to an indication of high count rate and requires an immediate stop of all operations until the situation is evaluated by the applicant. Normally the alarm used for this purpose is the containment evacuation alarm. In the event the evacuation alarm is actuated during core loading and after it has been determined that no hazards to personnel exist, special preselected personnel are permitted to remain in the Containment to evaluate the cause and determine future action.

Core loading procedures specify alignment of fluid systems to prevent inadvertent dilution of the reactor coolant, restrict the movement of fuel to preclude the possibility of mechanical damage, prescribe the conditions under which loading can proceed, identify chains of responsibility and authority, and provide for continuous and complete fuel and core component accountability.

14.2.10.2 Initial Criticality

The approach to initial criticality will be conducted according to approved written procedures which specify the plant conditions, safety and precautionary measures, and specific instructions. The procedures also delineate the chains of responsibility and authority in effect during this period of operation. Alignment of the fluid systems is specified to provide controlled "start" and "stop" as well as adjustments of the rate of the approach to criticality.

Initial criticality is achieved by reactor coolant system (RCS) boron concentration reduction, and by withdrawal of control rods.

Inverse count-rate ratio monitoring, using data from the normal plant source-range instrumentation is used as an indication of the proximity and rate of approach to criticality. Inverse count-rate ratio data are plotted as a function of rod bank position during rod motion and as a function of primary water addition during RCS boron concentration reduction.

A source range count rate of at least 2 cps will be visible on the source range meters, and the signal to noise ratio will be known to be greater than 2 prior to commencing start-up.

Initially, the shutdown and control banks of control rods are withdrawn incrementally in the normal withdrawal sequence, leaving the last withdrawn control bank inserted far enough in the core to provide effective control when criticality is achieved.

The boron concentration in the RCS is then reduced by the addition of primary water. Criticality is achieved during boron dilution or by subsequent rod withdrawal following boron dilution. The

rate of primary water addition, and hence the rate of approach to criticality, may be reduced as the reactor approaches criticality to ensure that effective control is maintained. Throughout this period, samples of the reactor coolant are obtained and analyzed for boron concentration.

Written procedures specify plant conditions, precautions, and specific instructions for the approach to criticality.

Successive stages of control rod assembly group withdrawal and of boron concentration reduction will be monitored by observing changes in neutron count rate, as indicated by the permanent source-range nuclear instrumentation, as functions of group position during rod motion, reactor coolant boron concentration, and primary water addition to the RCS during dilution. Throughout this period, samples of the reactor coolant will be obtained and analyzed for boron concentration.

Inverse count-rate ratio monitoring will be used as an indication of the proximity and rate of approach to criticality during control rod assembly group withdrawal and during reactor coolant boron dilution. The rate of approach will be reduced as the reactor approaches the time extrapolated for criticality to ensure that the approach to criticality will be less than one decade per minute. Criticality predictions for boron concentration and control rod positions will be provided and criteria as well as actions to be taken will be established if actual plant conditions deviate from predicted values.

14.2.10.3 Low Power Testing

Following initial criticality, a program of reactor physics measurements will be undertaken to verify that the basic static and kinetic characteristics of the core are as expected and that the values of the kinetic coefficients assumed in the safeguards analysis are conservative.

Procedures will specify the sequence of tests and measurements to be continued and the conditions under which each is to be performed in order to ensure both safety of operation and the validity and consistency of the results obtained. If test results deviate significantly from design predictions, if unacceptable behavior is revealed, or if unexplained anomalies develop, the plant will be brought to a safe, stable condition and the situation reviewed to determine the course of subsequent plant operation.

These measurements will be made at low power and primarily at or near normal operating temperature and pressure. Measurements will be made in order to verify the calculated values of control rod bank reactivity worths, the isothermal temperature coefficient under various core conditions, differential boron concentration reactivity worth, and critical boron concentrations as functions of control rod configuration. In addition, measurements of the relative power distributions will be made, and a concurrent test will be conducted on the instrumentation including the source and intermediate range nuclear channels. The test will verify that a minimum of a half decade overlap has been established for these channels.

14.2.10.4 Power Level Escalation

When the operating characteristics of the Unit are verified by low power testing, a program of power level escalation in successive stages brings the Unit to its full rated power level. Both reactor and balance of plant operational characteristics are closely examined at each stage and

the relevance of the safety analysis verified before escalation to the next programmed level is affected.

Measurements are made to determine the relative power distribution in the core as functions of power level and control assembly group position.

Secondary system heat balances ensure that the several indications of power level are consistent and provide bases for calibration of the power range nuclear channels. The ability of the Reactor Protection System to respond effectively to signals from primary and secondary instrumentation under a variety of conditions encountered in normal operations is verified.

At prescribed power levels the dynamic response characteristics of the Reactor Coolant and Main Steam Supply Systems are evaluated. The responses of system components are measured for design step and ramp changes in load, turbine trip, and trip of a single control rod assembly.

Adequacy of radiation shielding is verified by neutron and gamma radiation surveys inside the Containment and throughout the plant.

The sequence of tests, measurements, and intervening operations will be prescribed in the power escalation procedures.

14.2.11 TEST PROGRAM SCHEDULE

The sequential schedule for the preoperational testing of individual systems and components based on fuel loading date is shown in Figure 14.2.11-1. The sequential schedule for initial startup performed subsequent to fuel loading is shown in Figure 14.2.11-2. These schedules show certain milestones at which time the tests, or portions of test, will be completed and the overall time frame in which the test will be conducted. Detailed schedules for the test program will be developed on a continuing basis as plant completion progresses.

Station structures, systems, and components which are relied upon to prevent or mitigate consequences of postulated accidents will be fully tested to the maximum extent practicable prior to fuel load. Certain systems will have part of the preoperational testing performed after fuel load due to system configuration (e.g. Control Rod Drive Mechanism, Automatic Reactor Control, In core Moveable Detectors). Such systems will be adequately tested prior to fuel load to provide reasonable assurance of proper operation after fuel load.

The preparation of test procedures for a particular system will be scheduled to support the fuel loading date. Preoperational procedures preparation will be started approximately 36 months prior to fuel load or the earliest date consistent with the availability of approved reference information. These procedures should be available for review by required personnel 60 days prior to use.

It is planned to have approved initial start up procedures available for review by required personnel at least 60 days prior to fuel loading.

14.2.12 INDIVIDUAL TEST DESCRIPTIONS

These summaries describe the various tests which are specified as preoperational tests and start-up tests in Regulatory Guide 1.68. Preoperational tests must be completed before fuel loading, and start-up tests must be completed after fuel loading. The scope and titles of these summaries may not in all cases correspond directly to the actual test procedures which will be used during the two test programs. Certain test procedures may include more than one test as described in these summaries, and in some cases, tests described in one summary may be covered under more than one procedure. The overall scope and content of the tests described in these summaries will be addressed in final procedures. It should be noted that all system acceptance tests are designated as preoperational tests, but only those tests listed in Section 14.2.12.1 must be completed prior to fuel loading. The test program will include those features designed to prevent or mitigate anticipated transients without scram (ATWS) that will be incorporated into the SHNPP design.

14.2.12.1 Preoperational Test Summaries

The following is an index of preoperational test summaries described in this Section:

1. Heat Tracing and Freeze Protection Test Summary
2. Main, Auxiliary and Start-Up Transformers Test Summary
3. 6.9 kV Switchgear Test Summary
4. 480 V AC Distribution Test Summary
5. 120 V ESF Uninterruptible AC System Test Summary
6. Class 1E DC System Test Summary
7. Normal Emergency AC/DC Lighting Systems Test Summary
8. Communications System Test Summary
9. Annunciator System Test Summary
10. Reactor Protection System Engineered Safety Features Actuation Logic Test Summary
11. Reactor Protection System Engineered Safety Features Actuation Response Time Test Summary
12. Piping Vibration Test Summary
13. Metal Impact Monitoring System Test Summary
14. Radiation Monitoring System Test Summary
15. Excore Nuclear Instrumentation System (NIS) Test Summary

16. Emergency Diesel Generator Test Summary
17. Deleted
18. Fire Protection System Test Summary
19. Normal Service Water Test Summary
20. Emergency Service Water Test Summary
21. Compressed and Instrument Air Systems Test Summary
22. Reactor Coolant System Hydrostatic Test Summary
23. RTD/TC Cross Calibration Test Summary
24. Pressurizer Relief Tank (PRT) Test Summary
25. Safety Injection System Performance Test Summary
26. High-Head Safety Injection System Check Valve Test Summary
27. Safety Injection Accumulator Test Summary
28. Residual Heat Removal System Cold Test Summary
29. Residual Heat Removal System Hot Test Summary
30. Containment Spray System Test Summary
31. Chemical and Volume Control System Cold Test Summary
32. Chemical and Volume Control System Hot Test Summary
33. Deleted
34. Auxiliary Feedwater System Test Summary
35. Fuel Handling Equipment System Test Summary
36. Fuel Pool Cooling and Clean up System Test Summary
37. Component Cooling Water System Test Summary
38. Gaseous Waste Processing System Test Summary
39. Solid Waste Processing System Test Summary
40. Liquid Waste Processing System Test Summary
41. Containment Isolation Test Summary

42. Containment Integrated Leak Rate Test and Structural Integrity Test Summary
43. Reactor Coolant System Hot Functional Test Summary
44. Piping Thermal Expansion and Dynamic Effects Test Summary
45. Deleted by Amendment No. 4
46. Deleted by Amendment No. 20
47. Pressurizer Pressure and Level Control Test Summary
48. Deleted by Amendment No. 23
49. Deleted by Amendment No. 4
50. Main Steam System Test Summary
51. Feedwater System Test Summary
52. Condensate System Test Summary
53. Turbine Generator Test Summary
54. Circulating Water System Test Summary
55. Condenser Vacuum and Condensate Make-up System Test Summary
56. Waste Processing Computer Test Summary
57. Containment Ventilation Test Summary
58. Plant HVAC Test Summary
59. Engineered Safety Features Integrated Test Summary
60. Process Computer Test Summary
61. Boron Recycle Test Summary
62. Refueling Water Storage Tank Test Summary
63. Primary Makeup Water System Test Summary
64. Rod Control System Test Summary
65. Passive Safety Injection System Check Valve Test Summary
66. Containment Recirculation Sump Test Summary
67. Containment Vacuum Relief Test Summary

68. Combustible Gas Control System Test Summary
69. Deleted
70. Gross Failed Fuel Detection System Test Summary
71. Essential Services Chilled Water System Test Summary
72. Stud Tensioner Hoist Load Test Summary
73. Polar Crane Test Summary
74. Feedwater Heater Drain, Level, and Bypass Control Systems Test Summary
75. Seismic Instrumentation Test Summary
76. Extraction Steam System Test Summary
77. Primary Sampling System Test Summary
78. Secondary Sampling System Test Summary
79. Loss of Instrument Air Test Summary
80. Containment Building Hot Penetration Testing
81. Simulated Loss of On-Site Power Test Summary
82. AC Distribution System Minimum Operating Voltage Test Summary
83. Auxiliary Feedwater Turbine 2 Hour Run Test Summary

There are certain prerequisites which apply in general to all preoperational tests. For convenience, these general prerequisites are listed here rather than included in each summary.

General Prerequisites:

a) Construction is complete and the system is released for testing in accordance with the start-up manual.

b) Required component testing, instrument calibrations, and system flushing/cleaning are complete.

c) Required electrical power supplies, control circuits, and instrumentation are operational.

d) Approved flow diagrams, logic diagrams, wiring diagrams, specifications, and vendors' technical data are available.

e) For fluid systems, hydrostatic tests are complete.

f) Communications have been established as required.

14.2.12.1.1 Heat Tracing and Freeze Protection Test Summary

a) Test Objective

The objective of this test is to determine the operability of the following:

1) Temperature maintenance panels and associated circuits. (As described in 7.7.1.11.2)

2) Freeze protection panels and associated circuits. (As described in 7.7.1.11.1)

b) Prerequisites

1) The general prerequisites must be met.

2) Applicable engineering drawings must be completed showing as built information, such as actual voltage, current, wattage, etc.

c) Test Method

1) Temperature maintenance shall be tested on a control panel by control panel basis as follows:

a) Resistance temperature detectors RTD's settings shall be verified.

b) A comparison shall be made between the circuit current and the as built circuit current recorded in the engineering drawings to verify that each circuit is complete and working.

c) Operation of panels, recorders, and alarms shall be verified.

2) Freeze Protection System shall be tested on a control panel by control panel basis as follows:

a) Ambient sensing thermostat setting shall be verified.

b) A comparison shall be made between the circuit current and the as built circuit current recorded in the engineering drawings to verify that each circuit is complete and working.

c) Operation of panels, recorders, and alarms shall be verified.

3) When heat tracing or freeze protection for piping is redundant, the independence of each train from the other will be verified.

d) Acceptance Criteria

1) The operation of panels, recorders, and alarms must function in accordance with the applicable vendor technical manuals.

2) The current measured on each heat tracing or freeze protection circuit must be the same as the current readings recorded in the engineering drawings for each circuit plus or minus 5 percent.

3) When heat tracing or freeze protection for piping has control or alarm redundancy, each panel must function with its associated redundant panel power off.

14.2.12.1.2 Main, Auxiliary, and Start up Transformers Test Summary

a) Test Objectives

1) Demonstrate the capability of the main, unit auxiliary, and start-up transformers to supply electrical power to the 6900 volt buses.

2) Verify operation of protection devices and functional operation of controls and interlocks.

3) Demonstrate fast transfer features.

b) Prerequisites

1) 6900 volt breakers racked out.

2) The general prerequisites are met.

c) Test Method

1) All auxiliary equipment such as fans and oil coolers will be operated to verify proper operation.

2) Protective relay operation will be simulated to verify proper alarms and breaker trips, both 6.9 kV and 230 kV breakers (those controlled from the Main Control Room).

3) Control logic will be verified per the control wiring diagrams.

4) Verify each startup transformer's ability to supply the maximum ESF load by loading each transformer with the total safe shutdown KW Load specified in FSAR Table 8.3.1-2a and 8.3.1-2b for 15 minutes (minimum) and by observing the transformer winding temperatures.

5) Conditions will be simulated for the various transfer schemes to verify proper transfer operation between the unit auxiliary transformer and the start-up transformer feeds.

d) Acceptance Criteria

1) Transformer cooling equipment function IAW vendor's technical manual.

2) Protective relaying and controls functions IAW control wiring drawings.

3) Winding temperatures for each startup transformer do not exceed the temperatures specified in the manufacturer's technical manual.

4) Fast transfer features perform as stated in FSAR Section 8.3.

14.2.12.1.3 6.9 kV switchgear test summary.

a) Test Objectives

1) Energize 6900 volt buses from both sources.

2) Simulate electrical and mechanical interlocks to test functions properly.

b) Prerequisites

1) 6900 volt breakers racked out.

2) General prerequisites are met.

c) Test Method

1) Close 6900 volt breakers required to energize 6900 volt buses, measure voltage, and verify phase relationship.

2) Operation of the protective relaying will be simulated to verify proper alarm and breaker trips.

3) Breaker controls and operating devices will be operated to ensure breakers can be operated both locally and remotely.

d) Acceptance Criteria

1) The 6900 volt buses can be energized from their normal and alternate sources and that proper phase relationship is exhibited.

2) System interlocks and alarms function IAW control wiring diagrams.

14.2.12.1.4 480 V AC Distribution Test Summary

a) Test Objective

1) Energize the 480 volt buses and MCC's from their preferred and alternate sources.

2) Simulate electrical functions in accordance with approved control wiring diagrams.

3) Simulate proper operation of local and remote controls.

b) Prerequisites

1) Breakers on the 480 V buses are racked out.

2) General prerequisites are met.

3) Mechanical interlocks have been verified for 480V buses.

4) 480V buses and MCC's have been verified for proper phasing.

c) Test Method

1) Close 6900 volt breakers and 480 V breakers required to energize station service transformers, 480 V buses, and MCCs.

2) Measure voltage.

3) Shift buses to alternate power sources, as applicable.

4) Operation of the protective relaying will be simulated to verify proper alarms and breaker trips.

d) Acceptance Criteria

1) 480 volt buses and MCC's can be energized from their preferred and alternate sources.

2) Interlocks, protective devices, and alarms function in accordance with control wiring diagrams.

3) Local and remote controls operate in accordance with control wiring diagrams.

14.2.12.1.5 120 V ESF Uninterruptible AC System Test Summary

a) Test Objectives

Demonstrate the capabilities of the 120 V AC system to provide power to instrumentation and control loads under normal and emergency conditions.

b) Prerequisites

1) The general prerequisites are met.

2) Test load for inverters available.

c) Test Method

1) The inverters will be tested under full load to verify operation on loss of normal power feeds by tripping the normal AC power feeds. Re-energize normal AC and verify transfer back to normal AC power.

2) Inverter design output voltage and frequency regulation will be verified by observing output before and after step load changes.

3) Verify operability of alarms and protective features by simulating alarm and protective action conditions.

4) Switch buses from inverters to back-up AC feeds and back to inverter to verify manual bus transfer capability to back up power source.

5) Insure that the DC and AC feeds to the inverter and the bus back-up AC feeds are connected to proper safety train by opening circuit breakers and observing that the bus is not energized.

d) Acceptance Criteria

1) Inverters shall provide output voltage and current in accordance with the technical manual.

2) Inverters will supply their design output power when energized by either normal AC feed or DC back-up.

3) Alarms and protective features function in accordance with control wiring diagrams.

4) Buses can be energized from inverters or regulated AC backup.

5) Each instrumentation bus and inverter is independent from the others.

14.2.12.1.6 Class 1E DC System Test Summary

a) Test Objectives

Demonstrate the capability of the system to provide a source of reliable, uninterruptible power for normal and emergency instrumentation, control, and power loads.

b) Prerequisites

1) The general prerequisites are met.

2) Adequate test load available for loading the system.

3) Battery room ventilation system in operation.

c) Test Method

1) Alternately de energize each battery charger and verify that the energized battery charger provides power to the bus.

2) Verify operability of alarms and protective features including ground detection by simulating alarm and protective action conditions.

3) Apply service load to system and charge battery simultaneously with one charger out of service.

4) Perform a service test per IEEE Std. 450-1975 on the batteries to verify that the batteries are capable of delivering the design requirements of the DC loads.

5) Reduce bus voltage to battery minimum design level voltage and operate loads.

6) Insure that AC feeds to the battery chargers are connected to the proper safety train by opening each charger's circuit breaker at the 480 VAC Motor Control Center and verifying that the charger loses power.

7) Perform hydrogen survey during full charge to determine that ventilation is adequate to prevent dangerous levels of hydrogen from accumulating.

d) Acceptance Criteria

1) System alarms and protective features, including ground detection, function in accordance with control wiring diagrams.

2) Batteries shall successfully perform the design service test.

3) Battery chargers are capable of maintaining design base normal continuous loads while simultaneously charging the batteries from the service test discharged condition within 24 hours.

4) Buses can be energized by alternate battery chargers.

5) The redundant Class 1E DC systems are independent from one another.

6) Hydrogen survey points indicate less than 2 percent hydrogen by volume.

7) DC loads continue to function normally while bus voltage is at designed minimum level.

14.2.12.1.7 Normal Emergency AC and DC Lighting Systems Test Summary

a) Test Objectives

To demonstrate the transfer capability from normal and normal/emergency AC to emergency DC lighting, and the adequacy of the lighting provided by the normal/emergency AC and emergency DC systems.

b) Prerequisites

All general prerequisites are met.

c) Test Methods

1) Insure that AC feeds to the normal/emergency AC lights are connected to the proper safety train by opening circuit breakers and verifying that the light is not powered.

2) De-energize the normal and normal/emergency AC lighting and verify that the loss of power to the normal emergency lighting results in the transfer to emergency DC lighting, external supplied as well as self-contained.

3) Energize the self-contained emergency lights and verify that the battery load life and lighting levels meet manufacturers' specifications.

4) By use of an illuminometer verify that acceptable lighting levels are provided by both the normal/emergency AC and DC lighting systems.

d) Acceptance Criteria

1) Normal/emergency AC and DC lighting systems operate in accordance with plant control wiring diagrams and tech manuals.

14.2.12.1.8 Communications System Test Summary

a) Test Objectives

To demonstrate the adequacy of the plant telephone, sound powered phones and public address (PA) system including audibility of evacuation and fire alarms. To determine interference characteristics of the plant radio system.

b) Prerequisites

1) The general prerequisites are met.

2) Any high noise generating equipment, in the areas to be checked for PA audibility, can be operated.

c) Test Method

1) Operate each telephone, sound powered handset and circuit and verify proper operation under anticipated operating noise conditions.

2) Operate alarms and verify audibility of evacuation alarms in plant areas under anticipated operating noise conditions.

3) Simulate primary power source failure and verify automatic shift to alternate power source.

4) Simulate PA system failures and verify proper alarms are generated.

5) Perform Engineering evaluation to determine areas in the plant which could be affected by radio transmission, and label these areas as zones of no transmission.

d) Acceptance Criteria

1) Communications are intelligible from each communication device under anticipated operating noise conditions for each area.

2) Evacuation and fire alarms are intelligible under anticipated operating noise conditions in areas of the plant.

3) Failure of the PABX system power source results in automatic transfer to the alternate source.

4) PA failure alarms are annunciated in accordance with vendor's technical manual.

14.2.12.1.9 Annunciator System Test Summary

a) Test Objectives

To verify that the annunciator system functions to indicate the status of each of its inputs.

b) Prerequisites

1) The annunciator system is aligned in accordance with the vendor's technical manual.

2) The general prerequisites are met.

c) Test Method

1) Individually simulate each of the inputs to the annunciator system and verify the following:

a) Alarm sounds and point indicator flashes on and off when input is in alarm state.

b) Alarm is silenced and point indicator stays on solid when "Silence" and "Acknowledge" switches are activated.

c) Point indicator flashes at a slower rate when the input returns to the normal state.

d) Reflash point indicators return to state (a) if the input returns to the alarm state.

e) Point indicator goes dark when the "Reset" switch is activated.

2) Verify that all point indicators flash and the alarm sounds when the "Test" switch is activated.

3) Verify that each annunciator trouble signal alarms in the same manner as C)1)(a) above.

d) Acceptance Criteria

The annunciator system functions as stated in the vendor's technical manual.

14.2.12.1.10 Reactor Protection System Engineered Safety Features Actuation Logic Test Summary

a) Test Objectives

1) To demonstrate the ability of the Reactor Protection System/Engineered Safety Features Actuation System to initiate reactor trip, safety injection, containment isolation, containment spray actuation, containment ventilation isolation, feedwater isolation and steamline isolation signals on input of the appropriate signals.

2) To demonstrate proper operation of logic, permissive, bypass, block and interlock functions, indications, and alarms.

3) To demonstrate redundancy, electrical independence, coincidence and safe failure on loss of power.

4) To demonstrate proper operation of self-testing equipment.

b) Prerequisites

1) The general prerequisites are met.

c) Test Method

1) Using test signals, input the proper coincidence signals independently to train A and train B of the reactor protection system as listed on FSAR Table 7.2.1-1 and verify that reactor trip signals are generated or blocked in both trains.

2) Verify that the undervoltage and shunt trip coils will independently cause the reactor trip breakers to open.

3) Using test signals, input the proper coincidence signals independently to train A and train B of the reactor protection/engineered safety features system as listed on FSAR Table 7.3.1-2 and 7.3.1-3 and verify that output signals in accordance with FSAR Table 7.3.1-5 are generated/reset/blocked in both trains.

4) Simulate each of the interlocks and verify that they function per FSAR Tables 7.2.1-2 and 7.3.1-4 with appropriate alarms and indications.

5) Remove power from the RPS and verify a reactor trip signal results.

6) Operate testing circuitry in accordance with the vendors' technical manuals.

d) Acceptance Criteria

1) Reactor trip signals are generated, blocked and reset in accordance with FSAR Tables 7.2.1-1 and 7.2.1-2.

2) Undervoltage coils and shunt trip coils independently cause the reactor trip breakers to open.

3) Engineered Safety Features Actuation signals are generated, blocked and reset in accordance with FSAR Tables 7.3.1-2, 3, 4 and 5.

4) A reactor trip signal is generated upon loss of power to either train.

5) The automatic testing circuitry functions in accordance with the vendor's technical manual.

14.2.12.1.11 Reactor Protection System Engineered Safety Features Actuation Response Time Test Summary

a) Test Objectives

To verify reactor protection and engineered safety features loop response times.

b) Prerequisites

1) The general prerequisites are met.

2) The reactor protection system (RPS) inputs (including the Process Instrumentation and Control cabinets and the Nuclear Instrumentation System) are aligned and calibrated.

3) Reactor Trip Breakers are checked out.

4) Applicable ESFA components are checked out.

c) Test Method

1) Simulate a reactor trip signal (no voltage) from the RPS and verify that the reactor trip breakers trip.

2) For each of the parameters that generate a reactor trip (FSAR Table 7.2.1-3), simulate a sensor input, where practicable, that is beyond the trip set point and determine the time required to trip the reactor trip breakers.

3) For each parameter that actuates the ESFAS output relays (FSAR Table 7.3.1-12), simulate a sensor input, where practicable, that is beyond the trip set point and determine the time required to actuate the ESFAS output relays.

4) For system components designated in Technical Specifications Table 3.3-5, the actuated devices shown on FSAR Tables 7.3.1-5 determine the time required for the components to assume their safety position following ESFAS output relay actuation. (This may have been performed during other pre-ops).

d) Acceptance Criteria

1) Reactor Trip System Response Times, as defined in the Technical Specifications, are within the values of PLP-106, Attachment 1.

2) ESF Response Times, as defined in the Technical Specifications, are within the values of the PLP-106, Attachment 2.

14.2.12.1.12 Piping Vibration Test Summary

a) Test Objectives

1) To verify that piping and piping restraints will withstand dynamic effects due to testing actions such as pump and valve trips, as per the guidance of NUREG-75/087, August 1978, Standard Review Plan Section 3.9A, and that for systems subject to steady state operation piping vibrations are within acceptable levels.

2) The program will include ASME Code Class 1, 2, and 3 systems as well as high energy piping located inside Seismic Category I structures and Seismic Category I moderate energy piping located outside Containment. Transient testing will include events per the guidance of NUREG-75/087, August 1978, Standard Review Plan, Section 3.9.2-5.

3) A listing of systems subject to steady state vibration and transients to which the components will be subjected is developed.

b) Prerequisites

1) Piping supports (including snubbers and spring supports) installation shall be complete as deemed necessary by design engineering to achieve a meaningful test for each piping system.

2) The general prerequisites are met.

c) Test Method

1) Observe the system under operational and transient modes to identify any excessive vibration and take quantitative measurements at selected points chosen as the most likely high vibration locations.

2) If an observed displacement or velocity is judged to be excessive anywhere in the prescribed system, quantitative measurements will be taken and corrective action taken. If the displacement measured is three times the acceptance criteria, the test shall be stopped or the excessively vibrating pipe isolated, until released to proceed by design engineering.

d) Acceptance Criteria

1) For visual systems, no observed vibration will be present unless items 2 or 3 acceptance criteria are met.

2) Displacements are acceptable if they produce stresses according to the following criteria:

a) If the maximum amplitude is determined by visual observation or if the piping is ASME Section III, Class I, then the maximum alternating stress intensity will be limited to 0.5 of the endurance limit from Figures I-9.1 or I.9.2, ASME Code, Section III.

b) If the maximum amplitude is determined by instrumentation, (i.e. accelerometer) and the piping is not ASME Code, Section III, Class I, then the maximum alternating stress intensity will be limited to 0.62 of the endurance limit from Figures I-9.1 or I 9.2, ASME Code, Section III.

3) Where velocity measurements are taken, the acceptance criteria for carbon and stainless steel will comply with the endurance limits noted above.

4) When the vibration is beyond the acceptance criteria above or restraints are found to be inadequate or damaged, evaluation by design engineering will be performed and where required corrective restraints will be designed, incorporated into the piping system analysis, installed, and retested.

14.2.12.1.13 Metal Impact Monitoring System Test Summary

a) Test Objective

To ensure the proper operation of the Metal Impact Monitoring System (MIMS).

b) Prerequisites

1) Reactor coolant pumps operational.

2) Reactor coolant system filled and operational.

3) The general prerequisites are met.

4) All vendors' tests completed.

c) Test Method

1) Run reactor coolant pumps in various combinations to ensure that the MIMS operates properly on each accelerometer as per vendor specifications.

2) Verify operation of console functions.

d) Acceptance Criteria

1) Operator must be able to determine which pumps are running during combinational pump runs, using the MIMS as his sole indication.

2) Console functions must operate as described in vendor supplied technical manual.

14.2.12.1.14 Radiation Monitoring System Test Summary

a) Objective

The objective of this is to document the proper operation of the hardware and software for the Radiation Monitoring Computerized System.

b) Prerequisites

1) The general prerequisites must be met.

2) The four RM-11 computers and the RM-21 computer and all associated I/O cabinets and all man-machine I/O devices must be operational with general software checkout complete. (The software checkout will consist of loading vendor diagnostic software to ensure that the machines are generally functional and then loading the operations software to check for software operability by exercising it to verify that it functions IAW vendor documentation.)

c) Test Method

Every monitor will be individually checked.

1) The alarm states will be simulated with computer software to verify local and remote alarm.

2) The communication link between monitors and the main computer will be checked by interrogating each monitor from the main RM-11 console.

3) All functions of the monitors will be checked from the normal control point to verify operability. (This will entail loading data base and verifying the operability of the function buttons.)

4) Communications link redundancy will be verified by lifting leads of communications cable to simulate a severing of communications lines and establishing communications with the monitor by both primary and backup main display computers.

5) The backup capability of each of the main display computers will be verified by artificially inducing failure of one computer to see that the other computer can carry on monitor functions.

6) The onboard check source for each monitor will be activated from the main display computer to check for proper operation.

7) Graphic software will be operationally tested to verify proper indication.

8) Each safety-related monitor that provides contacts to operate dampers, valves, pumps or other equipment will include the equipment in operability tests such that when contacts actuate the operation of connected equipment will be verified.

d) Acceptance Criteria:

All equipment and software will operate in conformance with the acceptance criteria contained in vendor supplied technical manuals.

14.2.12.1.15 Excore Nuclear Instrumentation System (NIS) Test Summary

a) Test Objective

1) To demonstrate the operability of the excore nuclear instrumentation, including its ability to supply signals to the Reactor Protection System for generating appropriate trip signals and alarms, and indicating power levels.

b) Prerequisites

1) The NIS is aligned in accordance with the vendor's technical manual, and the associated NIS readout devices are calibrated.

2) Source range instrumentation is calibrated in accordance with vendor technical manuals.

3) The general prerequisites are met.

c) Test Methods

1) Simulate signals, as required, to verify that the NIS functions in accordance with the vendor's technical manual, and that the associated readout devices and analog devices receive the proper input signals.

2) Verify by simulating inputs to the NIS that analog output signals to associated equipment are of proper polarity and span in accordance with the vendor's technical manual.

d) Acceptance Criteria

1) Each NIS channel, interlock, permissive, trip, and indication operate to provide the specified functions in the Precautions, Limitations, and Setpoint Document.

14.2.12.1.16 Emergency Diesel Generator Test Summary

a) Test Objective

To demonstrate the operability of the diesel generator unit and associated support systems to include: starting performance, load acceptance performance, rated load capability, design load capability, load rejection capability, electrical performance, and subsystem performance.

b) Prerequisite

1) DC power is available for control and protective circuitry.

2) The following Emergency Diesel Generator Support Systems are in service: air start, jacket water (including emergency service water and potable water), lube oil, and fuel oil storage and transfer.

3) Diesel Building Ventilation in operation.

4) Fire Protection available.

5) General prerequisites are met.

c) Test Method

1) With the diesel generator unit in a standby status, conduct local and manual starts and operate in an unloaded condition to verify the operation of and establish base-line data for diesel engine components, auxiliary systems, alarms, indications, interlocks and protective devices.

2) Conduct local and remote starts and synchronization of each unit and verify operation of the generator, generator excitation and voltage regulation, engine-generator controls, indication, alarms systems.

3) Conduct automatic and manual load acceptance and rejection testing to verify the voltage, frequency of speed control performance of each diesel generator unit.

4) Perform a 24 hour load reliability test of each diesel generator unit in accordance with RG 1.108 (Rev. 1) C.2.a(3). RG 1.108 (Rev. 1) C.2.a(5) will be performed in conjunction with the Integrated Engineered Safety Features Actuation System Test.

5) Perform a Combined Mode Diesel Generator Unit test to demonstrate independence of the two units.

6) Perform a diesel generator restart and loading sequence after shutdown from a full-load operating condition.

d) Acceptance Criteria

1) Each diesel generator starts (automatic start or local/remote manual start) and accelerates to rated speed and voltage within 10 seconds after receiving a signal to start.

2) Each diesel generator shall start and accelerate emergency bus loads to rated speed in the required sequence (FSAR Table 8.3.1-2c) without exceeding five percent speed drop, 25 percent voltage drop at the load terminals, and recover to within 10 percent of nominal voltage and two percent of nominal frequency within 60 percent of each load-sequence time interval.

3) The diesel generator speed shall not exceed 111.25 percent of nominal (450 rpm) upon disconnecting of the single largest load and shall not trip on overspeed (115 percent of nominal) upon disconnecting of all load.

4) The diesel generators and auxiliaries operate to maintain 110 percent load for a 2 hour period followed by a 100 percent load for an additional 22 hours.

5) Each diesel generator satisfactorily performs during thirty-five consecutive starts per Regulatory Guide 1.108, Section c.2.e.

6) Both diesel generators start and operate satisfactorily upon receiving simultaneous start signals.

7) Each diesel generator shall, when restarting from hot conditions (lube oil and jacket water temperatures within $\pm$10F of normal operating temperature), start and accelerate to rated speed and voltage in ten seconds or less and assume load via the sequencer.

14.2.12.1.17 Deleted

14.2.12.1.18 Fire Protection System Test Summary

a) Test Objective

This test will demonstrate the operability of the Fire Protection System, including its fire detection and suppression functions in accordance with FSAR Section 9.5.1.

b) Prerequisites

1) Sufficient water in the Auxiliary Reservoir for system flow testing is available.

2) The general system prerequisites are met.

c) Test Method

An Operational Test will be performed on the fire protection system to ensure that it meets the requirements in FSAR Section 9.5.1 in the following area:

1) Automatic controls function of the fire pumps.

2) Fire pump flow requirements.

3) System pressure requirements.

4) The proper functioning of the fire detection devices by simulating inputs to activate the automatic fire protection system, alert the control room operator and actuate fire alarms.

d) Acceptance Criteria

1) Operation of the system is in accordance with FSAR Section 9.5.1.

2) Automatic controls function in accordance with FSAR Section 9.5.1.

14.2.12.1.19 Normal Service Water Test Summary

a) Test Objectives

1) To demonstrate the capability of the Normal Service water pumps to supply the normal operation service water flow requirements in accordance with FSAR Table 9.2.1-1 and Section 9.2.1.2.a.

2) To demonstrate system component response performance to automatic initiation signals.

3) To verify system controls and interlock functional performance to be in accordance with system design documents and FSAR Section 9.2.1.5.

b) Prerequisites

1) The general prerequisites are met.

2) Sufficient water in the cooling tower basin is available.

3) Permanent screens are installed at the normal service water pump chamber to prevent debris from entering the pump suction.

4) Normal service water pump seal and lube water supply is available.

5) Proper flow distribution for the safety-related loads has been established with the emergency service water pumps in operation.

c) Test Method

1) The Normal Service Water system is placed in operation with one normal service water pump running, one safety-related water header in service, and the non-safety related header in service to allow:

a) Measurement of total flow provided to the safety header;

b) measurement of normal service water flow to the Turbine Building and components therein, Containment Fan Coil Units and to the Waste Processing Building;

c) determine performance characteristics of the operating normal service water pump;

d) verification of automatic strainer operation.

2) Secure system operation and place the system in operation with the alternate service water pump or safety-related header and repeat items 1(a) through 1(d).

3) Test Main Control Room and Auxiliary Control Panel controls of the normal service water system and verify system indicators and alarms with local indicators and/or alarms where installed.

4) Test system interlocks and standby pump starts features using actual or simulated signals when necessary.

5) The Normal Service Water system is placed into operation with both safety-related headers, both normal service water pumps and the non-safety-related header in service to allow measurement of service water flow.

d) Acceptance Criteria

1) Normal service water requirements, where measurable with installed instrumentation, of FSAR Table 9.2.1-1 for Normal Operation is met.

2) System remote controls, alarms and indicators, automatic controls and interlock features function in accordance with design documents.

3) Normal service water pump and pump motor performance, meets or exceeds design criteria in vendors instruction manual SHNPP File No. IJR.

14.2.12.1.20 Emergency Service Water Test Summary

a) Test Objectives

1) To demonstrate the capability of the Emergency Service Water pumps to supply the emergency operation service water flow requirements to the service water safety headers A and/or B in accordance with FSAR Table 9.2.1-1, Service Water Requirements, FSAR Section 9.2.1.2-b (page 9.2.1-4), and Section 9.2.1.3.1.

2) To demonstrate the capability of the service water Booster Pumps to provide sufficient flow and system piping arrangement to meet design criteria of FSAR section 9.2.1.2-c (page 9.2.1-4).

3) To demonstrate the availability of the Emergency Service water pumps, and the associated safety-related components and piping to supply service water requirements per FSAR Section 9.2.1.3.1.

4) To verify the operation of various system components and control circuitry to operate in accordance with vendor technical manuals and/or design drawings.

5) To conduct Steady-State Vibration and Piping Dynamic Response testing of system piping and components.

b) Prerequisites

1) The general prerequisites are met.

2) There is sufficient water in the Main and/or Auxiliary Reservoirs to provide adequate submergence for the emergency service water pumps.

3) The traveling water screens and screen wash system are operational.

c) Test Method

1) The Emergency Service Water System; i.e. safety-related portion of the service water system shall be placed in operation with each emergency service water pump supplying its respective header. Components supplied by either header will initially be isolated.

2) Proper system flow requirements to components supplied only from safety header A or B shall be set using installed flow instrumentation.

3) Performance characteristics of both E.S.W. pumps shall be checked for satisfactory performance.

4) Flow to components supplied from either header shall be established from Header A and then B and performance characteristics of each E.S.W. pump shall be verified.

5) Controls, alarms, interlocks and automatic initiation of valve operation and pump start features shall be verified to function upon receipt of operational and/or casualty signals. Where required, casualty signals will be simulated to initiate action.

6) Proper operation of the automatic strainers, including backwash will be verified.

7) Service water booster pump performance characteristics, system flow and pressures in containment service water piping will be verified.

d) Acceptance Criteria

1) Emergency service water flow, where measureable with installed instrumentation, meets the requirements listed in FSAR Table 9.2.1-1

2) System remote manual and automatic controls, alarms, indicators and interlock features function in accordance with SHNPP drawing CAR-2166-G425S01 and CAR-2166-G425S02.

3) Emergency service water pump and pump motor performance meets or exceeds design criteria in vendors instruction manual 01-002-072, Rev 0 (SHNPP T/M No. 16-P182-4065).

4) Service water booster pump and pump motor performance meets or exceeds design criteria in vendors' instruction manual.

5) Steady-State Piping Vibration Tests and Piping Dynamic Response test per FSAR Section 3.9.2.1.2 are completed.

6) Emergency service water pressure inside of Containment is greater than the containment design pressure.

14.2.12.1.21 Compressed and Instrument Air Systems Test Summary

a) Test Objectives

To demonstrate the ability of the compressed and instrument air systems to provide a sufficient quantity of air that meets the design specifications for pressure purity and maximum dew-point in accordance with Section 9.3.1 FSAR.

b) Prerequisites

Cooling water to compressor coolers, system pneumatic pressure test and general prerequisites are met in accordance with FSAR Section 9.3.1.

c) Test Methods

An operational test will be performed on the system to ensure that it meets the requirement in FSAR Section 9.3.1 in the following areas:

1) Capacity of the system air compressors

2) Proper operation of the system air coolers and dryers.

3) Demonstrate the air quality by analyzing for oil, water and particulate matter.

4) Analyze system air for maximum dew-point at dryer outlet.

5) Simulate required signals to verify automatic controls, interlocks, and setpoints for alarms.

d) Acceptance Criteria

Acceptance criteria shall be in accordance with FSAR Section 9.3.1 and demonstrated as discussed in c above.

14.2.12.1.22 Reactor Coolant System Hydrostatic Test Summary

a) Test Objectives

1) To verify the integrity and leak tightness of the Reactor Coolant System and the high pressure portions of associated systems.

b) Prerequisites

1) The reactor coolant pumps are available to support this test.

2) The reactor vessel's lower and upper internals and the closure head are installed. The studs are tensioned to design value for the associated hydrostatic test pressure.

3) Temporary temperature instrumentation is installed for measuring the temperature of the steam generator tube sheets, the bottom of the pressurizer, and the closure flange of the reactor vessel.

4) A charging pump or test pump is available to pressurize the system.

5) The general prerequisites are met with the exception of e).

c) Test Method

1) The reactor coolant pumps are operated as required to vent the systems and to aid in establishing the required minimum temperature for pressurizing to the test pressure.

2) The system is pressurized to test pressure.

3) System welds and components are inspected for leakage.

d) Acceptance Criteria

1) The Reactor Coolant System and associated high pressure systems are verified leak tight in that no leakage is observed from system welds.

2) System pressure remains at the prescribed hydrostatic test pressure for the required time interval as per the ASME Boiler and Pressure Vessel Code Section III.

14.2.12.1.23 RTD/TC Cross Calibration Test Summary

a) Test Objective

1) To provide a functional checkout of the reactor coolant system resistance temperature detectors (RTDs) and incore thermocouples, and to generate isothermal cross calibration data for subsequent correction factors to indicated temperatures.

b) Prerequisites

1) RCS heatup section of hot functional has commenced.

2) The general prerequisites are met.

c) Test Method

1) At selected temperature plateaus, RTD and in-core thermo-couple data are recorded.

2) Isothermal cross-calibration correction factors for individual thermo-couples are determined.

3) Installation corrections for individual RTD's are determined.

d) Acceptance Criteria

1) Installation Corrections for RTD's are as specified in the Westinghouse NSSS Start-up Manual.

14.2.12.1.24 Pressurizer Relief Tank (PRT) Test Summary

a) Test Objectives

1) To verify pressure and level alarm setpoints.

2) To demonstrate draining and recirculating of the PRT through the RCDT heat exchanger using the RCDT pump.

3) To demonstrate that the PRT cover gas regulating valve operates at the specified setpoint.

b) Prerequisites

1) The Reactor Makeup Water System is available to supply water to the PRT.

2) Nitrogen system available to supply PRT.

3) Required portions of the Waste Processing System are operational.

4) The general prerequisites are met.

c) Test Method

1) Vary the level and pressure in the PRT to verify actuation of alarms.

2) Recirculate the water in PRT and verify that proper flowpath exists.

d) Acceptance Criteria

1) The pressure and level setpoints function as stated in the Westinghouse Precautions, Limitations, and Setpoint Document.

2) Drainage from the PRT is verified by the resetting of the PRT high level alarm and the actuation of the PRT low alarm as PRT level drops.

3) Recirculation is verified by maintaining PRT level in the normal operating band while the RCDT pump is aligned and operating in the recirculation mode.

14.2.12.1.25 Safety Injection System Performance Test Summary

a) Test Objectives

1) Demonstrate system and component capability by injecting water from the Refueling Water Storage Tank into the reactor vessel from various combinations of injection legs and pumps.

2) To adjust flows to all Hi-Head Safety Injection branch lines for even flow distribution and total flow rate to prevent the Charging/Safety Injection Pumps from exceeding runout.

3) To verify proper system activation time with safety injection signal.

4) To verify the capability of the Charging/Safety Injection Pumps to take suction from the Residual Heat Removal Pumps.

5) To verify the characteristic performance curve of the Charging/Safety Injection Pumps at various flows.

6) To verify operation of critical valves under flow conditions.

b) Prerequisites

1) The Refueling Water Storage Tank contains a supply of demineralized water for this test.

2) The reactor vessel and reactor cavity are available to receive water.

3) The applicable portions of the Chemical and Volume Control System and the Residual Heat Removal System are available to support this test.

4) The applicable general prerequisites are met.

c) Test Method

1) Performance characteristics of the Charging/Safety Injection Pumps are measured while the pumps are operating at various flows.

2) Flows are adjusted so that all branch lines receive equal flow and the Charging/Safety Injection Pumps do not exceed runout.

3) The Residual Heat Removal Pumps can supply the required NPSH to the Charging/Safety Injection Pumps (CSIP) as dictated by the CSIP Technical Manual.

4) The Residual Heat Removal (RHR) Pumps are operated in series with Charging/Safety Injection Pumps to verify that the RHR Pumps can supply adequate suction head.

5) Critical valves are operated under maximum expected differential pressure conditions.

d) Acceptance Criteria

1) The measured Charging/Safety Injection Performance Curve matches the performance curve provided in the Charging/Safety Injection Pump Technical Manual.

2) The response times of the pump and valves are in accordance with FSAR Section 6.3.

3) The Residual Heat Removal Pumps can supply adequate suction head to the Charging/Safety Injection Pumps.

4) Critical valves are able to open against the maximum expected differential pressure conditions during operation.

5) Safety Injection components actuate to the state specified in FSAR Section 6.3.2.1 on receipt of a safety injection signal.

6) The measured Charging/Safety Injection Pump NPSH meets or exceeds that required by the vendor technical manual for the CSIP.

14.2.12.1.26 High-Head Safety Injection System Check Valve Test Summary

a) Test Objective

1) To demonstrate that emergency core cooling water can be delivered into the reactor coolant system at approximately no-load operating temperature and pressure.

b) Prerequisites

1) Hot Functional Testing in progress with the RCS at approximately no-load pressure and temperature.

2) The water level in the pressurizer is as low as practical.

3) The applicable general prerequisites are met.

c) Test Method

1) Injection shall be verified by flow noise and/or increase in pressurizer level for each cold leg injection path.

d) Acceptance Criteria

1) The Safety Injection System injects emergency core cooling water into the reactor coolant system at approximately no-load operating temperature and pressure.

14.2.12.1.27 Safety Injection (SI) Accumulator Test Summary

a) Test Objective

1) To verify the discharge characteristics of each Safety Injection Accumulator.

2) To demonstrate that the SI Accumulator discharge isolation valves will open under the maximum differential pressure conditions.

b) Prerequisites

1) The Reactor Coolant System is drained down and the reactor vessel head and internals have been removed.

2) The Refueling Water Storage Tank Contains an adequate supply of demineralized water for this test.

3) Nitrogen and compressed air is available to pressurize the accumulators.

4) The applicable general prerequisites are met.

c) Test Method

1) Each accumulator is filled to its normal operating level and partially pressurized. The discharge isolation valve is opened and level and pressure measurements are used to determine line resistance and accumulator injection performance to develop a blowdown curve.

2) Each accumulator is pressurized to approximately 600 psi pressure and the discharge isolation valve is opened.

d) Acceptance Criteria

1) The slope of the SI Accumulator blowdown curve is within the limits prescribed by Westinghouse Start-up procedure SU-2.3.2.

2) The SI Accumulator discharge isolation valves are capable of opening with zero Reactor Coolant Pressure and maximum accumulator pressure.

14.2.12.1.28 Residual Heat Removal System Cold Test Summary

a) Test Objective

1) To demonstrate the operability of the RHR pumps, verify by flow test their ability to supply water at required flow rates, verify automatic controls, interlocks, and alarms function in accordance with design.

2) To verify the characteristic performance curve of the Residual Heat Removal Pumps.

b) Prerequisites

1) The reactor vessel and cavity are capable of receiving water.

2) The Refueling Water Storage Tank contains an adequate supply of demineralized water to support this test.

3) The applicable general prerequisites are met.

c) Test Method

1) Performance characteristics of the RHR Pumps are verified during discharge to the RCS loops.

2) Controls, alarms, and interlocks are verified to function properly by operation and/or simulation of signals.

d) Acceptance criteria

1) The measured Residual Heat Removal Pumps performance matches characteristic curve provided by the Residual Heat Removal Pump Technical Manual.

2) Residual heat Removal System Automatic controls and alarms function in accordance with the Precautions, Limitations and Setpoint Document.

3) Residual Heat Removal interlocks function in accordance with FSAR Section 5.4.7.

14.2.12.1.29 Residual Heat Removal Hot Test Summary

a) Test Objective

1) To demonstrate the heat removal capability of the Residual Heat Removal System.

b) Prerequisites

1) The Reactor Coolant System is in the cooldown phase of hot functional testing.

2) All support systems required for initiating residual heat removal are in operation.

3) The applicable general prerequisites are met.

c) Test Method

1) RHR will be initiated when the RCS is at approximately 350 F and 400 psi.

2) A cooldown rate will be established and temperature and flow data will be recorded for RHR and component cooling water systems.

3) The RHR pumped fluid shall have its pressure, temperature, and chemistry recorded. The duration of RHR pump testing shall also be recorded for this test.

d) Acceptance Criteria

1) The RHR heat removal capability is in accordance with the FSAR Section 5.4.7.

14.2.12.1.30 Containment Spray System Test Summary

a) Test Objectives

1) To verify the characteristic performance of the containment spray pumps.

2) To verify proper operation of the spray additive eductor system.

3) To verify that flow paths to the containment spray nozzles are free of obstructions and not blocked.

4) To verify system response time from initiation of the containment spray pumps, to the time that water reaches the nozzles and spray starts.

5) To demonstrate that Containment Phase "A" Isolation (T Signal), Containment spray actuation Signal (CSAS), and RWST Lo-Lo Level Signal initiate the proper containment spray pump and valve operation.

b) Prerequisites

1) Adequate water supply is present in the RWST for performance of this test.

2) Adequate water supply is present in the Containment Spray Additive Tank for performance of the spray additive Eductor Test.

3) The general prerequisites are met.

c) Test Methods

1) Operate the containment spray pumps at various flow rates to verify the pumps performance curves.

2) Operate the containment spray pumps in the recirculation test mode at design flow with the NAOH isolation valves open and verify the flow rate from the Containment Spray Additive Tank.

3) Test spray flow paths and assure no flow obstruction by either an air/water combination test or a complete water flow test from pump to nozzles. If an air/water test is done, the air supply connection will be downstream of the water discharge connection (e.g. the air test flow path will overlap the water test flow).

4) By either actual flow measurement or calculation obtain the time from CSAS to actual spray flow at injection phase pump design flow.

5) Initiate each of the following signals and assure the proper operation occurs:

a) Containment Phase "A" Isolation.

b) Containment Spray Actuation.

c) RWST Lo-Lo Level (Containment spray switchover to recirculation mode of Operation).

d) Acceptance Criteria

1) Containment spray pumps operate in accordance with the specific pump performance curves contained in the Containment Spray Pump Technical Manual, Ingersoll-Rand.

2) The Containment Spray chemical addition tank will operate, at Containment Spray Pump design flow, in accordance with Section 6.5.2, SHNPP FSAR.

3) Spray nozzles are free of obstructions.

4) Pumps and valves operate on specific signals and spray commences with a time delay consistent with the Technical Specifications after Containment Spray Actuation.

14.2.12.1.31 Chemical and Volume Control Cold Test Summary

a) Test Objectives

1) To verify the automatic makeup mode function in accordance with design.

2) To verify volume control tank level and pressure alarms and controls operate properly.

3) To demonstrate the operation of the charging/safety injection pumps on minimum flow.

b) Prerequisites

1) Reactor Makeup Water is available to support operation of the automatic makeup.

2) Service water is available to the charging/safety injection pump coolers.

3) The applicable general prerequisites are met.

c) Test Method

1) Operate or simulate operation of the system to verify that all controls, interlocks, and alarms function as designed.

2) Operate the Charging/Safety Injection Pumps on minimum flow and record baseline data.

d) Acceptance Criteria

1) Volume Control Tank level and pressure alarms function in accordance with the Precautions, Limitations, and Setpoint Document.

2) The automatic makeup mode functions in accordance with FSAR Section 9.3.4.

3) Charging/Safety Injection minimum flow is in accordance with FSAR Section 9.3.4.

14.2.12.1.32 Chemical and Volume Control System Hot Test Summary

a) Test Objectives

1) To demonstrate the ability of the Chemical and Volume Control System to maintain minimum and maximum charging and letdown flow rate and to maintain seal water injection flow to the reactor coolant pumps.

2) To verify all charging and letdown flow paths and differential pressures across filters and demineralizers.

3) To verify all pressure, flow, and temperature alarms of the CVCS.

4) To demonstrate the ability to maintain reactor coolant chemistry within specifications using chemical addition and purification.

5) To demonstrate boration and dilution of the Reactor Coolant System in all modes, and verify the operation of the Boron Thermal Regeneration.

b) Prerequisites

1) The Reactor Coolant System and all support systems have been filled with primary grade water and are lined up for hot functional testing.

2) The applicable general prerequisites are met.

c) Test Method

1) Operate the system in all modes required for establishing a bubble in the pressurizer, heating and pressurization of the reactor coolant system to hot standby condition.

2) Operate the Reactor Makeup Control System in all modes of dilution and boration.

3) Operate the Boron Thermal Regeneration System with borate letdown flow to determine the operational capabilities for storage and release of boron.

4) Establish seal injection to the reactor coolant pumps and verify the capability of the CVCS to maintain proper flows.

5) Operate or simulate operation of the system to verify all temperature, flow, and pressure alarms.

6) Record differential pressures across filters and demineralizers.

7) Operate purification and make chemical additions as necessary to maintain Reactor Coolant System water purity.

d) Acceptance Criteria

1) The charging, letdown and seal water injection function are in accordance with FSAR Section 9.3.4.

2) Differential pressures across filters and demineralizer are in accordance with Westinghouse System Description SD-CQL-282.

3) Pressure, flow and temperature alarms function in accordance with the Precautions, Limitations and Setpoint Document.

4) Chemical addition and purification function to keep the Reactor Coolant chemistry in accordance with Plant Operating Manual.

5) Boration and dilution can be accomplished using the Reactor Makeup Control System or Boron Thermal Regeneration System in accordance with FSAR Section 9.3.4.

14.2.12.1.33 Deleted by Amendment No. 23

14.2.12.1.34 Auxiliary Feedwater System Test Summary

a) Test Objectives

1) To evaluate system performance per FSAR section 3.9.2.1.2, Steady-State Piping Vibration Test and Piping Dynamic Response Tests.

2) To measure the feedwater flow rate obtainable from the turbine driven auxiliary feedwater pump and from both motor-driven feedwater pumps.

3) To document system component response performance to automatic initiation signals.

4) To demonstrate steam turbine driven auxiliary feedwater pump startup from cold conditions and measure steam pressure operating range.

5) To verify system controls and interlocks functional performance to be in accordance with system design logic diagrams and FSAR Section 10.4.9.2.4.

b) Prerequisites

1) All general prerequisites are met.

2) Source of Steam Generator feedwater available. Condensate Storage Tank level within normal operating limits.

3) Demineralized water make-up to Condensate Storage Tank available.

4) Service Water system is operational.

5) Affected portions of the Main Steam System are operational.

6) Hot Functional testing is in progress.

c) Test Method

1) Operate the auxiliary feedwater pumps at various flows to verify their performance characteristics.

2) During auxiliary feedwater pump operation, monitor operation of the pressure control valves and flow control valves.

3) Determine system response time to automatic initiation signals.

4) Exercise all system controls at the Main Control Board and Auxiliary Control Panel.

5) Initiate simulated or actual automatic initiation signals to verify isolability of a faulted steam generator, and initiation of auxiliary feedwater flow due to loss of off-site power, loss of main feedwater flow, safety injection signal, or low-low level in one or more steam generators.

6) Visually observe system piping and components during system operation for abnormal vibration or piping response to system and component operations. Perform instrumented tests as required by the System Dynamic Test and Analysis Test Procedures.

d) Acceptance Criteria

1) Automatic initiation of feedwater flow from the Auxiliary Feedwater System shall occur within one minute of the automatic auxiliary feedwater actuation signal listed in FSAR Section 10.4.9.2.4 (a) and (b).

2) The turbine-driven auxiliary feedwater pump and turbine performance shall meet or exceed vendor performance data supplied in SHNPP Technical Manual 16-P043-3065.

3) The turbine-driven auxiliary feedwater pump reliability shall be demonstrated by performance of five consecutive cold starts.

4) The motor driven auxiliary feedwater pumps pressure control valves maintain pump discharge pressure above 1000 psig.

5) The motor-driven auxiliary feedwater pumps flow to the steam generators shall meet or exceed the rate shown on the vendor pump curves. This rate shall be equal to or greater than 400 gpm per pump as indicated by installed flow elements.

6) Note: Steam Generator capacity in gallons/inches determined during initial steam generator filling.

7) System dynamic testing completed per SHNPP Dynamic Test and Analysis, FSAR Section 3.9.2.

8) The motor driven auxiliary feedwater pump shall not exceed the limitations for vibration, bearing, and bearing oil outlet temperatures as specified in SHNPP Technical Manual 16-P043-3065. In addition, the RAB Ventilation and Equipment Cooling Systems shall maintain environmental conditions of the Auxiliary Feedwater piping area within the design requirements of FSAR Sections 9.4.3 and 9.4.5.

14.2.12.1.35 Fuel Handling Equipment System Test Summary

a) Test Objective

1) To demonstrate the operability of the fuel handling equipment components and fuel transfer system.

2) To demonstrate the operability of protective interlocks and devices.

3) To verify load capability.

b) Prerequisites

1) The refueling areas are clean and cleared of obstructions.

2) Dummy Fuel assembly is available.

3) Load cells are calibrated and weights are available to load test handling cranes and hoists.

4) The general prerequisites are met.

c) Test Method

1) Load test (both static and dynamic) spent fuel bridge crane, manipulator crane, manipulator crane auxiliary hoist, FHB auxiliary crane, and the spent fuel cask handling crane.

2) Using the dummy fuel assembly, demonstrate the proper operation of system components: spent fuel bridge crane, fuel transfer system, new fuel elevator, manipulator crane, RCC change fixture, all handling tools, and indexing of system. Also verify the operation of safety interlocks and the proper setting of limit switches.

d) Acceptance Criteria

1) The manipulator crane passes a full operational test using the dummy fuel assembly containing a dummy RCCA. The spent fuel bridge crane, new fuel elevator, spent fuel cask handling crane, fuel handling building auxiliary crane and the manipulator crane auxiliary hoist pass a full operational test of 100% of rated load.

2) The spent fuel bridge crane, spent fuel cask handling crane, fuel handling building auxiliary crane, manipulator crane, new fuel elevator and the manipulator crane auxiliary hoist pass a static load test of 125% of rated load.

3) Fuel handling equipment including any protective interlocks and safety devices operate in accordance with the Fuel Transfer System Technical Manual, Westinghouse Electric Corporation and the Manipulator Crane Technical Manual, Stearms-Roger, Incorporated.

14.2.12.1.36 Fuel Pool Cooling and Clean-up System Test Summary

a) Test Objectives

1) To demonstrate the capability of the Fuel Pool Cooling and Cleanup System to provide the required flows and verify proper operation of the purification loops and skimmers.

2) To verify no leakage of water past gaskets on new and spent fuel pool gates.

3) To demonstrate the operability of the fuel pool level alarms.

b) Prerequisites

1) The fuel pools and transfer canals, and Plant Reactor Cavity are filled with demineralized water as required.

2) The general prerequisites of Section 14.2.12.1 are met.

c) Test Method

1) Operate the Fuel Pool Cooling Pumps at various flow rates to verify the pump performance curves.

2) Operate the Fuel Pool and Refueling Water Purification Pumps at various flow rates to verify the pump performance curves.

3) Operate the Fuel Pool Skimmer Pumps at various flow rates to verify the pump performance curves.

4) Simulate high fuel pool temperatures and low fuel pool cooling flows and verify proper alarm annunciation.

5) Vary levels in fuel pools and demonstrate proper operation of fuel pools level instrumentation and alarms.

6) Fill fuel pools as necessary to have water on one side of pool gates and air on the other, to prove no leakage past the gates.

d) Acceptance Criteria

1) The Fuel Pool Cooling, Fuel Pool and Refueling Water Purification, and Fuel Pool Skimmer Pumps operate in accordance with the specific pump performance curves.

2) System controls and alarms function properly in Fuel Pool Cooling Cleanup and Skimmer Systems.

3) The fuel pool gates shall be leak tight as evidenced by no leakage past each of the pool gates.

14.2.12.1.37 Component Cooling Water System Test Summary

a) Test Objectives

1) To verify the characteristic performance of the component cooling water pumps.

2) To verify that each train of the Component Cooling Water System is capable of providing adequate cooling water to supplied components.

3) To verify alarms and control setpoints.

4) To verify system activation with safety injection signal.

b) Prerequisites

1) Adequate makeup water available.

2) All components supplied by the Component Cooling Water System are capable of receiving flow.

3) All general prerequisites are met.

c) Test Method

1) Operate the component cooling water pumps at various flows to verify the characteristic performance curve.

2) Set up required flows to components and verify alarm setpoints.

3) Verify that standby pumps start on low discharge header pressure.

d) Acceptance Criteria

1) With one pump in operation and another pump in stand-by, as the discharge valve of the operating pump is throttled closed and the low header pressure alarm reached, the stand-by pump starts.

2) With CCW flow established to all system heat exchangers, as each heat exchanger's flow is reduced, (except sample panel heat exchanger, gross failed fuel detector heat exchanger, recycle evaporator heat exchanger and letdown heat exchanger), a low flow alarm is received at instrument setpoint established in Setpoint Document.

3) Flows will be verified to meet minimum required flow rates.

4) Upon receipt of an "S" signal, two CCW pumps start, and both the gross failed fuel detector and the sample panel isolation valves close.

14.2.12.1.38 Gaseous waste processing system test summary.

a) Test Objectives

1) To demonstrate the capability of the Gaseous Waste Processing System (GWPS) to:

a) Receive

b) Transport

c) Process

d) Store

e) Dispose of

gaseous radioactive waste.

2) To verify the performance, to the extent practical, of the:

a) Waste gas compressors

b) Hydrogen recombiners

c) Tanks

d) Pumps

e) Controls

f) Valves

g) Automatic isolation and protective features

h) Instrumentation and Controls

i) Other miscellaneous associated equipment

3) To verify

a) Sampling and radiation monitoring can be accomplished.

b) Proper calibration and operation of instrumentation.

b) Prerequisites

1) General Prerequisites are met (Listed in Section 14.2.12.1)

2) O_2, N_2, and H_2 stored gas systems are available.

3) Instrument Air System is available.

4) Primary Makeup System is available.

5) WPB Cooling Water System is available.

6) WPS Computer is available.

c) Test Method

1) Operate the waste gas compressors and verify proper operation of interlocks and controls.

2) Operate the hydrogen recombiners and verify proper operation of interlocks and controls.

3) Operate the GWPS and verify that sampling and radiation monitoring can be accomplished.

4) Operate the GWPS and verify proper operation and calibration of associated instrumentation and alarms.

d) Acceptance Criteria

Acceptance criteria shall be in accordance with FSAR Section 11.3.1 and demonstrated as discussed in Section C above.

14.2.12.1.39 Solid Waste Processing System Test Summary

a) Test Objective

1) To demonstrate the ability of the Solid Waste Processing System (SWPS) to:

a) Collect

b) Control

c) Process

d) Package

e) Store

concentrated liquid wastes, spent resins resulting from plant operation, and low activity solid waste, such as contaminated clothing, rags, paper, etc.

2) To verify the performance, to the extent practical of the:

a) Pumps

b) Tanks

c) Controls

d) Valves

e) Automatic isolation and protective features

f) Instrumentation and controls

g) Other miscellaneous associated equipment

3) To verify

a) Proper calibration and operation of instrumentation

b) Sampling and radiation monitoring can be accomplished

4) As of July 1, 1987, the startup test program was considered to be complete. The volume reduction testing that remained will be completed by the Technical Support Unit using POM procedures.

b) Prerequisites

1) General prerequisites are met (Listed in Section 14.2.12.1).

2) WPB Cooling Water System is available.

3) Instrument Air-System is available.

4) Demineralized Water System is available.

5) WPS Computer is available.

6) Service Air-System is available.

c) Test Method

1) Operate the volume reduction system with representative non-radioactive chemical streams and verify the proper operation of interlocks and controls.

2) Operate the waste solidification subsystem with representative non-radioactive chemical streams and verify proper operation of interlocks, controls and that sampling and radiation monitoring can be accomplished. Also ensure that no free standing water exists within the solidified product.

3) Load and operate the dry waste compaction subsystem and verify operation of interlocks and controls.

d) Acceptance Criteria

1) Verification that the Solid Waste Processing System has the ability to collect, control, and process concentrated liquid wastes, spent resins, and solid wastes such as clothing, rags, paper, etc.

2) Verification that the Solid Waste Processing System pumps, controls, valves, instrumentation, automatic isolation and protective features operate in accordance with design drawings and specifications from their respective control switches and interlocks.

14.2.12.1.40 Liquid Waste Processing System Test Summary

a) Test Objective

1) To demonstrate the ability of the Liquid Waste Processing System LWPS to:

a) Collect

b) Store

c) Process

d) Distribute

the processed water from the subsystem collection points.

2) To verify the performance, to the extent practical, of the:

a) Pumps

b) Tanks

c) Evaporators

d) Reverse-Osmosis Units

e) Controls

f) Valves

g) Automatic isolation and protective features

h) Instrumentation and controls

i) Other miscellaneous associated equipment

3) To verify:

a) Proper calibration

b) Sampling and radiation monitoring can be accomplished

b) Prerequisites

1) General prerequisites are met (Listed in Section 14.2.12.1).

2) Auxiliary Steam and Auxiliary Condensate Systems are available.

3) WPB Cooling Water System is available.

4) WPS Computer is available.

5) Instrument Air System is available.

6) Demineralized Water System is available.

7) System Relief Valves have been tested and they are set at system pressure.

c) Test Methods

1) Operate the collection tanks, pumps, and sumps and verify proper operation of interlocks, controls, and that sampling can be accomplished.

2) Operate the reverse osmosis units with non-radioactive representative chemical waste streams and verify proper operation of interlocks, controls, and that sampling can be accomplished.

3) Operate the waste processing evaporators with non-radioactive representative chemical waste streams and verify proper operation of interlocks, controls, and that sampling can be accomplished.

4) Operate the Filter Backwash System with representative suspended solid stream and verify proper operation of interlocks, controls, and that sampling can be accomplished.

5) Operate the Spent Resin and Concentrates Storage and Transfer System with non-radioactive resin sample and verify proper operation of interlocks, controls, and that sampling can be accomplished.

6) Sources or jumpers will be used to verify operability of the automatic isolation and protective features and/or proper calibration of radiation detectors and monitors.

d) Acceptance Criteria

Acceptance Criteria shall be in accordance with FSAR Section 11.2.1 and demonstrated as discussed in c above.

14.2.12.1.41 Containment Isolation Test Summary

a) Test Objectives:

1) Demonstrate the capability of the containment isolation system to respond properly to an isolation signal.

b) Prerequisites

1) The general prerequisites are met.

2) Reactor Protection System/Engineered Safety Features Actuation Systems logic testing complete.

3) All systems included in this test are in the proper lineup to support the test.

c) Test Method

1) Simulate a phase A containment isolation signal and verify that phase A containment isolation valves close.

2) Simulate a phase B containment isolation signal and verify that phase B containment isolation valves close.

3) Measure the time required for each containment isolation valve to close.

d) Acceptance Criteria

Isolation valves close on their respective signal and closing times are as specified on Table 6.2.4-1 of the FSAR.

14.2.12.1.42 Containment Integrated Leak Rate Test and Structural Integrity Test Summary

a) Test Objective

1) To demonstrate that the overall leakage of the Containment meets the requirements of 10 CFR 50, Appendix J. Also see Section 6.2.6 for additional discussion.

2) To demonstrate that the structural integrity of the Containment is adequate to withstand the internal pressure that would be generated during postulated accidents. See Section 3.8.1 for additional discussion.

b) Prerequisites

1) The general prerequisites are met.

2) Required local (Appendix J, Type B and C) leak tests of penetrations, locks, hatches, and valves are complete.

3) Sufficient temporary air compressor capacity is available.

4) Containment ventilation and cooling systems are operable to the extent required to control containment temperatures.

5) Those instruments or equipment which might be damaged by high containment pressure are vented or removed.

6) Systems exposed to containment atmosphere following a LOCA are properly aligned.

c) Test Method

1) Safety systems are aligned in accordance with applicable regulations and standards.

2) Containment isolation is achieved by normal actuation.

3) The containment is pressurized with air. Temperatures, humidities, pressures, and structural conditions are recorded at the appropriated containment pressures.

4) A known leakage rate is established and the new leak rate data is correlated to 3) above, if required.

5) Data may be taken at reduced pressure for use in future leak rate tests as described in Appendix J.

d) Acceptance Criteria

1) Structural observations and measurements meet the acceptance criteria contained in Section 3.8.1.

2) Containment integrated leakage is within the criteria of 10 CFR 50, Appendix J and Section 6.2.6.

14.2.12.1.43 Reactor Coolant System Hot Functional Test Summary

a) Test Objectives

1) To operate the Reactor Coolant System at full flow conditions for a minimum of 240 hours (need not be consecutive) to provide the necessary vibration cycles on the vessel's internal components for their inspection prior to core load.

2) To provide coordination and initial conditions necessary for the conduct of those preoperational test procedures to be performed during heatup, normal operating temperature, and pressure, and cooldown of the reactor coolant and secondary systems.

b) Prerequisites

1) Off-site power is available on short notice.

2) The emergency diesel generators are fully operational and set up for auto-start.

3) All systems and components required to support heatup, operating at normal temperature and pressure, and cooldown of the Reactor Coolant System are available.

4) The general prerequisites are met.

c) Test Method

1) The Reactor Coolant System and support systems are lined up for normal operation.

2) Utilizing reactor coolant pump heat and pressurizer heaters, the RCS is heated to normal operating temperature and pressure, maintained at normal operating temperature and pressure, and cooled down to ambient.

3) Preoperational test procedures dependent on RCS pressure and temperature are performed.

d) Acceptance Criteria

1) The RCS has operated at full flow conditions and over 515F for a minimum of 240 hours.

2) Necessary functional responses of components systems and instrumentation with the plant at normal no-load operating temperature, pressure, level and flow are verified.

14.2.12.1.44 Piping Thermal Expansion and Dynamic Effects Test Summary

a) Test Objectives

1) To verify that during initial heatup and cooldown of safety related system piping whose operating temperatures exceed 250°F, the associated components, piping, snubbers, support and restraint deflections are unobstructed and within design specifications.

b) Prerequisites

1) This test is conducted in conjunction with the Reactor Coolant System Hot Functional preoperational test, and the conditions required for that test must be established.

2) Supports, restraints, and hangers deemed necessary by design engineering are installed and reference points and predicted movements established.

3) Preservice examination of snubbers has been completed as described in Section 3.9.2.1.

4) The general prerequisites are met.

c) Test Method

1) Prior to starting preoperational test, with systems at ambient temperature, a complete set of position measurements at selected points is taken and the data recorded.

2) During the preoperational test, position measurement data is recorded at plateaus given in the detailed test procedure and snubber thermal movements are verified as discussed in Section 3.9.2.1.

3) At each measurement, plateau data is evaluated and interferences are corrected prior to proceeding with heatup or cooldown.

4) After completion of preoperational test cooldown, a complete set of position measurements is taken at ambient temperature.

d) Acceptance Criteria

1) Unrestricted expansion and acceptable predicted movements are verified as required by Section 3.9.2.1.

2) Components and piping return to acceptable cold position upon test completion.

14.2.12.1.45 Deleted by Amendment 4.

14.2.12.1.46 Deleted by Amendment 20.

14.2.12.1.47 Pressurizer Pressure and Level Control Test Summary

a) Test Objectives

1) To demonstrate proper operability of the pressurizer pressure control system, including the verification of the pressurizer pressure alarms and control functions.

2) To verify that the relieving capacity of a PORV is less than that assumed in the accident analysis.

3) To demonstrate that the opening and closing setpoints for the pressurizer power-operated relief valves meet the design specifications, that the opening time of the power operated relief valves is within specification.

4) To demonstrate that the PORV block valves will close against flow.

b) Prerequisites

1) The Reactor Coolant System is in the hot shutdown condition, all reactor coolant pumps running, and hot functional testing is in progress.

2) The pressurizer relief tank is filled to normal operating level with a nitrogen blanket and aligned for normal operation.

3) The general prerequisites are met.

c) Test Method

1) Pressurizer pressure is varied, and the ability of the pressurizer pressure control system to automatically control and stabilize pressurizer pressure is verified.

2) Pressurizer pressure is varied and the pressurizer pressure alarms control setpoints are verified.

3) Pressurizer pressure is increased to verify the opening setpoint of the pressurizer power-operated relief valves. Opening and closing pressures are recorded and verified to meet the design specification.

4) Pressurizer level is varied and the ability of the pressurizer level control system to automatically control and stabilize pressurizer level is verified.

5) Pressurizer level is varied and the level alarms and control setpoints are verified.

6) With pressurizer pressure at 2235 psig or above, open a PORV and record Pressurizer Pressure at 10 second intervals.

7) With pressurizer pressure at 2235 psig or above, close the PORV block valves. Record the shutting time with the respective PORV open to obtain maximum pressure differential.

d) Acceptance Criteria

1) Pressurizer pressure alarms and control setpoints are within design specification per the Precautions, Limitations, and Setpoints for the Westinghouse NSSS.

2) The response and stability of the pressurizer level control system are within design specification per the Precautions, Limitations, and Setpoints for the Westinghouse NSSS.

3) The pressurizer level alarms and control functions are within design specifications per the Precautions, Limitations, and Setpoints for the Westinghouse NSSS.

4) Pressurizer power operated relief valves open and close within their design setpoints as per the Precautions, Limitations, and Setpoints for the Westinghouse NSSS.

5) The pressurizer relief tank receives the discharge from the power operated relief valves without exceeding its design discharge limit of 50 psig.

6) The pressure drop due to opening a PORV is slower than that assumed in FSAR Figure 15.6.1.2.

7) The PORV block valves can be shut, with flow, within 10 seconds. This stroke time was used as an acceptance criteria for preoperational testing and is not necessarily indicative of current stroke time limits.

14.2.12.1.48 Deleted by Amendment No. 23

14.2.12.1.49 Deleted by Amendment 4

14.2.12.1.50 Main Steam System Test Summary

a) Test Objective

This test will demonstrate the capability of main steam system components to operate in accordance with design during hot functional testing.

b) Prerequisites

1) Steam dump control system is operational.

2) High pressure steam drains are in operation.

3) Hot functional testing is in progress.

4) Main condenser and circulating water system are in operation.

5) Condensate and Feedwater Systems are in operation.

6) General prerequisites are met.

c) Test Method

Verify the capability of the system valves as follows:

1) The main steam isolation valves and the isolation bypass valves will be cycled and their design closure time verified. The "at power" testing feature of the MSIV will also be operated. This feature allows slow partial closure to verify freedom of motion of the valve stem and disk and operation of the pneumatic control system.

2) The main steam power operated relief valves will be operated at various steam flow rates and pressures. Operability of these valves without off-site power available will be proven during other portions of the preoperational test program.

3) The main steam dump valves will be operated using simulated signals.

4) The main steam safety valve setpoints will be verified.

d) Acceptance Criteria

1) Safety Relief Valves

Safety Relief Valve setpoints are within $\pm$ 1% of designated lift pressure per Technical Specification Table 3.7-3 and FSAR Table 10.3.1-1.

2) Power Operated Relief Valves (PORV)

a) PORV can be cycled at various pressures by using simulated signals.

b) Limit switch operation and control logic demonstrated in accordance with system control logic diagrams and FSAR Section 10.3.2.3.

3) Main Steam Isolation Valves & Bypass Valves

a) MSIV will close within 5 seconds under load conditions (per FSAR Table 10.3.1-1c).

b) MSIV can be opened. (Time should be less than 15 minutes with 90-125 psig inlet air pressure).

c) Demonstrate the MSIV exercise mode. The valve should automatically close until reaching the 90% open position and then return to 100% open, per FSAR 10.3.3 (Note: Time should be 30 seconds to 5 minutes per MSIV instruction manual.).

d) MSIV will fail closed on loss of instrument air, per FSAR 10.3.2.1 c (observe proper operation of fail-safe mechanism).

e) Exercise MSIV bypass valves for operability and operation of fail-safe mechanism. Closing time is within 10 seconds under load conditions per FSAR 10.3.1-1f.

f) Limit switch operation and control logic demonstrated in accordance with system design logic diagrams and FSAR Section 10.3.2.1.

4) Main Steam Dump Valves

a) The dump valves operate in accordance with the system control logic diagrams.

b) Demonstrate that valves will fail closed upon loss of signal or instrument air, per FSAR 10.4.4.2 c.

5) Main Steam Instrumentation/Sensors

Demonstrate operation of instrumentation and control logic necessary for isolation per Regulatory Guide 1.68 Appendix A.1.j.

14.2.12.1.51 Feedwater System Test Summary

a) Test Objective

1) To demonstrate the operability of the main feedwater pumps.

2) To verify the safety related functions of feedwater isolation valves and feedwater regulating valves.

3) To demonstrate the operability of remotely operated system valves.

4) To demonstrate the capability of the steam generator level control system to properly respond to simulated inputs.

5) To evaluate system performance per FSAR Section 3.9.2.1.2, Steady-State Piping Vibration Test and Piping Dynamic Response Tests.

b) Prerequisites

1) The general prerequisites are met.

2) The Condensate System is operational and an adequate supply of water available.

3) The automatic Steam Generator Level Control System for the main feedwater regulating valves and the feedwater bypass valves is operational.

4) The steam generator feed pumps and associated lube oil and gland seal systems are operational.

c) Test Method

1) Simulated safety signals are applied to the main feedwater isolation valves, main feedwater isolation bypass valves, main feedwater regulating valves, regulator bypass valves, and chemical addition isolation valves. Operation and closing times are observed.

2) The steam generator feed pumps are operated on recirculation paths.

3) Other system valves, control, interlocks and alarms are verified to function as designed during system operation by actual or simulated signals.

d) Acceptance Criteria

1) Feedwater pump and pump motor characteristics shall meet or exceed vendor technical manual specifications.

2) Pumps, valves, interlocks, alarms, and other system controls function as prescribed by SHNPP Instrument Schematic Logic Diagrams and SHNPP technical manuals.

14.2.12.1.52 Condensate System Test Summary

a) Test Objective

1) To demonstrate the capability of the Condensate System to supply high-quality water to the Feedwater System.

2) To verify the proper operation of system valves, controls and interlocks.

b) Prerequisites

1) The general prerequisites are met.

2) A clean water supply is available in the condenser hot well.

3) The condensate polishing demineralizer (CPD) vessels are filled with resin and in service.

4) The condensate booster pump discharge pressure control system and fluid coupling are operational.

5) Service water is available to appropriate coolers.

c) Test Method

1) During system operation, condensate pump and condensate booster pump flows are measured and proper control operation verified.

2) During system operation, proper operation of the condensate booster pump hydraulic coupling is verified.

3) During system operation, proper differential pressures across the CPD vessels are verified for the test flow rates.

4) Proper chemical operation of the CPD's is verified during system operation insofar as practical.

5) Valves, controls, alarms, and interlocks are verified to function as designed by actual operation or simulation, as appropriate.

d) Acceptance Criteria

1) Condensate pump and motor meet or exceed design flow performance requirements as specified in vendor technical manuals.

2) Condensate booster pump and motor meet or exceed design flow and performance requirements as specified in vendor technical manuals.

3) Pumps, valves, interlocks, alarms, and other system controls function as prescribed by instrument and logic diagrams.

14.2.12.1.53 Turbine Generator Test Summary

a) Test Objective

This test will demonstrate that the main turbine & generator are ready for initial operation in conjunction with hot functional testing.

b) Prerequisites

1) Turbine lube oil system is in service.

2) Hydrogen seal oil system is in operation.

3) Generator hydrogen cooling system is in operation.

4) Generator leakage test is complete.

5) Circulating water and main condenser systems are in operation.

6) Turbine-generator digital electro-hydraulic control system is operational.

7) Gland steam seal and leakoff system is operable.

8) Service Water System is in operation.

9) The general prerequisites are met. (Exception: Only the tests and measurements required prior to rolling unit with steam need be completed prior to this test.)

c) Test Method

1) Simulate signals as necessary to demonstrate the operation of the turbine supervisory instruments.

2) Place the main turbine on turning gear and verify that no rubbing or binding exists.

3) Admit steam; bring turbine to rated speed, if possible; and verify correct operation of mechanical turbine protective devices.

4) Collect data for the turbine-generator start-up manual.

d) Acceptance Criteria

1) Turbine Supervisory instruments operate according to the control wiring diagrams and appropriate instruction manuals.

2) There must be no evidence of binding or rubbing throughout the length of the turbine generator shaft.

3) Turbine mechanical protective devices and turbine throttle, governor, reheat stop and reheat interceptor valves function as discussed in FSAR Section 10.2.2 and 16.2.

4) Operating parameters are within the limits specified in the turbine generator start-up manual.

14.2.12.1.54 Circulating Water System Test Summary

a) Test Objective

This test will demonstrate that the Circulation Water System (CWS) is capable of providing adequate cooling water to the condenser.

b) Prerequisites

1) The Cooling Tower is available with sufficient water in the basin.

2) The condenser is operational.

3) The required NPSH is available for the circulating water pumps.

4) The Circulating Water System has been filled with water.

5) Circulating water pump lube bearing water is available.

6) The general prerequisites are met.

c) Test Method

1) Operate the CWS with various combinations of circulating water pumps running.

2) Verify that controls, interlocks, and alarms function in accordance with design by actual or simulated signals.

3) Operate the circulating water pumps to provide flow and verify proper cooling tower flow distribution.

d) Acceptance Criteria

1) Circulating Water System operates at design conditions as specified in FSAR Table 10.4.5-3.

2) Controls and alarms function as described in FSAR Section 10.4.5.3 and 10.4.5.5.

3) Visually observe that water is distributed throughout the cooling tower cooling area.

14.2.12.1.55 Condenser Vacuum and Condensate Make up System Test Summary

a) Test Objective

1) To verify performance of the Condensate Vacuum System to draw condenser vacuum.

2) To verify performance of the Condensate Make up System to store and supply water to the condenser hotwell and to the Auxiliary Feedwater System.

b) Prerequisites

1) Condensate pumps are operable.

2) The cooling and sealing water systems are available for the mechanical vacuum pumps.

3) Turbine Gland Sealing System is in operation with the turbine on the turning gear.

4) Adequate water is available in the condensate storage tank to provide makeup to the condenser.

5) The general prerequisites are met.

c) Test Method

1) Fill the condensate storage tank with demineralized water and verify level instrument indications and alarms operate as designed.

2) Fill the condenser hotwell from the condensate storage tank by operating the condensate transfer pumps.

3) Operate the condensate transfer pump to verify the head/flow characteristics.

4) Operate the mechanical vacuum pumps to draw a vacuum in the condenser and verify proper operation of the mechanical pumps and Condensate Vacuum System.

5) Operate condensate pumps and verify proper operation of the hotwell level control system by transferring water to the hotwell by vacuum drag and back to the condensate storage tank by condensate pump discharge pressure.

d) Acceptance Criteria

1) The condensate transfer pump head/flow characteristics meet those shown in FSAR Table 9.2.6-1.

2) The condenser vacuum system shall evacuate the combined turbine and main condenser steam space within a maximum period of 52.6 minutes (two pump operation) in accordance with FSAR Section 10.4.2.2.

3) Hotwell level control valves operate to transfer water from the condenser to the condensate storage tank and vice versa in response to hotwell high and low level signals.

4) Automatic interlocks and alarms function in accordance with design wiring diagrams.

5) On filling of the condensate storage tank, minimum content is 240,000 gallons when the condensate storage tank low minimum level alarm clears as indicated by an associated level change in the demineralized water storage tank level.

14.2.12.1.56 Waste Processing Computer Test Summary

a) Test Objective

To demonstrate that the Waste Processing Computer functions as per vendor's technical manual to provide monitoring, alarming, displaying and logging capability.

b) Prerequisites

1) The general prerequisites are met.

2) Hardware checkout is completed.

3) Software loaded and vendor diagnostics checkout completed.

c) Test Method

1) Follow test plan document titled: "Carolina Power & Light Company Validation Test Plan Waste Processing Computer" provided by the Harris Plant Engineering Section.

d) Acceptance Criteria

1) Use acceptance criteria indicated by the test plan document titled: "Carolina Power & Light Company Validation Test Plan Waste Processing Computer" provided by the Harris Plant Engineering Section.

14.2.12.1.57 Containment Ventilation Containment Cooling System, Primary Shield and Reactor Supports Cooling System Test Summary

a) Test Objectives

The test objectives will be to demonstrate the proper operation of the Containment Ventilation, Containment Cooling System, Primary Shield and Reactor Supports as delineated in Sections 6.2.2.2.1, 6.2.2.2.3, and 9.4.7.

b) Prerequisites

1) The general prerequisites are met.

2) Specific prerequisites will be delineated in the system preoperational test procedure.

c) Test Methods

1) Operate at flow rates which will demonstrate the system will function (controls, automatic isolations) as required to meet the test objectives and the acceptance criteria. When applicable, testing will be done in accordance with ANSI/ASME N510-1980.

2) Cooling Coil Capacities will be verified to meet design criteria. Tests described in the preceding paragraph are to verify design criteria. These design criteria include normal and postulated accident heat loads.

d) Acceptance Criteria

These criteria are delineated in Sections 6.2.2.2.1, 6.2.2.2.3, and 9.4.7.

14.2.12.1.58 Plant HVAC Test Summary

a) Test Objectives

The test objectives will be to demonstrate the proper operation of the Reactor Auxiliary Building, Control Room, Diesel Generator Building, Fuel Handling Building, Waste Process Building, and Turbine Building (Condensate Polishing Demineralizer Areas, Electrical and Battery Room, General Service Switchgear Room, Condenser Vacuum Pump Effluent) ESWIS, and DFOTPH HVAC systems.

Proper operation is delineated in the FSAR sections listed in d) Acceptance Criteria.

b) Prerequisites

1) The general prerequisites (listed in section 14.2.12.1)

2) Specific prerequisites will be delineated in the system Preoperational Test Procedure.

c) Test Methods

1) Operate at flow rates which will demonstrate the system will function (controls, automatic isolations) as required to meet the test objectives and the acceptance criteria. When applicable, testing will be done in accordance with ANSI/ASME N510-1980.

2) Cooling coil capacities will be verified to meet design criteria. Tests described in the preceding paragraph are to verify design criteria. These design criteria are based on postulated accident heat loads.

d) Acceptance Criteria

These criteria are delineated in the applicable sections as follows:

Reactor Auxiliary Building	6.5.1, 9.4.3, 9.4.5
Control Room	6.4, 9.4.1
Diesel Generator Building	9.4.5
Fuel Handling Building	6.5.1, 9.4.2
Waste Processing Building	9.4.3
Turbine Building	
Condensate Polishing Demineralizer Areas	9.4.4
Electrical and Battery Room	9.4.4
General Service Switchgear Room	9.4.4
Condenser Vacuum Pump Effluent	9.4.4, 10.4.2
Fuel Oil Transfer Pump House	9.4.5
Emergency Service Water Intake Structure	9.4.5
Computer and Communication Complex	9.4.9
Decontamination Facility	9.4.10

14.2.12.1.59 Engineered Safety Features Integrated Test Summary

a) Test Objective

To demonstrate the integrated operation of the ESF systems with and without the loss of off-site power, upon receipt of the proper actuation signals.

b) Prerequisites

1) Preoperational testing of the following ESF systems must be completed to the extent necessary to support this test:

a) Emergency Core Cooling

b) Containment Isolation

c) Containment Spray

d) Containment Cooling

e) Auxiliary Feedwater

f) Main Feedwater Isolation

g) Emergency Exhaust

h) Emergency Power (Diesel Generators)

i) Control Room Isolation

j) Component Cooling Water

k) Containment Vacuum Relief

l) Essential Service Chilled Water

m) RAB ESF Equipment Cooling

n) Essential Electrical Area HVAC

o) Spent Fuel Pool Pump Room Ventilation

p) Fuel Oil Transfer Pump House Ventilation

q) Emergency Service Water Intake Structure Ventilation

r) Diesel Fuel Oil

s) Main Steam Isolation

2) All systems or portions of systems required to support the ESF systems must be complete and functional.

3) The Engineered Safety Features Actuation System (ESFAS), including the Solid State Protection Systems (SSPS) and Safeguards Test Cabinet (STC) must be functional, calibrated, aligned and preliminary testing complete.

4) All components actuated by the ESFAS are available.

5) All instrumentation associated with the components must be calibrated and aligned as required.

6) The RCS is capable of receiving water with the vessel head and internals removed.

7) The refueling water storage tank has an adequate supply of demineralized water.

8) The Containment Spray System is valved to prevent actual spraying of containment.

c) Test Method

1) With the ESFA systems aligned for normal power operation, manually initiate safety injection, containment spray, and main steam line isolation. Test to be performed with train A devices inoperable, then train B devices inoperable and then with both trains operable. De energized opposite train 6.9 kV busses will be monitored to insure de energization.

2) Record position/actuation of components that are required to operate or change mode of operation upon receipt of an ESFA signal.

3) Manually reset safety injection, control room isolation, containment isolation phase A, containment isolation phase B, containment ventilation isolation, feedwater isolation, main steamline isolation, and containment spray.

4) Repeat test with no offsite power available and verify proper operation of emergency diesel generators in conjunction with load shedding and sequencing.

d) Acceptance Criteria

1) The ESFAS components actuate into the states shown on FSAR Tables 7.3.1-5 through 7.3.1-11 as appropriate for A train operation, B train operation, and both train operation. During single train operation, the opposite train 6.9 kV buses remain de energized.

2) The emergency diesel generators start and sequence loads, including capability to carry manual loads of FSAR Table 8.3.1-2c when offsite power is not available.

3) Upon resetting the initiating ESFAS signals, the safety related components actuated above remain in their emergency mode.

14.2.12.1.60 Process computer test summary

a) Test Objective

To demonstrate that the ERFIS computer system functions as per vendor's technical manual to provide monitoring, alarming, displaying, reporting, and archiving capabilities to the Control Room Operator, the Technical Support Center, and the Emergency Operations Facility.

b) Prerequisites

1) The general prerequisites are met.

2) Hardware is complete and verified by the vendor test plan and procedures.

3) Software is installed and proven by satisfactory completion of the performance sections of the Vendor Test Plan and Procedures.

c) Test Method

1) Verify each process input is operable by simulating the input or application of a known input.

2) Verify that the alarm and conversion of each type process input provides valid information by simulating various input of conditions or by monitoring various levels of known inputs.

3) Verify the ERFIS system's capability to give proper computational results by simulating the inputs or using static test cases and comparing the result against independently computed values.

4) Verify the system display capability in the Control Room, the Technical Support Center (TSC) and in the Emergency Operations Facility (EOF).

5) Verify the redundancy capability of the ERFIS system by inducing system faults and observing system performance.

6) Verify the ERFIS system's ability to store and retrieve historical data.

d) Acceptance Criteria

1) Each process input will display a value equivalent to simulated input or known inputs.

2) Each type process input will respond to a simulated input per vendors technical documentation.

3) The ERFIS system is capable of performing computations and obtaining acceptable results.

4) Each display at each location will function per vendors documentation.

5) The ERFIS system has redundant capability as described in the vendor's documentation.

6) Historical data storage and retrieval may be performed per vendor's documentation.

14.2.12.1.61 Boron Recycle FSAR Test Abstract

a) Test Objectives

1) Demonstrate system pumps produce flows necessary for proper system operation.

2) Demonstrate Boron Recycle Evaporator can process borated water to produce < 10 ppm condensate and 4 weight percent boric acid concentrate.

3) Demonstrate, to the extent practical, system controls, interlocks, and alarms operate satisfactorily.

b) Prerequisites

1) The general prerequisites listed in Section 14.2.12.1 are met.

2) Auxiliary Steam, Component Cooling Water and Reactor Makeup Water are available or adequate temporary is provided.

3) A source of borated water is available for processing by the Recycle Evaporator package.

4) All demineralizers have been filled with specified resin.

c) Test Method

1) Operate Recycle Evaporator Feed Pumps and demonstrate pumps produce flows necessary for proper system operation.

2) Operate Recycle Monitor Tank Pumps and demonstrate pumps produce flow necessary for proper system operation.

3) Operate Evaporator Package Concentrate and Condensate pumps and demonstrate pumps produce flows necessary for proper system operation.

4) Operate Recycle Evaporator Package in accordance with Westinghouse Technical Manual using demineralized water. Verify proper operation of all controls and alarms within package.

5) Operate Recycle Evaporator Package using borated water and verify ability to produce < 10 ppm boron condensate and 4 weight percent boric acid concentrate.

6) Simulate high activity of Recycle Evaporate condensate effluent and verify automatic diversion of condensate to Recycle Holdup Tank.

d) Acceptance Criteria

1) System pumps operate satisfactorily to produce flows necessary for proper system operation.

2) Recycle Evaporator operates as specified in technical manual and produces effluents as specified in FSAR Table 9.3.4-3.

3) System controls, interlocks, and alarms operate satisfactorily.

14.2.12.1.62 Refueling water storage tank test summary.

a) Test Objectives

1) To demonstrate proper operation of associated alarms, and Indicators.

b) Prerequisites

1) Signal generators are available to simulate level transmitter output to test level alarms, computer points, and recorders.

2) The general prerequisites are met.

c) Test Method

1) Simulate water level in the RWST to test level alarms, computer points, and recorders.

d) Acceptance Criteria

1) Operation of RWST Level alarms, computer points, and recorders is verified against CP&L Setpoint Document.

14.2.12.1.63 Primary Makeup Water System Test Summary

a) Test Objectives

Verify and document:

1) Proper performance of system controls, interlocks and alarm functions.

2) Capability of reactor makeup water pumps to supply reactor makeup water to the Boric Acid Blender and the Pressurizer Relief Tank.

3) That the Reactor Makeup Water Pumps perform in accordance with the vendor supplied curves.

b) Test Prerequisites

1) The general prerequisites as listed in Section 14.2.12.1 are met.

2) Supporting equipment is operational or temporary systems providing similar services are available.

c) Test Method

1) Using a temporary level standpipe, perform functional checks of control and alarm circuitry associated with tank level detectors.

2) Operate Reactor Makeup Water Pumps and verify vendor's pump performances curves. Supply Reactor Makeup Water to the Boric Acid Blender.

3) Supply spray flow against design backpressure to the spray header internal to the Pressurizer Relief Tank.

4) Perform functional checks of all RMW system interlocks, alarms and control functions.

d) Acceptance Criteria

1) Each Reactor Makeup Water Pump delivers a minimum of 120 gallons per minute to the Boric Acid Blender at a delivery pressure of 60 psig or greater.

2) Reactor Makeup Water Pumps provide 150 gpm or greater to the pressurizer relief tank at a backpressure of 50 psig.

3) RMW system controls, interlocks, and alarms perform as denoted in applicable Control Wiring Diagrams and in the Setpoints Document.

14.2.12.1.64 Rod Control System Test Summary

a) Test Objective

1) To demonstrate the operability of the Rod Control System as installed during the hot functional test.

b) Prerequisites

1) Control rod drive mechanisms will be connected, but no drive shaft will be present.

2) The general prerequisites are met.

c) Test Methods

1) Operate the rod drive mechanism and monitor polarity and coil currents.

2) Operate the Control rod drive MG sets and their controls.

3) Sequence the control rod drive mechanism magnetic coils

d) Acceptance Criteria

1) Rod drive mechanism polarity and coil currents are in accordance with vendor's technical manuals.

2) Control rod drive MG sets operate in accordance with vendor's technical manuals and control wiring diagrams.

3) Control rod drive mechanisms sequence in accordance with vendor's technical manuals.

14.2.12.1.65 Passive Safety Injection System Check Valve Test Summary

a) Test Objective

1) To verify that the SI Accumulator Check valves will open with the RCS at elevated pressure and temperature.

b) Prerequisites

1) Initially, the Reactor Coolant System is at no-load temperature and pressure condition.

2) The applicable general prerequisites are met.

3) The accumulators are filled to a predetermined level and pressurized with nitrogen to approximately 600 psi.

c) Test Method

1) A decrease in accumulator level and/or increase in pressurizer level will be verified as the Reactor Coolant System pressure is decreased below the accumulator pressure.

d) Acceptance Criteria

1) The SI accumulator check valves open as required.

14.2.12.1.66 Containment Recirculation Sump Test Summary

NOTE: The following Containment Recirculation Sump Test Summary applied to the original sumps/screens. The replacement top hat type strainers were not subjected to scale model testing.

a) Test Objective

1) To verify vortex control and acceptable pressure drops across screening and suction lines and valves.

2) To verify adequate net positive suction head for the Residual Heat Removal Pumps.

b) Prerequisites

1) The applicable general prerequisites are met.

c) Test Method

1) The sump performance will be investigated by scale model testing and if it is determined that measures to reduce the Froude Number are necessary, solutions will be investigated and tested. The scale model testing shall verify the ability of the recirculation sumps to operate over the full range of anticipated sump conditions without vortexing tendencies.

2) Run-out flow rates shall be used to determine test flow for the scale model testing.

3) The scale model testing shall determine the screen and intake losses for operation of the containment recirculation sumps. This measured data, coupled with standard calculations to determine line and valve losses to the RHR pump shall be used to verify adequate NPSH over the range of sump operating conditions.

4) Subsurface vortexing will be investigated to determine whether sump modifications (internal to the screens) are necessary.

5) The scale model testing will determine the need for any changes to be made to reduce vertical flow in the neighborhood of the sump.

d) Acceptance Criteria

1) The measured pressure drop yields a Residual Heat Removal Net Positive Suction Head in excess of the amount required by the RHR Pump Technical Manual.

2) No vortex tendencies, including surface swirl, exist in the recirculation pump.

14.2.12.1.67 Containment Vacuum Relief Test Summary

a) Test Objectives

1) To verify proper operation of the Containment Vacuum Relief System as delineated in Section 6.2

b) Prerequisites

1) The general prerequisites listed in Section 14.2.12.1.

2) Specific prerequisites will be delineated in the system preoperational test procedure.

c) Test Methods

1) Simulated signals will be used to demonstrate that the system will function as required to meet the test objectives and the acceptance criteria.

d) Acceptance Criteria

1) These criteria are delineated in Section 6.2.1.1.3.4.

14.2.12.1.68 Combustible Gas Control System in Containment Test Summary

e) Test Objectives

1) The test objectives will be to demonstrate the proper operation of the Combustible Gas Control System as delineated in Section 6.2.5.

f) Prerequisites

1) The general prerequisites listed in Section 14.2.12.1.

2) Specific prerequisites will be delineated in the system preoperational test procedure.

g) Test Methods

1) Operate subsystems to demonstrate the system will function as required to meet the test objectives and the acceptance criteria.

h) Acceptance Criteria

1) Verify the equipment meets the temperature, flow, and monitoring capabilities identified in Section 6.2.5.

14.2.12.1.69 Deleted

14.2.12.1.70 Gross Failed Fuel Detection System Test Summary

a) Test Objectives

1) To demonstrate the operability of the Gross Failed Fuel Detection System (GFFDS).

2) To verify calibration of the low and high counts per minute alarms.

3) To verify detector high voltage plateau.

4) To verify sample transport time.

5) To verify detector response.

b) Prerequisites

1) The general prerequisites are met.

c) Test Method

1) Using a thermocouple tester, verify the high sample temperature alarm setpoint.

2) Using the operation selector switch in the level calibrate position, and level adjust position meter on the test calibrate board, verify high and low counts per minute alarms.

3) Using the frequency counter graph which previously established the detector high voltage setting, verify that high voltage setting is optimum.

4) By measuring actual flow path length and establishing a flow rate, verify sample transport time.

5) Using a check source, verify detector response.

d) Acceptance Criteria

1) High sample alarm annunciates at 135F.

2) High counts per minute alarm annunciates at 10^4 CPM.

3) Low counts per minute alarm annunciates at 10^1 CPM.

4) Detector high voltage is set at optimum setting according to the frequency counter graph.

5) Sample transport time is as specified in the vendor's technical manual from the center of the core to the detector.

6) Detector output is in accordance with the vendor's technical manual for the strength and distance of the source.

14.2.12.1.71 Essential Services Chilled Water System Test Summary

a) Test Objectives

1) To demonstrate operability of the ESCWS closed expansion tanks to maintain system pressure.

2) To verify proper makeup to the ESCWS during both normal and emergency operation.

3) To verify the chilled water circulation pumps operate per design.

4) To demonstrate that a Safety Injection "S" signal starts both chillers WC-2 and ESCWS circulation pumps P-4.

5) To verify manual start/stop of the ESCWS.

6) To verify the chillers will deliver water at the required temperature.

b) Prerequisites

1) The general prerequisites are met.

c) Test Method

1) Slowly drain each expansion tank and verify supply valves operate.

2) Operate the chilled water circulation pump at various flow rates to demonstrate that the pump performance curves are valid.

3) Initiate/Simulate an "S" signal.

4) Measure the chilled water supply temperature.

d) Acceptance Criteria

1) The Chilled Water Circulation Pumps operate in accordance with the specific pump performance curves contained in Gould Pumps, Inc. Technical Manual on Chilled Water Pumps GPIM-81.

2) Motor operated isolation valves shut upon receipt of an "S" signal to isolate nuclear safety related piping from non-nuclear safety related piping.

3) Chillers and Chilled Water Circulation Pumps start upon receipt of an "S" signal.

4) Chillers deliver chilled water at the temperature specified by Ebasco Specification.

14.2.12.1.72 Stud Tensioner Hoist Load Test Summary

a) Test Objective

1) To verify the capacity of the stud tension hoist.

b) Prerequisite

1) The stud hoist assemblies are installed on the Integrated Reactor Vessel Head.

c) Test Method

1) Verify limit switches.

2) Using load test blocks, verify the capacity of the hoist at 125 percent of rated load.

3) Reduce the test load to 100 percent of rated load.

4) With the 100 percent test load suspended, move the hoist through a 360 degree arc along the hoist support track.

5) With the 100 percent test load suspended, move the hoist the full length of its radial support track.

6) Fully raise and lower the 100 percent test load.

d) Acceptance Criteria

1) The stud tensioner hoist is fully maneuverable at 100 percent rated load (4000 lbs.).

2) The stud tensioner hoist has a lifting capacity of 125 percent of rated load (4000 lbs.).

14.2.12.1.73 Polar Crane Test Summary

a) Test Objectives

1) To verify the capacity of both polar crane hoists.

2) To test all limit switches, power drives, and brakes.

b) Prerequisites

1) The general prerequisites are met.

c) Test Methods

1) Using load test blocks, test the main hoist and the auxiliary hoist at 125% of rated load.

2) Reduce the test load to 100% of rated load on the auxiliary hoist and fully raise and lower the test load.

3) Test the main hoist at 100% of rated load by fully raising and lowering the test load.

4) With the 100% test load suspended from the main hoist, move the polar crane through a 360° arc and move the trolley the entire length of the runway.

d) Initial Acceptance Criteria Prior to Plant Start Up

1) The polar crane main hoist has a lifting capacity of 125% of rated load (250T) (Preoperation only).

2) The auxiliary hoist has a lifting capacity of 125% of rated load (50T).

3) The polar crane is fully maneuverable at 100% of rated load (250T) (Preoperation only).

4) Control circuitry functions as per the Harnischfeger Overhead Traveling Cranes Technical Manual.

14.2.12.1.74 Feedwater Heater Drain, Level and Bypass Control Systems Test Summary

a) Test Objective

1) To verify the proper operation of the feedwater heaters drain, level and bypass control systems, heater drain pump control circuitry, remotely operated valves, and heater drain pump performance.

b) Prerequisites

1) The general prerequisites are met.

2) The Normal Service Water and Instrument Air Systems are in operation and available for service.

3) Demineralized water is available.

c) Test Methods

1) Level and bypass controls and instrumentation will be checked by filling of the heaters and/or simulating level signals from the appropriate level instruments and noting the response.

2) Remotely operated valves will be operated through their full range of travel and their position indication and electrical interlocks will be verified.

3) Heater drain pump control circuits will be tested with the associated breaker in the test position and jumpering of appropriate contacts to supply control power to the trip circuit to verify interlocks and trip signals from system components.

4) Heater drain pump performance shall be determined by recirculating pump discharge back to low pressure heater #4A or B.

d) Acceptance Criteria

1) Feedwater heater drain, level and bypass controls, instrumentation, alarms, and interlocks function in accordance with design wiring diagrams and the Feedwater Level Control System technical manual.

2) System remote control valves meet or exceed design criteria in vendor instruction manuals.

3) Feedwater heater drain pump circuitry, controls, and interlocks function in accordance with design wiring diagrams.

4) Feedwater Heater drain pump and pump motor performance shall meet or exceed design criteria in vendor instruction manual.

14.2.12.1.75 Seismic Instrumentation Test Summary

a) Test Objectives

1) To ensure the proper operation of the Seismic Monitoring System.

b) Prerequisites

1) The general prerequisites are met.

2) Seismic Monitoring System installed as designed.

c) Test Method

1) Start the Seismic Monitoring System and perform test and calibration procedures as per Seismic Monitoring System Instruction Manual.

d) Acceptance Criteria

1) As per Seismic Monitoring System Instruction Manual.

14.2.12.1.76 Extraction Steam System Test Summary

a) Test Objective

1) To demonstrate the operability of the extraction steam motor and air operated valves.

b) Prerequisites

1) Instrument air for the non-return valves' actuators is supplied from the EHC oil pilot valve, or temporary air may be supplied.

2) General prerequisites are met.

c) Test Method

1) Motor Operated Valves - Using remote manual control, verify proper operation.

2) Air assisted non-return valves

a) 2.1 Apply air to the air cylinder so that the check valve is in its free swinging position, unhindered by the air cylinders.

b) 2.2 Supply a turbine trip signal, and verify that all non-return valve air cylinders close, thereby holding check valve closed.

3) Demonstrate that all computer inputs, valve indications, and interlocks function as designed.

d) Acceptance Criteria

1) All extraction steam valves are demonstrated to operate in accordance with system control wiring diagrams and FSAR Section 10.2.2.

14.2.12.1.77 Primary Sampling System Test Summary

a) Test Objective

1) To verify the proper flow rate for sampling the reactor coolant system hot legs based on a minimum delay time prior to existing containment and a maximum delay time prior to reaching the gross failed fuel detector.

b) Prerequisite

1) The general prerequisites are met.

2) Hot functional testing is in progress.

3) Component Cooling Water for sample coolers is available.

c) Test Method

1) Calculate the required flow rate to ensure that the transport time prior to exiting containment is greater than 40 seconds.

2) With the sampling piping isolated from the reactor coolant system and with the piping cooled to ambient, establish the flow rate calculated in 1), and note the transport time of the hot RCS water.

d) Acceptance Criteria

1) The transport time within Containment at the calculated flow rate is greater than 40 seconds.

14.2.12.1.78 Secondary Sampling System Test Summary

a) Test Objective

1) To verify the proper operation and performance of the Secondary Sampling System.

2) To verify the operation of the following sample points: P11, P12, P13, S1, S2, S3, S4, S5, and S6.

b) Prerequisites

1) To the extent practical, systems to be sampled are at operating pressure and temperature.

2) Cooling water is available to sample panels for sample coolers and chiller condensers.

3) Main Steam, Steam Generator Blowdown, Condensate and Condenser Vacuum systems are in operation.

c) Test Method

1) By valving "in and out" sample lines, verify samples to sample panels are correctly identified.

2) Demonstrate that all controls and alarms function in accordance with latest design documents.

3) With continuous sampling flow established, verify the operation of the temperature control system.

4) Test the operation of the Hotwell Sample Pumps.

5) Operate the Steam Generator Blowdown sample isolation valves and verify closure times specified by FSAR Section 6.2.4.

d) Acceptance Criteria

1) Sample points have been verified per FSAR Table 9.3.2-1 and 9.3.2-2.

2) All controls and alarms function in accordance with latest design documents.

3) Temperature control system has demonstrated the capability to maintain sample temperatures at 77 $\pm$ 5 F.

4) Steam Generator Blowdown samples are cooled to less than 120 F.

5) Hotwell Sample Pumps operate in accordance with vendor instruction manual (16-P175).

6) Steam Generator Blowdown sample isolation valves have demonstrated closure times specified by FSAR Section 6.2.4.

14.2.12.1.79 Loss of Instrument Air Test Summary

a) Test Objectives

1) To demonstrate that a reduction and loss of instrument air pressure causes fail safe operation of pneumatically operated valves and dampers both safety and non-safety related located in the reactor building, auxiliary building and fuel handling building.

b) Prerequisites

1) The general prerequisites are met.

Specific prerequisites will be delineated in the system preoperational test procedure.

c) Test Method

1) Where safe to personnel and equipment, a slow reduction in pressure and a loss of pressure test will be performed. Testing will be done in small segments/individually and response noted for both safety and non-safety related valves and dampers. The loss of pressure test will be conducted by isolating segments/individual items and venting the air from the isolated segment.

d) Acceptance Criteria

1) Proper fail safe operation of valves and dampers subject to a reduction and loss of instrument air is verified.

14.2.12.1.80 Containment Building Hot Penetration Testing

a) Test Objective

1) To demonstrate that containment concrete temperatures in the vicinity of hot containment penetrations do not exceed 200F.

b) Prerequisites

1) The general prerequisites are met.

2) For hot containment penetrations, the designer has provided the anticipated locations of maximum concrete temperatures.

c) Test Method

1) During hot functional testing, temperatures will be recorded using contact pyrometers or by installed test thermocouples.

d) Acceptance Criteria

1) Temperatures recorded during hot functional testing do not exceed those allowed by Article 3440, ASME Boiler and Pressure Vessel Code, Section III, Division 2.

14.2.12.1.81 Simulated Loss of On-site Power Test Summary

a) Test Objective

1) To verify the capability to maintain the plant using manual control of the atmospheric steam dump valves and the steam-driven auxiliary feed pump under adverse lighting and communication conditions.

b) Prerequisites

1) Hot Functional testing is in progress and the plant is stable at no-load values.

2) The general prerequisites are met.

c) Test Method

1) Power sources to plant equipment are de-energized except power to essential equipment such as reactor coolant pumps, charging pumps, component cooling water, service water, and lube oil systems.

2) Plant cooldown is controlled by manual control of the atmospheric steam dump valves and manual control of the steam-driven auxiliary feed pump.

d) Acceptance Criteria

1) The ability to maintain the plant in hot shutdown, remotely, is demonstrated.

14.2.12.1.82 AC Distribution System Optimum Operating Voltage Test Summary

a) Test Objective

1) The results of this test will be used to validate the analytical techniques and assumptions used in the analysis for "Adequacy of Station Electric Distribution System Voltages" performed by Ebasco to demonstrate compliance with Branch Technical Position PSB-1.

b) Prerequisites

1) The general prerequisites are met.

Sufficient unit auxiliary loads are operable with which to load the AC distribution system.

c) Test Method

1) Load the required AC distribution buses to 30 percent or more of each bus' normal continuous loading and measure/record the steady state voltage and loading.

2) With the required AC distribution buses loaded to 30 percent or more, install recorders on the string of buses that were analyzed by the AE to have the lowest voltage. Separately start a large Class 1E motor and a large non-Class 1E motor and record the voltages and loadings of the resulting transients.

3) Transmit the bus voltage and loading data taken in steps 1 and 2 above to the AE for evaluation and validation of the AE's analytical techniques and assumptions used in the bus loading analysis program.

d) Acceptance Criteria

1) The test results shall not be more than three percent lower than the analytical results. However, the difference between the two when subtracted from voltage levels determined in the original analysis shall not be less than the Class IE equipment rated voltages. Named equipment fed from the 6.9 KV bus is rated to start at 75 percent of 6.9 KV equipment fed from the 480V and 208V/120V busses are rated to start and operate at 90 percent of them nominal voltage.

14.2.12.1.83 Auxiliary Feedwater Turbine Pump Two Hour Run

a) Test Objectives

1) To demonstrate turbine driven pump and related AFW system operation on loss of all AC power to the AFW system.

2) To document component performance during a two hour run of the AFW system in a recirculation mode.

3) To monitor turbine bearing temperatures on plant computer and to ensure the parameters remain within design specifications.

4) To demonstrate remote control station will control turbine speed range of 2300-4100 RPM.

b) Prerequisite

1) All general prerequisites are met.

2) Condensate Storage Tank level within normal operating limits.

3) Service water system available as back up to Condensate Storage Tank.

4) Steam available for operation of AFW turbine.

5) Hot Functional Testing in progress.

6) Simulated loss of onsite power test in progress.

c) Test Method

1) Start Turbine Driven Pump from MCB by opening 1MS-70, 1MS-72.

2) Monitor turbine bearing temperatures on plant computer.

3) Monitor pump speed on MCB.

4) Vary pump speed from MCB M/A station.

d) Acceptance Criteria

1) Pump starts from operation initiation signal on MCB.

2) MCB M/A station will vary pump speed over range of 2300 to 4100 RMP.

3) Bearing temperatures on turbine, read on computer, do not exceed 160 F.

14.2.12.2 Power Ascension Test Summaries

The following is an index of Power Ascension Test Summaries described in this Section:

1) Movable Incore Detector Test Summary
2) Rod Control and Position Indication System Test Summary
3) Rod Drive Mechanism Timing Test Summary
4) Rod Drop Time Measurement Test Summary
5) Reactor Coolant System Flow Measurement Test Summary
6) Reactor Coolant System Flow Coastdown Test Summary
7) Calibration of Nuclear Instrumentation Test Summary
8) Rod Control System Test Summary
9) Flux Distribution Measurement Test Summary
10) Core Performance Test Summary
11) Power Coefficient Measurement Test Summary
12) Control Rod Reactivity Worth Test Summary
13) Boron Reactivity Worth Test Summary
14) Automatic Rod Control Test Summary
15) Deleted
16) Steam Generator Moisture Carryover Test Summary
17) Load Swing Test Summary
18) Large Load Reduction and Generator Trip From 100 Percent Power Test Summary
19) Turbine Trip From 100 Percent Power Test Summary
20) Remote Shutdown Test Summary
21) Loss of Offsite Power Test Summary
22) Pressurizer Heaters and Spray Valves Capability Test Summary
23) Gross Failed Fuel Detection System Test Summary
24) Pressurizer Continuous Spray Flow Verification Test Summary
25) Reactor Coolant System Leakrate Test Summary
26) Natural Circulation Test Summary

27) Main Steam and Feedwater Systems Test Summary

28) Shield Survey Test Summary

29) Loss of Feedwater Heater(s) Test Summary

30) Main Steam Isolation Valve Test Summary

31) Steam Generator Test for Condensation Induced Water Hammer

32) Steam Turbine Driven Auxiliary Feed Water Pump Endurance Test

33) RTD Bypass Flow Rate Verification Summary

34) Secondary Sampling System Test Summary

14.2.12.2.1 Movable Incore Detector Test Summary

a) Test Objective

1) To demonstrate that the Incore Nuclear Instrumentation System can remotely position the incore neutron detectors for the purpose of core flux mapping and to supply the appropriate digital and analog signals to the plant computer.

b) Prerequisites

1) The core has been loaded.

2) The general prerequisites have been met.

c) Test Methods

1) Ensure free passage to positions and verify operation of five path and ten path transfer assemblies in each mode.

2) During flux mapping at power, verify detector response to neutron flux.

d) Acceptance Criteria

1) The incore nuclear instrumentation operates in accordance to the vendor's technical manuals.

14.2.12.2.2 Rod Control and Position Indication System Test Summary

a) Test Objective

1) To verify that the Rod Control and Position Indication System satisfactorily performs required indication and alarm functions for each individual rod and that each rod operates satisfactorily over its entire range of travels.

b) Prerequisites

1) Plant conditions are established as required by the test instructions.

2) At least one reactor coolant pump is running.

3) The general prerequisites are met.

c) Test Method

1) Rod banks are fully withdrawn by bank in twenty-step increments while recording analog output voltage, control room position readout, and the group step position indication.

2) In addition, the pulse-to-analog converter chassis bank position digital readout is recorded for control rod banks.

d) Acceptance Criteria

1) The rod position indication system provides indication and alarm functions, and each rod operates over its entire range of travel in accordance with the vendor's technical manual and the Setpoint Document.

14.2.12.2.3 Rod Drive Mechanism Timing Test Summary

a) Test Objective

1) To verify proper timing of each rod control system slave cycler and conduct an operation check of each control rod drive mechanism.

b) Prerequisites

1) The Reactor Coolant System is filled and vented.

2) Base line count rates are established for each source range channel.

3) The general prerequisites are met.

c) Test Method

1) The timing for each slave cycler is set, measured, and reset as necessary, in accordance with technical manuals.

2) Each rod drive mechanism is operated, checking the latching and releasing features in both hot and cold conditions.

d) Acceptance Criteria

1) Mechanism timing and operational checks are in accordance with the vendor's technical manuals.

14.2.12.2.4 Rod Drop Time Measurement Test Summary

a) Test Objectives

1) To determine the rod drop time of each full length rod cluster control assembly (RCCA) under no flow and full flow with the Reactor Coolant System in the cold shutdown and hot standby conditions.

b) Prerequisites

1) Plant conditions are established for the cold shutdown and hot standby conditions as required.

The general prerequisites are met.

c) Test Method

1) Withdraw each bank of rods, one bank at a time. Interrupt electrical power to each associated rod drive mechanism, one at a time. Measure and record the rod drop time. Perform each step with the RCS at cold and hot condition, with no flow and full flow.

2) Perform additional drop tests for all rods outside the 2σ limit established from the drop times of all rods.

d) Acceptance Criteria

1) The rod drop times are acceptable in accordance with FSAR Technical Specification 3.1.3.4.

14.2.12.2.5 Reactor Coolant System Flow Measurement Test Summary

a) Test Objective

1) To verify predicted RCS flow rates at normal no load operating temperature and pressure and to align the RCS flow instruments after fuel load.

b) Prerequisites

1) The Reactor Coolant System is at hot shutdown condition with three reactor coolant pumps operational for flow measurement by elbow tap differential pressure.

2) The Reactor Coolant System is at 50 percent power with three RCPs operational for flow measurement by calorimetric.

3) The general prerequisites are met.

c) Test Method

1) For three reactor coolant pump configuration, measure and record loop elbow differential pressure, and calculate individual loop and total RCS flow rates.

2) The flow transmitters are adjusted for 100 percent flow at normal operating conditions and zero output at zero flow.

3) Perform a plant calorimetric to verify design RCS flow rate prior to escalation above 50 percent power.

d) Acceptance Criteria

1) The flow transmitters are satisfactorily aligned at zero flow and full flow conditions per the Westinghouse 752 Differential Pressure Electronic Transmitter technical manual.

2) The flow characteristics are within the specifications stated in the Westinghouse NSSS Start Up Manual.

14.2.12.2.6 Reactor Coolant System Flow Coastdown Test Summary

a) Test Objective

1) To measure the rate at which reactor coolant flow rate changes subsequent to reactor coolant pump trips and to measure various delay times associated with the loss of coolant accident.

b) Prerequisites

1) The Reactor Coolant System (RCS) is in the hot shutdown condition.

2) The RCS flow test has been completed.

3) The general prerequisites are met.

c) Test Method

1) With three reactor coolant pumps running, trip the reactor coolant pumps and measure the rate at which reactor coolant flow rate decreases.

2) Determine the loop response delay times associated with low flow.

d) Acceptance Criteria

1) The rate of reactor coolant flow decreases upon tripping of the reactor coolant pumps and is slower than the rate of flow decrease assumed in the loss of flow analysis, using a specific flow coastdown time constant provided by the Westinghouse NSSS Start up Manual.

14.2.12.2.7 Calibration of Nuclear Instrumentation Test Summary

a) Test Objective

1) To calibrate the nuclear instrumentation power range channels to reflect actual power levels, and to determine the linearity and uniformity of power range detector output.

b) Prerequisites

1) Pre-critical nuclear and temperature instrumentation calibration has successfully been completed.

2) The reactor is at a power level specified by the test procedure.

3) The general prerequisites are met.

c) Test Method

1) Perform calorimetrics and calibrate each power range channel to correspond to each calorimetric calculation.

2) Measure and plot power range detector currents versus power level.

3) Determine the linearity of each power range channel and the degree of uniformity between channels.

4) Observe the functioning of the nuclear instrumentation indication during start-up testing.

d) Acceptance Criteria

1) The power range channels display linear output over the normal operating range.

2) The nuclear instrumentation will demonstrate the ability to achieve the operational adjustments made during the calorimetric test.

14.2.12.2.8 Rod Control System Test Summary

a) Test Objective

1) To demonstrate the proper control and indication functions of the Rod Control System, including control rod withdrawal inhibit features and control rod withdrawal sequence devices.

To demonstrate correct failure mode on loss of power for the control rod drive systems and proper operation of system alarms.

b) Prerequisites

1) The Reactor Coolant System is at no load, operating temperature and pressure.

2) The core is loaded.

3) The general prerequisites are met.

c) Test Method

1) Check the control system for operation at each position of the bank selector switch. Observe rod withdrawal and bank overlap.

2) Simulate signals for rod withdrawal blocking. Observe proper operation.

3) Simulate alarm conditions. Observe status lights, alarms, and indicators.

4) On loss of power, observe rod mechanisms de energize and rods bottom.

d) Acceptance Criteria

1) The control and indication features function in accordance with vendor technical manuals.

14.2.12.2.9 Flux Distribution Measurement Test Summary

a) Test Objective

1) To determine the reactor core power flux distribution for comparison with distribution predictions and thereby provide a check for potential errors in fuel loading, fuel assembly enrichment, lumped poison elements, and mis-positioned or uncoupled control rods.

b) Prerequisites

1) Reactor is critical and the Incore Instrumentation and computer are calibrated and operable for flux mapping.

2) The general prerequisites are met.

c) Test Method

1) Stabilize Reactor Power at less than 5 percent power.

2) A complete incore flux map will be obtained and processed for the all rods out Control Rod Configuration.

d) Acceptance Criteria

1) Flux distribution measurement analysis yields hot-channel factors less than, or equal to, design safety limits to provide a check for potential errors in loading or enrichment

of fuel elements verses lumped poison elements and to check for mis-positioned or uncoupled control rods.

14.2.12.2.10 Core Performance Test Summary

a) Test Objective

1) To verify the operating characteristics of the core during power escalation.

b) Prerequisites

1) Power level is established as necessary to meet the test requirements.

2) The general prerequisites are met.

c) Test Method

1) At steady state power levels of 30, 50, 75, 90, and 100 percent, record reactor coolant system parameters and incore data.

2) Analyze data to determine core performance margins, axial power distribution, and quadrant power tilt.

d) Acceptance Criteria

1) The core performance margins are within predictions of the Westinghouse Nuclear Design Report and flux distribution measurement analysis yields power distribution limits less than, or equal to, SHNPP Technical Specification 3/4.2.

14.2.12.2.11 Power Coefficient Measurement Test Summary

e) Test Objective

1) To measure the doppler power coefficient verification factor.

f) Prerequisites

1) The instrumentation necessary for data collection is installed, calibrated, and operable.

2) Plant conditions are established as required by the test instruction.

3) The general prerequisites are met.

g) Test Method

1) At steady state power levels of approximately 50 and 90 percent the electrical output of the turbine generator is cycled by first decreasing then increasing the load by 2 to 4 percent.

2) Reactivity changes and RCS temperature and pressure are recorded throughout the load changes.

3) Measure RCS temperature changes due to the small load variations.

4) The total temperature change times the isothermal temperature coefficient of reactivity divided by the load change in percent is the power coefficient of reactivity.

h) Acceptance Criteria

1) The Doppler power coefficient verification factor C^M is within $\pm$0.5 of the power coefficient predicted C^P which is determined from data in the Cycle #1 Westinghouse Nuclear Design Report.

14.2.12.2.12 Control Rod Reactivity Worth Test Summary

a) Test Objective

1) To determine the Integral Rod Reactivity Worths of the control rods and shutdown rod banks, and to verify by analysis that the Rod Insertion limits will be adequate to ensure a shutdown margin consistent with accident analysis assumptions with the greatest worth control rod (B-8, Reference Figure 4.3.2-36 FSAR) stuck out of the core.

b) Prerequisites

1) The reactor is critical at zero power.

2) The general prerequisites are met.

c) Test Method

1) The integral control rod worths will be determined and compared to design predictions by utilizing the boron dilution or the Rod Swap technique.

2) Verify by calculation that a shutdown margin consistent with the accident analyses exists assuming the greatest worth rod remains in the full out position with the control rods previously inserted to their maximum Rod Insertion Limits.

3) With the greatest worth control rod in the full out position, determine the minimum boron concentration required to maintain the reactor shutdown.

d) Acceptance Criteria

1) The rod worths are determined to be within the limits of WCAP-10781, Nuclear Design Report - SHNPP Cycle 1 and the Westinghouse NSSS Start-up Manual.

2) The calculated shutdown margin is greater than 1.77% Wk/k.

14.2.12.2.13 Boron Reactivity Worth Test Summary

a) Test Objective

1) To determine the boron reactivity worth over the boron concentration ranges in which the reactor may be taken critical.

b) Prerequisites

1) The reactor is critical at zero power.

2) The general prerequisites are met.

c) Test Method

1) Determine the reactivity worth of the boron in solution by diluting the boron concentration and compensating for the reactivity effect by movement of control rods.

2) Equate the change in reactivity due to control rod motion to the worth of the change in boron concentration.

3) Generate a plot of integrated reactivity vs. boron concentration. The slope of this curve is the boron worth.

d) Acceptance Criteria

The boron reactivity coefficient is within -16 pcm/ppm to -7 pcm/ppm as stated in FSAR Table 4.3.2-2, Nuclear Design Parameters.

14.2.12.2.14 Automatic Rod Control Test Summary

a) Test Objective

1) To verify the performance of the automatic rod control.

b) Prerequisites

1) The reactor is at approximately 30 percent power level.

2) The Rod Control System is in manual control and the RCCAs are in the acceptable band for the existing power level.

3) Signals to automatic control are connected to recorders.

4) The general prerequisites are met.

c) Test Method

1) With the average reactor coolant temperature within $\pm$2F of the reference reactor coolant temperature, place the rod control system in automatic.

2) Observe system response during a period sufficient to assure proper control during steady state conditions.

3) Place the Rod Control System in manual and increase the average reactor coolant temperature to approximately 6 F above the reference reactor coolant temperature.

4) Return the Rod Control System to automatic and observe and record system response.

5) Place the Rod Control System in manual and lower the average reactor coolant temperature to approximately 6F below the reference reactor coolant temperature and repeat step 4.

6) If necessary, adjust setpoints and repeat test.

d) Acceptance Criteria

1) The Rod Control System maintains stability under steady state conditions in accordance with the precautions, limitations and setpoint document.

14.2.12.2.15 Deleted by Amendment No. 26.

14.2.12.2.16 Steam Generator Moisture Carryover Test Summary

a) Test Objective

1) To determine the moisture carryover performance of the steam generators.

b) Prerequisites

1) Power level is established as required by test procedure.

2) The general prerequisites are met.

c) Test Method

1) Inject a radioactive tracer into the steam generator and perform activity analysis of selected water and steam samples.

2) Using data results, and assumed calorimeter information, calculate the average steam generator moisture carryover.

d) Acceptance Criteria

Verify with a radioactive tracer injection method that steam generator moisture carryover is no more than 0.25 percent at the steam generator output per FSAR Table 10.2.1-1.

14.2.12.2.17 Load Swing Test Summary

a) Test Objective

1) To verify proper nuclear plant and secondary plant transient response, including automatic control system performance when load changes are introduced at the turbine generator.

b) Prerequisites

1) Plant conditions are established as required by the test instruction.

2) The general prerequisites are met.

c) Test Method

Note: Step load changes will be initiated from steady state conditions at approximately 30 and 75 percent power in accordance with Westinghouse NSSS Start-up Manual Section SU-3.4.7.

1) Manually initiate a load change in the turbine generator output as rapidly as possible to achieve an approximate 10 percent step load change.

2) Plant variables will be recorded, along with values observed on normal plant instrumentation, during the load transient for those parameters required.

d) Acceptance Criteria

1) The following acceptance criteria are to be used to determine successful test completion. Failure to meet those criteria does not constitute a need for stopping the test program, but correction of any deficiencies should be accomplished as required consistent with the current plant schedule.

   a) 1.1 Reactor and turbine do not trip.

   b) 1.2 Safety injection is not initiated.

   c) 1.3 Neither steam generator relief valves nor safety valves lift.

   d) 1.4 Neither pressurizer relief valves nor safety valves lift.

   e) 1.6 Plant variables (ie., T_{avg}, pressure, feed flow, steam flow, etc.) do not incur sustained or continued diverging oscillations.

   f) 1.7 Nuclear power overshoot (undershoot) must be less than 3 percent for load increase (decrease).

   g) 1.8 No manual intervention is required to bring plant conditions to steady state.

14.2.12.2.18 Large Load Reduction from 75 Percent Power Test Summary

a) Test Objective

1) To demonstrate satisfactory transient response to various load changes, to monitor the Reactor Coolant System and selected portions of the secondary plant during these transients, and if necessary, optimize the reactor and secondary plant control system setpoints.

b) Prerequisites

1) Plant conditions are established as required by the test instructions.

2) The general prerequisites are met.

c) Test Method

1) Step load reduction changes of approximately 50 percent will be initiated from steady state conditions at approximately 75 percent load by manually initiating a reduction in the turbine generator output.

2) Monitor plant response during the transient and record plant variables as required.

3) If necessary, adjust the reactor and secondary plant control setpoints until satisfactory response is attained.

d) Acceptance Criteria

Large Load Reduction	Generator Trip From 100% Power
1) Reactor and turbine must not trip.	1) Reactor and turbine should not trip.
2) Safety injection is not initiated.	2) Safety injection is not initiated.
3) Steam generator safety valves shall not lift.	3) Steam generator safety valves should not lift.
4) Pressurizer safety valves shall not not lift.	4) Pressurizer safety valves should not lift.
5) No manual intervention should be required to bring plant conditions to steady state.	

14.2.12.2.19 Turbine Trip From 100 Percent Power Test Summary

a) Test Objective

1) To verify the ability of the plant automatic control system to sustain a trip from 100 percent and to bring the plant to stable conditions following the transient, to determine the overall response time of the hot leg resistance temperature detectors, and to evaluate the data resulting from the trip to determine if changes in the control system setpoints are warranted to improve transient response based on actual plant operations.

b) Prerequisites

1) Plant conditions are established as required by the test instructions.

2) The general prerequisites are met.

c) Test Method

1) Initiate a plant trip from 100 percent power by manually initiating a trip in the turbine. Monitor plant response and record plant variables as required.

2) If necessary, adjust the control system setpoints to obtain optimal response.

d) Acceptance Criteria

1) The following acceptance criteria are used to determine successful test completion:

a) Pressurizer safety valves do not lift.

b) Steam generator safety valves do not lift.

c) Safety injection is not initiated.

d) The overall hot leg RTD response time must be no greater than as specified by the NSSS Vendor Supplied Test Procedure.

14.2.12.2.20 Remote Shutdown Test Summary

a) Test Objective

1) To demonstrate the capability to shut down the Unit from outside the Control Room.

2) To establish and maintain the Unit in hot standby from outside the Control Room.

3) To demonstrate the capability to cooldown from hot standby outside the Control Room by reducing the RCS temperature sufficiently to allow RHR system operation without exceeding cooldown rate.

4) To demonstrate that the RHR System can be placed in service from outside the Control Room and can reduce the RCS temperature approximately 50F without exceeding the cooldown rate.

b) Prerequisites

1) Generator output ≥ 10 percent.

2) Equipment, instrumentation, and controls associated with the auxiliary control panel are operable.

3) Personnel stationed at the auxiliary control panel are in communication with the Control Room.

c) Test Method

1) Trip the reactor at the trip breakers.

2) Operate equipment as necessary from the auxiliary control panel to bring and maintain the Unit in hot standby.

3) Operate equipment as necessary from the auxiliary control panel to cool the RCS down sufficiently to permit RHR System operation without exceeding the cooldown rate.

4) Operate RHR System from the auxiliary control panel to cool the RCS approximately 50F without exceeding the cooldown rate.

d) Acceptance Criteria

1) Hot standby is maintained from outside the Control Room for at least 30 minutes.

2) The RCS is cooled from the no load condition sufficiently to allow RHR System operation without exceeding the cooldown rate.

3) The RHR System is operated from outside the Control Room and will reduce the RCS temperature 50F without exceeding the cooldown rate.

14.2.12.2.21 Loss of Offsite Power Test Summary

a) Test Objective

To demonstrate that the necessary equipment, controls, and indication are available following the isolation of the offsite power distribution system to remove decay heat from the core using only emergency power supplies.

b) Prerequisites

1) The plant is at a steady state power level between 10 and 20 percent.

2) The general prerequisites are met.

c) Test Method

1) Simulate a loss of offsite power coincident with a loss of turbine-generator.

2) Using approved operating procedures, bring the plant to a hot standby condition and maintain the plant in a hot standby condition for at least thirty (30) minutes using only emergency on-site power sources.

d) Acceptance Criteria

1) The hot standby condition is achieved and maintained for at least thirty (30) minutes using only emergency on-site power sources.

2) The emergency diesel generators start and sequence loads when off-site power is not available.

14.2.12.2.22 Pressurizer Heaters and Spray Valves Capability Test Summary

a) Test Objective

1) To determine the capability of the pressurizer heaters and spray valves.

2) To measure the effect of auxiliary pressurizer spray on pressurizer pressure.

3) To measure the effects of charging flow and steam flow on subcooling.

b) Prerequisites

1) The plant is in hot standby condition with three reactor coolant pumps running and system pressure and temperature at approximately 2235 psig and 557 F.

2) The general prerequisites are met.

c) Test Method

1) Vary charging flow to allow a 5 percent increase in pressurizer level and obtain subcooling data.

2) Initiate an RCS cooldown of 10F/hour to 552F and obtain subcooling data.

3) With the pressurizer spray valves closed, all heaters are energized, and the time to reach a 2300 psig system pressure is measured and recorded.

4) With all pressurizer heaters de-energized, both spray valves are opened, and the time to reach a 2000 psig system pressure is measured and recorded.

5) With auxiliary spray in service record/trend system parameters to approximately 2000 psig RCS pressure.

d) Acceptance Criteria

1) The pressurizer pressure response, as the heaters are energized, is within the allowable range graphed in the Westinghouse NSSS Start up Manual.

2) The pressurizer pressure response, as the spray valves open, is within the allowable range graphed in the Westinghouse NSSS Start up Manual.

3) The pressurizer pressure response, as auxiliary spray is placed in service, is within the allowable range graphed in the Westinghouse NSSS Start up Manual.

4) The effects of RCS temperature decrease (steam flow) on RCS subcooling are recorded/determined.

5) The effects of charging flow variations (increase) on RCS subcooling are recorded/determined.

14.2.12.2.23 Gross Failed Fuel Detection System Test Summary

a) Test Objective

1) To verify proper operation of the Gross Failed Fuel Detection System during power ascension.

b) Prerequisites

1) Power level is established to meet the test requirements.

2) The general prerequisites are met.

c) Test Method

1) At steady state power levels of 30 and 100 percent, verify that detector H.V. is at the setting determined during the initial preoperational setup.

2) At a power level of 100 percent, set the high alarm to 2×10^4 CPM above the level established by the plant chemistry section, to be within technical specifications.

3) Using the Level Adjustment potentiometer A1R3, verify the high alarm annunciates at the setpoint established in 2 above.

d) Acceptance Criteria

1) The high alarm annunciates at the setpoint established in Test Method (2).

14.2.12.2.24 Pressurizer Continuous Spray Flow Verification Test Summary

a) Test Objective

1) To perform final adjustment of the pressurizer continuous spray.

b) Prerequisites

1) The general prerequisites are met.

2) Core loading is complete.

c) Test Method

1) Adjust the continuous spray flow valves to minimize automatic heater cycling and to maintain spray line temperatures above the low temperature alarm setpoint.

d) Acceptance Criteria

1) Continuous spray flow valves are throttled to maintain spray line temperature within the 450F to 550F band.

14.2.12.2.25 Reactor Coolant System Leakrate Test Summary

a) Test Objective

1) To determine that the actual RCS leakrate is within specified limits.

b) Prerequisites

1) The general prerequisites are met.

2) Core loading is complete.

c) Test Methods

1) Stabilize the RCS temperature at the no load value.

2) Use the Operations Surveillance Test for RCS Leakage Evaluation which accounts for tank inventory changes, changes in system volumes and water inventory changes resulting from RCS temperature changes to measure the total RCS leak rate.

3) Analyze the sources of leakage and components that potentially receive RCS leakage to determine both identified and unidentified leakage.

d) Acceptance Criteria

1) The identified and unidentified leakage from the Reactor Coolant System are less than the limits stated in Technical Specification 3/4.4.6.2.

14.2.12.2.26 Natural Circulation Test Summary

a) Test Objective

1) To confirm that design heat removal capability exists under natural circulation conditions.

2) To verify that flow (without pumps) and temperature data are comparable to prototype designs for which equivalent tests have been successfully completed.

3) To obtain a data base for simulator training in natural circulation operation.

4) To demonstrate the effects of loss of pressurizer heaters on margin to saturation temperature.

b) Prerequisites

1) Plant is stable at approximately 3 percent and parameters are at no-load values.

2) Three reactor coolant pumps are running.

3) The general prerequisites are met.

c) Test Method

1) Trip the reactor coolant pumps.

2) Verify adequate natural circulation flow to maintain cooling.

3) Demonstrate the effects of loss of pressurizer heaters by de-energizing all heater banks. Maintain natural circulation and constant T_{avg} while observing the pressure drop.

4) Obtain core flux maps at specified intervals to compare power distributions.

d) Acceptance Criteria

1) The heat removal capability, and temperature data are comparable to those of the prototypes (North Anna) for which equivalent tests have been completed.

2) Pressurizer pressure remains above 1800 psig.

14.2.12.2.27 Main Steam and Feedwater Systems Test Summary

a) Test Objective

1) To verify the operating characteristics of the main steam and feedwater systems during power escalation.

b) Prerequisites

1) Power level is established as necessary to meet the test requirements.

2) The general prerequisites are met.

c) Test Method

1) At steady state power levels of 30, 50, 75, and 100 percent, record main steam and feedwater system parameters.

2) Analyze data to determine main steam and feedwater system performance margins.

d) Acceptance Criteria

1) The Main Steam System and Feedwater System performance margins are within predictions of the Westinghouse Thermal Performance Data.

14.2.12.2.28 Shield Survey Test Summary

a) Test Objective

1) This test will establish the adequacy of shielding and identify high radiation areas.

b) Prerequisites

1) All removable shielding shall be installed in the original design location.

2) Portable neutron survey instrumentation shall be calibrated using an appropriate neutron source. Portable gamma survey instrumentation shall be calibrated in accordance with gamma survey instrument calibration procedures.

3) During power ascension the power level shall be at a 50% and 100% plateau.

c) Test Method

1) 50 Percent Power Plateau

a) All accessible penetrations of the primary shield shall be surveyed for neutron and gamma radiation using appropriate gamma and neutron portable instrumentation.

b) All accessible areas on the outside surface of the primary shield shall be surveyed for neutron and gamma radiation using appropriate gamma and neutron instrumentation.

c) All accessible areas immediately adjacent to the secondary shield shall be surveyed using appropriate portable neutron and gamma instrumentation.

2) 100 Percent Power Plateau

a) All accessible penetrations of the primary shield shall be surveyed for neutron and gamma radiation using appropriate gamma and neutron portable neutron instrumentation.

b) All other accessible areas of the primary shield where the 50% plateau radiation readings appear to exceed the design criteria shall be surveyed for neutron and gamma radiation using appropriate gamma and neutron survey instruments.

c) All accessible areas within the secondary shield shall be surveyed at 50% and 100% power plateau for gamma and neutron radiation using appropriate portable neutron and gamma instrumentation.

d) All accessible areas immediately adjacent to the secondary shield shall be surveyed using appropriate portable neutron and gamma instrumentation.

e) Gamma radiation levels will be determined in various other plant locations.

d) Acceptable Criteria

1) Measured neutron and gamma radiation levels are within the limits as specified in FSAR Section 12.3 for the zone designations for each area surveyed.

14.2.12.2.29 Loss of Feedwater Heater(s) Test Summary

a) Test Objective

1) To demonstrate the plant response to isolating and/or bypassing flow around feedwater heater(s)

2) To determine the most severe loss of feedwater heater transient due to single operator or equipment failure

b) Prerequisites

1) The general prerequisites have been met.

2) The plant is operating at a power level as specified.

c) Test Method

Note: The below test will be conducted with the plant initially operating at 50% power and at maximum power allowed by turbine limitations but not to exceed 90% power.

1) Bypass and isolate the "A" train low pressure feedwater heaters #1 and 2. Monitor feedwater temperatures, heater level controllers heater levels, heater pressure in addition to the parameters of Section 15.1.1. When feedwater temperature has stabilized, record temperature, levels, and shell pressures.

2) Return the "A" train low pressure feedwater heaters #1 and 2 to service.

3) Repeat steps 1 and 2 for the "B" train low pressure heaters #1 and #2.

4) Bypass low pressure feedwater heaters #3 and #4. Monitor feedwater temperatures, heater level controllers heater levels, and heater pressure in addition to the parameters of Section 15.1.1. When feedwater temperature has stabilized, record temperature, levels, and shell pressures.

5) Return low pressure feedwater heaters #3 and #4 to service.

d) Acceptance Criteria

1) With the isolating and/or bypassing of either heater group, the resultant transient will be less severe than the predicted response of FSAR Section 15.1.1.

2) The most severe loss of feedwater heater transient will be identified based upon the resultant data from the series of tests.

14.2.12.2.30 Main Steam Isolation Valve Test Summary

a) Test Objective

1) This test will demonstrate the capability of the main steam isolation valve (MSIV) "Test Feature" to operate as designed under maximum steam flow conditions.

b) Prerequisites

1) Plant is at approximately 100% power.

2) The general prerequisites are met.

c) Test Methods

1) The MSIV control switch is put in the "Test" mode. (Each valve is tested separately)

2) Monitor plant response and valve stem travel.

d) Acceptance Criteria

1) MSIV stem travels from 100% open to 90% open and back to 100% open.

2) The plant's control systems operate to maintain steady state conditions.

14.2.12.2.31 Steam Generator Test for Condensation Induced Water Hammer

a) Test Objective

1) To demonstrate the capability of transferring feedwater flow from the auxiliary feedwater nozzles to the main feedwater nozzles.

b) Prerequisites

1) Plant conditions are established as required by test instructions for 15 percent power level.

c) Test Method

1) Operate the plant at approximately 15 percent of full power by feeding the steam generators through the auxiliary feedwater nozzles.

2) Transfer the feedwater flow to the main feedwater nozzles by opening the main feedwater isolation valves per general plant operating procedures.

3) Observe and record the transient that follows.

d) Acceptance Criteria

Either low amplitude or no condensate-induced water hammer is observed in the region of the main feedwater nozzle/preheater section of steam generator.

14.2.12.2.32 Steam Turbine Driven and Motor Driven Auxiliary Feedwater Pumps Endurance Test

a) Test Objective

1) To demonstrate the capability of the steam turbine driven and motor driven auxiliary feedwater pumps to continuously feed two or more steam generators for a 48 hour period without exceeding the design conditions of FSAR Section 9.4.3 and 9.4.5 (i.e., pump cubicle temperatures must not exceed 104°F).

b) Prerequisites

1) The general prerequisites have been met.

2) The plant is operating at a power level of 30% with a main feedwater pump in operation.

c) Test Method

1) Start motor driven AFW pumps 1A and 1B from the MCB. Adjust flow to the steam generators (2 or more) for a total flow of 300-400 gpm (150-200 Kpph).

2) Every hour for the next 48 hours record motor winding temperatures, bearing temperatures, vibration on motors and pumps, and pump cubicle temperatures.

3) Makeup to the Condensate Storage Tank will be via the condensate reject line downstream of the condensate polishers.

4) Upon completion of the 48 hour endurance run on the motor driven AFW pumps, stop the pumps.

5) Start turbine driven AFW pump 1X from the MCB. Adjust flow to the steam generators (2 or more) for a total flow of 300-400 gpm (150-200 kpph).

6) Every hour for the next 48 hours record turbine oil temperatures, bearing temperatures, pump and turbine vibration, and pump cubicle temperatures.

7) Upon completion of the 48 hour endurance run on the turbine driven AFW pump, stop the pump.

8) Restart and run for one hour the MDAFW pumps 1A and 1B. The pumps will be at ambient conditions for they have been sitting idle for at least 48 hours. Record data as before.

9) Stop MDAFW pumps 1A and 1B one hour after restart.

10) When local turbine oil temperatures are < 100°F, restart TDAFW pump 1X (this will indicate pump has reached ambient conditions). Record data as before.

11) One hour after restart, stop TDAFW pump 1X.

d) Acceptance Criteria

1) The AFW pumps motors and turbine will not exceed the following conditions:

Vibration ≤ 2.0 mils
Bearing temperatures ≤ 160°F
Bearing metal temperatures ≤ 200°F
Motor winding temperatures ≤ 266°F

2) The Reactor Auxiliary Building Ventilation and Equipment Cooling Systems shall maintain environmental conditions of the auxiliary feed pump areas within the design requirements of FSAR Sections 9.4.3 and 9.4.5 (cubicle temperatures maintained ≤ 104°F).

3) The Reactor Auxiliary Building Ventilation and Equipment Cooling Systems shall maintain environmental conditions of the auxiliary feedwater pump areas within the design requirements of FSAR Sections 9.4.3 and 9.4.5.

14.2.12.2.33 Resistance Temperature Detector (RTD) Bypass Flow Verification Test Summary

a) Test Objectives

1) To determine that the flowrate in each RTD bypass loop is sufficient to achieve the design RTD bypass transport time.

b) Prerequisites

1) The reactor is in the hot shutdown condition with all reactor coolant pumps running.

2) RTD bypass loop flow instrumentation is calibrated and in service.

3) The general prerequisites are met.

c) Test Method

1) The flow required to achieve the design reactor coolant transport time is determined by measuring and recording the lengths of installed piping in each hot and cold leg bypass loop and then calculating the flow necessary to achieve design transport time.

2) Total bypass flow rate for each loop is measured and recorded, and then actual bypass transport time is calculated.

d) Acceptance Criteria

1) The flow rate in each RTD bypass loop yields design transport time as per the Westinghouse NSSS Startup Manual.

14.2.12.2.34 Secondary Sampling System Test Summary

a) Test Objective

1) To verify the proper operation and performance of the Secondary Sampling System.

To verify the operation of the following sample points: S7, S8, S9, S10, S11.

b) Prerequisites

1) To the extent practical systems to be sampled are at operating pressure and temperature.

2) Cooling water is available to sample panels for sample coolers and chiller condensers.

c) Test Method

1) By valving "in and out" sample lines, verify samples to sample panels are correctly identified.

2) With continuous sampling flow established, verify the operation of the temperature control system.

d) Acceptance Criteria

1) Sample points have been verified per FSAR Table 9.3.2-2.

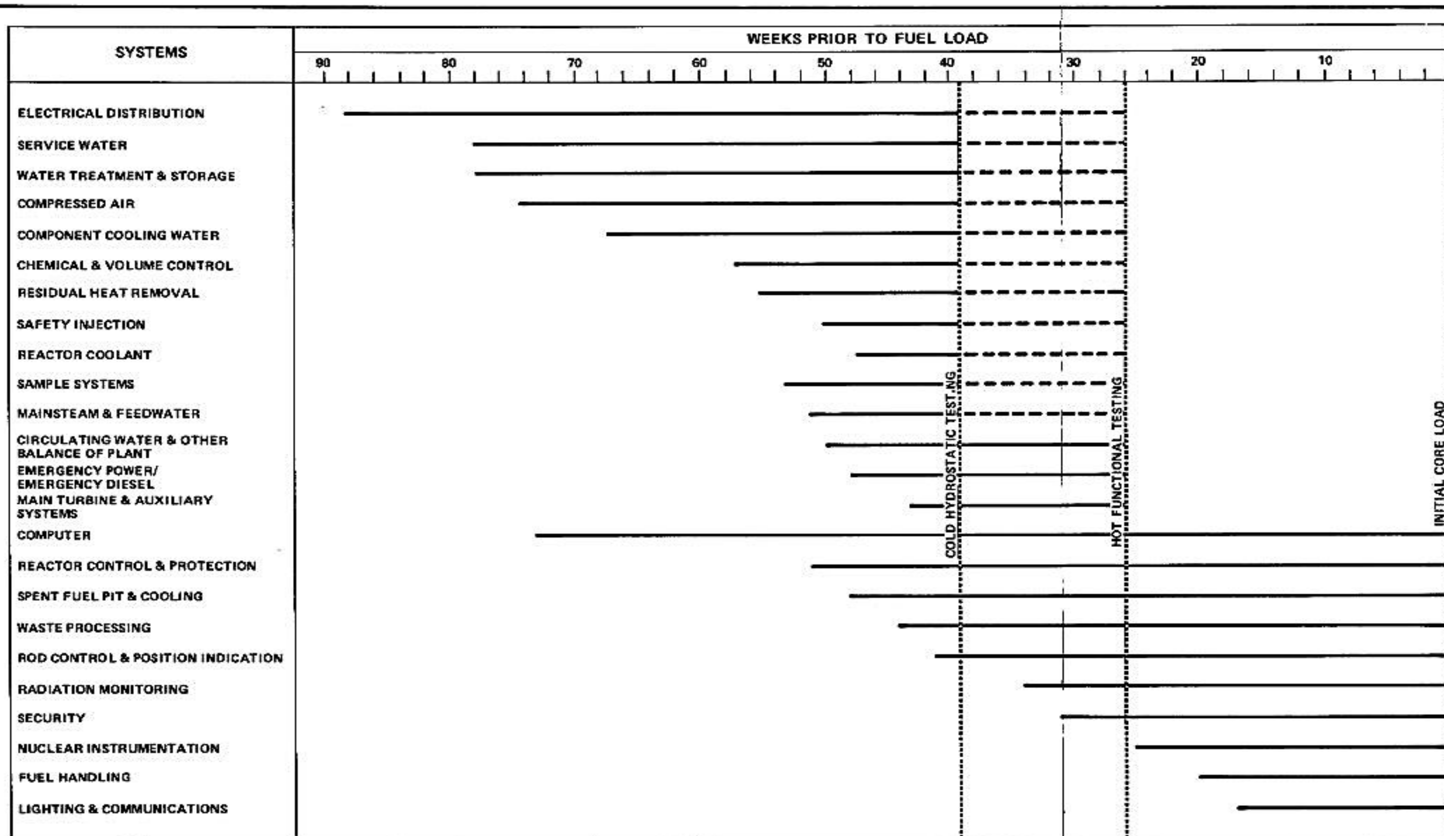
2) Temperature control system has demonstrated the capability to maintain sample temperatures at 77 $\pm$ 5 F.

TABLE	TITLE
N/A	THERE ARE NO TABLES FOR CHAPTER 14

FIGURE	TITLE
14.2.11-1	SHNPP PRE-OPERATIONAL TEST SCHEDULE
14.2.11-2	INITIAL START-UP TEST SCHEDULE (SHNPP)

FIGURE 14.2.11-1

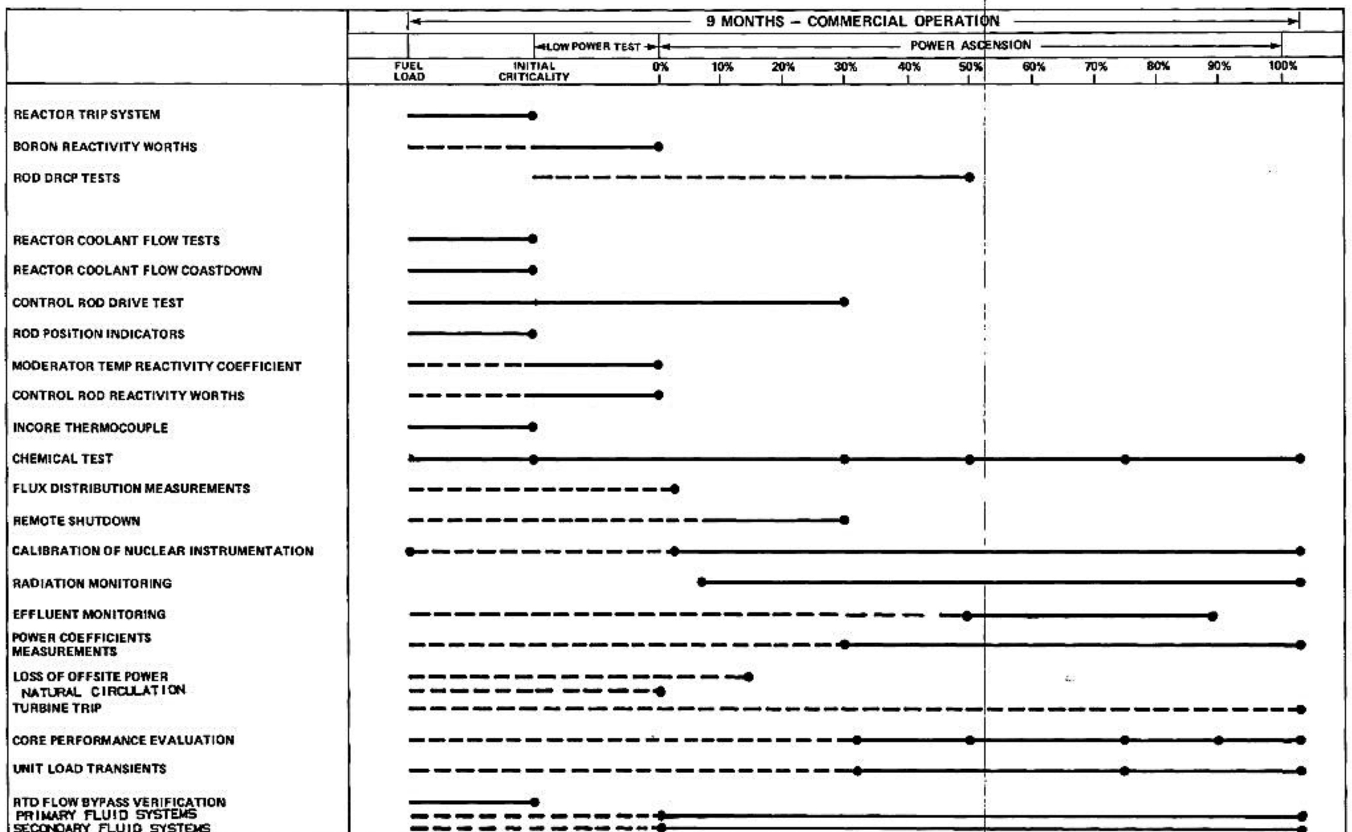
SHNPP PRE-OPERATIONAL TEST SCHEDULE



NOTE: THIS FIGURE IS INTENDED TO SHOW THE OVERALL START-UP AND TEST PROGRAM AND TO PROVIDE A GENERAL GUIDE TO TESTING SEQUENCE. ALL TEST SUMMARIS ARE NOT NECESSARILY SHOWN.

FIGURE 14.2.11-2

INITIAL START-UP TEST SCHEDULE--(SHNPP)



NOTE: THIS FIGURE IS INTENDED TO SHOW THE OVERALL START-UP AND TEST PROGRAM AND TO PROVIDE A GENERAL GUIDE TO TESTING SEQUENCE. ALL TEST SUMMARIS ARE NOT NECESSARILY SHOWN.