CHAPTER 14 - INITIAL TEST PROGRAM

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14.1 SPECIFIC INFORMATION TO BE INCLUDED IN PSAR

This information is not required to be included in the FSAR.

Refer to YGN 3&4 PSAR Section 14.1

14.2 SPECIFIC INFORMATION TO BE INCLUDED IN FSAR

14.2.1 Summary and Objectives of the Initial Test Program

14.2.1.1 Objectives of the Initial Test Program

The initial test program is designed to establish the following:

a. Demonstrate that components and systems of the NSSS operate in accordance with design requirements.

b. Demonstrate that the systems can be safely operated and that performance levels can be maintained in accordance with established safety requirements.

c. Confirm proper transient system operation and thereby verify that the NSSS can be brought to power as well as to a shutdown condition in a controlled and safe manner.

d. Provide verification of core physics parameters and baseline performance data for use during normal plant operation.

14.2.1.2 Summary of the Initial Test Program

The initial test program begins as systems become available for testing during the construction phase and ends with completion of the power ascension tests. The testing program is divided into the following major tests:

- Preoperational tests (cold functional tests)
- Pre-core hot functional tests
- Initial core loading
- Post-core hot functional tests

- Initial criticality
- Low power physics tests
- Power ascension tests

Each of these tests is described individually in the following paragraphs. A summary listing of the various tests with the corresponding test procedure number and title is included as Table 14.2-9.

a. Preoperational Tests (Cold Functional Tests)

Preoperational tests are performed to demonstrate proper system and component installation, calibration, and operation; to demonstrate the capability of these systems and components to meet safety-related performance requirements; and to provide initial baseline performance data for use during subsequent plant operation. Simulated signals or inputs may be used where actual signals are not available to verify system and instrument operating ranges. Systems that are not used during normal plant operation, but which must be in a state of readiness to perform safety functions, are verified as operational before initial plant startup.

Summaries and lists of the preoperational tests are provided in Subsection 14.2.12.1 and Table 14.2-1.

b. Pre-core Hot Functional Tests

The pre-core hot functional tests are performed to assure, wherever possible, that systems necessary for normal plant operation will safely perform their function when required.

During pre-core hot functional testing, in so far as practical, the normal plant operating procedures are used to bring the plant to hot shutdown and hot zero-power conditions. Tests are performed at predetermined stages to demonstrate that plant systems function as expected. Upon completion of elevated temperature testing, plant operating procedures are used, in so far as practical, to bring the plant to cold shutdown conditions.

This testing sequence provides system baseline performance data and allows the operators to become familiar with the plant operating procedures.

Summaries and lists of the pre-core hot functional tests are provided in Subsection 14.2.12.2 and Table 14.2-2.

c. Initial Core Loading

Initial core loading starts after completion of the preoperational and pre-core hot function tests. This phase of the initial test program provides a systematic process for safely accomplishing and verifying the initial core loading.

Initial core loading is discussed in more detail in Subsection 14.2.10.1.

d. Post-Core Hot Functional Tests

The post-core hot functional tests are performed following the completion of initial fuel loading operations and before initial criticality. The objectives of these thests are to provide additional assurances that plant systems necessary for normal plant operation function as expected and to obtain performance data on core-related systems and components. Normal plant operating procedures, in so far as practical, are used to bring the plant from cold shutdown conditions through hot shutdown to hot zero-power conditions. Testing normally proceeds directly to initial criticality and the beginning of low-power physics testing. For the YGN 3 unit only, the plant is returned to hot shutdown before proceeding to initial criticality. Summaries and lists of the post-core hot functional tests are provided in Subsection 14.2.12.3 and Table 14.2-3.

e. Initial Criticality

The initial criticality phase of the startup test program assures that criticality is achieved in a safe and controlled manner. A description of the procedures followed during the approach to initial criticality is included in Subsection 14.2.10.2.

f. Low-Power Physics Tests

Following initial criticality, a series of low-power physics tests are performed to verify selected core-design parameters. These tests serve to substantiate the safety analysis and Technical Specifications. They also demonstrate that core characteristics are within expected limits and provide data for benchmarking the computer algorithms used for predicting core characteristics later in life. A list of the low power physics tests is provided in Table 14.2-4, a description of each test is provided in Subsection 14.2.12.4, and the parameters for each test are provided in Table 14.2-6.

g. Power Ascension Tests

A series of power ascension tests is conducted to bring the reactor to full power. Testing is performed at plateaus of approximately 20, 50, 80, and 100% power and is intended to demonstrate that the facility operates in accordance with its design during steady-state conditions and, to the extent practicable, during anticipated transients. A list of the power ascension tests is provided in Table 14.2-5, and a description of each test is provided in Subsection 14.2.12.5.

h. Initial Startup Testing

The initial startup testing is a part of the initial test program which begins with the start of nuclear fuel loading and ends with the completion of power ascension test and the performance of warranty tests. These tests confirm the design basis and demonstrate, to the extent practicable, that the plant operates and responds to anticipated transients and postulated accidents as designed. Power ascension testing follows fuel loading and is sequenced so that plant dependence upon untested systems, or components is minimized. . The objectives of the initial startup tests are as follows:

- o Accomplish a controlled and orderly initial core loading.
- o Accomplish a controlled, orderly, and safe initial criticality.
- o Conduct zero and low-power testing sufficient to ensure that design parameters are satisfied and safety analysis assumptions are correct or conservative.
- o Perform a controlled, orderly, and safe power ascension with requisite testing terminating at plant rated conditions.

14.2.2 Organization and Staffing

14.2.2.1 Startup Organization

The startup organization has the responsibility and authority to conduct all startup testing. The startup organization is directed by the startup manager for matters relating to the preoperational testing. For matters relating to the initial startup testing, the startup manager reports to the plant manager. The startup organizaiton is a composite of startup engineers from KEPCO, the architect-engineer (AE), and the nuclear steam supply system (NSSS) and the turbine-generator (T/G) suppliers. Figure 14.2-1 illustrates the YGN 3&4 plant staff and startup organizations and their interrelationships.

14.2.2.2 Test Working Group

Before preoperational testing, the test working group (TWG) is formed to perform a review of safety-related preoperational tests and pre-core hot functional tests before testing and to review safety-related preoperational test results after testing. The chairman of the TWG has overall responsibility for the TWG findings and recommendations. The TWG consists of the following mambers:

a. Chairman - KEPCO Startup Manager
b. AE Representative
c. NSSS Supplier Representative
d. Quality Assurance Representative
e. Operation Department Representative

The TWG has the following responsibilities:

a. Review safety-related preoperational test procedures before testing and review preoperational test procedure results after testing.
b. Make recommedations to the KEPCO startup manager regarding the accepability of procedures and tesults.
c. Approve major changes to safety-related preoperational test procedures.
d. Ensure that all test deficiencies are resolved.

14.2.2.3 Plant Nuclear Safety Committee

Before initial startup testing, the Plant Nuclear Safety Committee (PNSC) is formed to control initial startup testing activities. The PNSC responsibilities begin at initial core loading. The PNSC consists of the following members:

a. Chairman - YGN 3&4 Plant Manager
b. Others: refer to Chapter 16.

The PNSC has the following responsibilities :

a. Review and approve initial startup test procedures.

b. Approve major plans during initial startup testing and monitor actual progress.

c. Meet, as required, to ensure the safety and proper sequencing of the test program during initial startup testing.

d. Resolve major test problems.

e. Ensure that the test program is conducted in accordance with approved test procedures and the plant operation manual.

f. Approve major changes to initial startup test procedures.

g. Review and approve the results of tests performed during initial startup testing.

h. Ensure that all test deficiencies are resolved.

i. Recommend modifications of system design, equipment, or operation manual based on the evaluation of the test results.

14.2.2.4 Plant Manager

The plant manager is responsible for implementation of the initial startup test programs and for safe plant operation. He is chairman of the PNSC, which assists the plant manager in reviewing the plant operation manual, test procedures, and test results during initial startup testing. He approves the initial startup test procedures.

14.2.2.5 Startup Manager

The startup manager has complete authority to control the conduct of the initial test program and safety-related and non-safety-related preoperational and pre-core hot functional testing through acceptance and rejection of test procedures and results, by establishing and enforcing administrative controls and policies, and through general surveillance of startup activities. The startup manager is delegated the responsibility for the administration and control of the startup organization. He ensures the review of all test results and accepts or rejects them. He is responsible for the production of all test procedures. He coordinates requests for operations, maintenance, and construction staff support.

14.2.2.6 Startup Department Managers

The startup department managers are responsible to the startup manager for the conduct of startup activities of their department. They have the following specific responsibilities:

a. Maintain status of components/systems for their department.

b. Prepare and update system logic networks and test schedules.

c. Coordinate with the startup/construction coordination group for turnover of components/system.

d. Coordinate the initial operation of equipment.

e. Review startup field reports and resolve test deviations.

f. Prepare test procedures.

g. Review and recommend acceptance of test results.

h. Coordinate vendor assistance, as necessary, to support testing activities of their group.

14.2.2.7 Test Engineers

The test engineers, under the supervision of the group supervisors, are responsible for conducting all preoperational test activities for the systems assigned to them. They have the following specific responsibilities:

a. Define preoperational test scope boundaries required to support testing.

b. Be totally familiar with all aspects of their assigned systems and be generally familiar with the systems assigned to the other test engineers in his group.

c. Provide detailed system test scheduling information to the group leader for assigned systems. Assist in developing detailed system logic network and schedules.

d. Write, revise, and submit for approval preoperational test procedures for assigned systems.

e. Complete system prerequisites and conduct system tests in accordance with approved procedures. Assist other test directors in conducting their tests, as required.

f. Supervise and direct the activities of the plant operations and maintenance personnel assigned to them for testing.

g. Review operating, maintenance, and test procedures used in the course of testing; suggest corrections and/or improvements, and assist in familiarizing plant operations and maintenance personnel with system features.

h. Reduce, analyze, and interpret test data. Prepare test reports, documents, and results for review and approval.

i. Participate in system walkdowns prior to turnover.

j. Initiate, track, and resolve system deficiencies and discrepancies via startup field reports.

k. Initiate, track, and resolve test changes and exceptions.

l. Provide on-the-job training of KEPCO personnel on assigned systems.

m. Obtain approval to run all tests from the operations shift supervisor and keep the operations shift supervisor informed of status of tests and equipment.

14.2.2.8 Startup Scheduler

The startup scheduler, under the direction of the startup control department manager, is responsible for directing and coordinating the activities of the scheduling group. The startup scheduler has the following specific responsibilities:

a. Maintain the startup summary schedule, ensuring that it interfaces realistically with the construction schedule.

b. Maintain status of overall system testing to be performed.

c. Prepare weekly reports that identify problem areas that impact the initial test program.

d. Interface with the department managers for input to the system logic networks and schedules.

e. In consort with test engineers, prepare work-arounds for test schedule problems.

14.2.2.9 Startup Control Department Manager

The startup control department manager, under the direction of the startup manager, is responsible for activities associated with system turnover. He has the following specific responsibilities:

a. Coordinate turnover walkdowns and identify discrepancies.

b. Review discrepancies identified on turnover walkdowns and ensure their resolution.

c. Review turnover packages received from construction for acceptability.

d. Review operational turnover packages for completeness.

e. Provide scheduling input for components and systems turned over by Construction and for those systems turned over to operations.

f. Coordinate systems/component work-around as required to support the initial test program.

g. Coordinate green turnover tagging of components/system when turnover from Construction has been accepted.

14.2.2.10 Project Construction

The construction manager represents Hyundai in all matters relating to construction. He will provide Startup with construction support and information concerning construction progress and will expedite startup requests for construction assistance or action.

14.2.2.11 Startup Quality Assurance

Startup quality assurance performs monitoring and audit functions during all testing phases.

14.2.2.12 Plant Operations

Plant operations personnel operate permanent plant equipment during testing. Following completion of system preoperational testing and during initial startup testing, the plant manager is responsible for conducting and coordinating fuel loading operations and initial startup tests. Plant maintenance personnel will be used to provide craft support for testing to the extent practicable. The plant staff chemistry and radiation protection personnel are responsible for all chemical, radiochemical, and radiation protection activities required to support testing.

14.2.2.13 Project Field Engineering

Project field engineering provides technical assistance in reviewing test procedures, designs, and services to satisfy special startup requirements; writes special test procedures to verify unique YGN 3&4 designs; when requested, analyzes and reviews test data and results; and provides design recommendations for any design-related deficiencies or discrepancies. If required, project design personnel may be assigned to Startup to lend their technical assistance.

14.2.2.14 KHIC/CE/GE/KOPEC/S&L OSS and Technical Advisors

The technical advisors and OSS engineers, under the supervision of department managers, provide startup testing support to the startup group on the systems assigned, including preparation and review of test procedure, test scheduling and review of test results. They also provide technical assistance as directed by the startup manager.

14.2.2.15 Qualification of Personnel

All personnel involved in the initial test program shall be qualified in accordance with training and indoctrination programs developed by KEPCO. Qualification of plant personnel is discussed in Subsection 13.1.3 and in the

Startup Administrative Procedure number SUM-15. Certification is performed in accordance with ANSI/ASME NQA-1 as modified by SUM-15.

14.2.2.16 Utilization of the Plant Staff

The plant operating staff will be utilized to the fullest extent practicable during the initial test program. The plant staff will operate all permanently installed and powered equipment for preoperational and subsequent tests. Plant service personnel, such as instrument control, chemistry, and health physics technicians, will be used extensively to perform testing applicable to their fields of specialization.

The plant engineering staff will participate in the review of startup test procedures and plans, assist and coordinate in the performance of the tests as required, and participate in the analysis and review of test results.

14.2.3 Test Procedures

The preoperational and initial startup testing programs are conducted in accordance with detailed preoperational and startup test procedures. KEPCO maintains overall responsibility for test procedure preparation, review, and approval. These activities are completed as described in the following sections.

14.2.3.1 Procedure Preparation

Detailed test procedures will be prepared utilizing appropriate design disclosure documents. A test procedure will be prepared applying to each specific test performed during various evolutions of the initial test program.

Test procedure drafts are initially prepared by test engineers in accordance with the format as follows:

1.0 Objectives

2.0 Acceptance Criteria

3.0 References

4.0 Prerequisites

5.0 Precautions and Notes

6.0 Test Equipment

7.0 Initial Conditions

8.0 Procedure and Data Collection

9.0 System Restoration

10.0 Attachments

The completed drafts are then reviewed by OSS engineer/technical advisor to ensure that test procedure objectives and acceptance criteria are consistent with current design document requirements. Review comments are resolved between the writing organization and the reviewer. Upon satisfactory resolution of comments, subsequent changes to test procedure objectives or acceptance criteria will be made to be consistent with approved design documents and reviewed by TWG/PNSC.

14.2.3.2 Procedure Review and Approval

Following initial preparation, test procedures are processed through a formal review and approval cycle. The review cycle uses a graded approach as follows:

a. Preoperational tests important to plant safety are reviewed by the Test Working Group (TWG).

b. Initial startup tests are reviewed by the Plant Nuclear Safety Commithe (PNSC).

Individuals designated review responsibility are responsible for reviewing test procedures for total accuracy, technical content, conformance with FSAR requirements, and compatibility with approved design documents. Specific review responsibilities include the following:

a. Verify that procedure references have been updated to latest revisions.

b. Verify that procedures have been revised to incorporate known design changes.

c. Verify procedure compatibility with field installation of equipment.

d. Verify procedure conformance with the FSAR and its amendments and technical specifications.

e. Verify that procedures reflect, as appropriate, reactor operating and testing experiences of similar power plants.

Upon completion of initial reviews and inclusion of required changes, test procedures for preoperational tests are submitted to the startup manager for approval and initial startup test procedures to the plant manager for approval.

These procedure revisions and procedure modifications are processed in accordance with Subsection 14.2.4.3.

14.2.4 Conduct of Test Program

The administrative controls that govern conduct of the plant staff and of the startup group during the initial test program are specified by administrative procedures. These administrative procedures are KEPCO-controlled and-approved documents. Administrative procedures define tasks to be performed, prescribe methods, and assign responsibilities for performing the tasks.

The administrative procedures governing conduct of the startup group are contained in the Startup Administrative Manual. These procedures do not establish the administrative controls of other project groups or organizations except as they interface with the startup group. The Startup Administrative Manual will be approved for use before the start of the initial test program.

14.2.4.1 Test Performance

Testing performed during the initial test program is in accordance with approved test procedures. The methods for preparing, reviewing, and approving test procedures are detailed in Subsection 14.2.3. Before the start of testing, a test engineer is assigned to each procedure. The test engineer is the individual responsible for coordinating test performance. Test engineers are assigned from the startup group by the startup manager or his designee. The test engineers are directed and supervised in technical matters by test group supervisors in the preparation and performance of the tests.

The plant operating staff is responsible for the safe and proper operation of equipment during testing. Should an unsafe condition arise, the plant operating staff shall take whatever action is necessary including but not limited to, stopping the test in order to restore safe plant conditions. During power testing, the plant operating staff is specifically responsible for compliance with technical specifications, compliance with the provisions of the operating license, and authorization of testing.

14.2.4.2 Test Prerequisites

Specific test prerequisites are identified in each preoperational and initial startup test procedure. The test engineer verifies that each prerequisite is completed and properly documented before signoff on the official working copy of the procedure. If a prerequisite cannot be satisfied, the test engineer may waive the prerequisite to expedite testing after making an exception list and receiving approval from the startup manager or his designee for preoperational testing or from the plant manager or his designee for initial startup testing. Waiving of a prerequisite is permissible only if the prerequisite has a minimal and definable effect on the test.

Waiving of a prerequisite constitutes a procedure modification; therefore, the test engineer is responsible for complying with the requirements of Subsection 14.2.4.3.

14.2.4.3 Procedure Modifications

Tests are to be conducted in accordance with approved procedures, but, if necessary, a procedure may be modified to complete the testing. Such modifications are documented within the text of the procedure and on a special test change notice form. The test engineer marks up the working copy of the procedure to clearly indicate the required change and initials and dates the change. For modifications to initial startup test procedures, the change is also initialed and dated by a licensed senior operator. In addition, the test engineer prepares and processes a test change notice form and submits it to the startup manager (for preoperational testing) or plant manager (for initial startup testing) for approval. The test change notice form becomes an attachment to the working copy of the procedure. Preparation, review, and approval activities are accomplished before or after performance of associated testing based on the following criteria:

a. For minor modifications that obviously preserve the intent of the test, the test change notice may be processed after performance of associated testing.

b. For major modifications that alter the intent of the test, the test change notice is processed before continuing performance of associated testing.

14.2.4.4 Design Problems

In the process of checkout, preliminary operation, and preoperational or initial startup testing, design problems may be encountered. All such design problems are formally documented and reported to appropriate design organization representatives for resolution. Typical design problems include the following:

a. Errors or discrepancies in approved project design documents

b. Items that represent a potential hazard to personnel safety

c. Failure of a tested system or component to satisfy design requirements or acceptance criteria

d. Failure of a system or component to continue to operate within expected design parameters.

Design response for all such reported items is mandatory. Should the response require a facility modification, the appropriate design documents are revised and issued to the field. Field implementation of the modification is subsequently controlled in accordance with Subsection 14.2.4.5.

14.2.4.5 Control of Rework, Modification, and Repair

A comprehensive listing of outstanding work items is maintained for each system during the initial test program to ensure that identified work is performed. Typical work items listed include the following:

a. Incomplete or incorrect equipment installation
b. Equipment repaired (corrective maintenance)
c. Approved facility modifications
d. New or additional construction.

This work is performed by the Construction organization, the Plant Maintenance staff, or a contract organization in accordance with approved project procedures. In any event, in order to maintain the required controls, formal authorization is required to perform the work. This authorization is obtained through the implementation of appropriate administrative procedures. These administrative procedures, in addition to authorizing performance of the work, specifically identify any retesting required as a result of the work and document completion of both the work and the specified retesting. Closure of the associated work list item similarly requires completion of both the specified work and the specified retesting.

Administrative procedures for control of this work are found in the YGN 3&4 Startup Administrative Manual.

14.2.4.6 Test Phase Prerequisites

Completion of each major phase of the initial test program is a prerequisite to starting the succeeding phase. Subsection 14.2.11 identifies the specific testing scheduled to be conducted during the phase of preoperational and initial startup testing. A phase is considered complete only after the results of required testing are evaluated, reviewed, and approved per the requirements of Subsection 14.2.5.

14.2.5 Review, Evaluation, and Approval of Test Results

KEPCO has overall responsibility for review, evaluation, and approval of test results. The following paragraphs establish the requirements for review, evaluation, and approval of individual test results, major test phase test results, and power ascension test results.

14.2.5.1 Individual Test Results

Upon completion of testing, the test engineer assembles a test package that includes the working copy of the procedure and all related documentation. Preoperational and initial startup test packages are submitted to the TWG and PNSC members responsible for performing an in-depth review and evaluation of test results.

Test discrepancies, deficiencies, and omissions identified during testing or during review of test results are documented as test deviations. Test deviations occurring because of design problems are reported to the appropriate design organization representatives for resolution per Subsection 14.2.4.4. Following review and resolution of review comments, the TWG/PNSC chairman has three options:

a. Recommend that the entire test be repeated.

b. Recommend rejecting the test results as unacceptable until all or part of the outstanding exceptions are resolved.

c. Recommend accepting the test results with or without exceptions.

Final approval of preoperational and startup test results is by the startup manager for preoperational testing and the plant manager for initial startup testing.

For procedures approved with deviation, each exception and deviation will be evaluated and assigned a required completion date relative to the different phases of the initial test program. These test deviations are subsequently resolved by processing retest results through the same review and approval cycle.

14.2.5.2 Major Test Phase - Test Results

Commencement of initial fuel loading and zero power testing requires the results of the preoperational tests of designated systems in Tables 14.2-1 and 14.2-2 be reviewed and approved.

14.2.5.3 Power Ascension Testing - Test Results

Table 14.2-7 prescribes the sequence of testing during the power ascension testing phase as a function of power level. Commencement of the power testing specified for each power level requires the power test results specified for the preceding level be reviewed and approved.

14.2.6 Test Records

A single copy of each approved procedure, denoted as the working copy, is used as the official record of the test. The completed working copy and all associated test documents are assembled into a test package at the end of testing. Test packages are retained for the life of the plant in accordance with KEPCO procedures for retention of historical records.

Each test package contains, either as part of the procedure or as separate documentation, the following information:

a. A description of the test method and objectives

b. A comparison of test data with acceptance criteria

c. Deficiencies relating to design and construction identified during testing

d. Modifications and corrective actions required and the schedule for their implementation

e. Justification for acceptance of systems or components not in conformance with design predictions or performance requirements

f. Conclusions regarding system or component adequacy

14.2.7 Conformance of Initial Test Programs with Regulatory Guides and Industry Standards

The intent of the following Regulatory Guides will be followed with the noted differences.

14.2.7.1 Regulatory Guide 1.68 (Rev. 2, 8/78)

The following exceptions and/or clarifications address only significant differences between the YGN 3&4 test program and the applicable regulatory position. Minor terminology differences, testing not applicable to the plant design, and testing that is part of required surveillance tests will not be addressed. Reference is made to the applicable portion of Regulatory Guide 1.68 (Revision 2, 8/78).

14.2.7.1.1 Regulatory Guide 1.68, Appendix A, Section 2.b

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

The CEA drop-time testing is consistent with the recommendations of the regulatory guide; however, tests which do not provide meaningful data will be deleted. As outlined in the test summary in Subsection 14.2.12.3.4, the CEA drop time testing will have the following features:

a. One drop of each CEA will be conducted at hot, full-flow conditions.

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

c. Hot no-flow scram insertion rod drops will not be performed for YGN 3&4 reactors. The NSSS supplier has demonstrated that rod drop times under full-flow conditions are more limiting than the drop times under conditions of no-flow.

d. The CEA drop time test at the low-temperature plateau was eliminated since the hot, full-flow conditions are more bounding and since criticality is not allowed below 500°F (260°C) except for a short period of time during low-power physics testing.

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

14.2.7.1.2 Regulatory Guide 1.68, Appendix A, Appendix C, Section 3

These sections require that a neutron count rate of at least 1/2 count per second should be registered on the startup channels before the startup begins.

The NSSS supplier's design criteria call for a neutron count rate of 1/2 count per second with all CEAs fully withdrawn and a multiplication of 0.98. Therefore, before starting the initial approach to criticality, the startup channels may register significantly less than 1/2 count per second; but before exceeding a multiplication of 0.98, the desired neutron count rate of 1/2 count per second will have been achieved.

14.2.7.1.3 Regulatory Guide 1.68, Appendix C.4

The standard NSSS-Supplier test plateau power levels of 20, 50, 80, and 100% are used instead of the recommended power levels of 25, 50, 75, and 100%.

14.2.7.1.4 Regulatory Guide 1.68 Appendix A, Section 5.a

The complete set (20, 50, 80, and 100% power) of power reactivity coefficients will be measured at YGN 3. Since the YGN 4 core is essentially identical to the YGN 3 core, the power reactivity coefficients will be measured only at 50% and 100% power.

14.2.7.1.5 Regilatory Guide 1.68 Appendix A, Section 5.i

Since the plant protection system (core protection calculators (CPCs) and CEA Calculators (CEACs)) detects the CEA positions by means of two independent sets of reed-switch position transmitters and uses this information in determining margin to trip, it is not necessary to rely on incore or excore nuclear instrumentation to detect control element misalignment or drop. Thus, this testing will not be performed on YGN 3&4.

14.2.7.1.6 Regulatory Guide 1.68 Appendix A, Section M.M.

Section M.M. requires that the dynamic response of the plant to automatic closure of all main steam isolation valves (MSIVs) be demonstrated from full power. Performance of this test could result in the opening of primary and secondary safety valves. Instead, the dynamic response of the plant can be obtained during the performance of the turbine trip test when the turbine stop valves are closed. The turbine trip test from full power will result in an essentially similar dynamic plant response and should ensure that primary and secondary safety valves do not lift open during the performance of the test. For these reasons, the plant response to automatic closure of all MSIVs from full power will be not be demonstrated at YGN 3&4.

14.2.7.1.7 Regulatory Guide 1.68, Appendix A, Section K.K.

Section K.K. requires that the dynamic response of the plant to the most severe reduction in feedwater temperature be demonstrated from 50% and 90% power. The reduction in feedwater temperature results in only minor changes to RCS temperatures and pressure and reactor power. In addition, the performance of this test will result in unnecessary thermal cycling of the steam generator economizer valves. The performance of load rejection test and turbine trip test from full power provides sufficient information to verify design adequacy. Thus, the plant response to reduction in feedwater temperatures will not be demonstrated at YGN 3&4.

14.2.7.2 Regulatory Guide 1.79, Revision 1

The intent of Section C.1.c(2), "Isolation Valve Test", is satisfied by opening the valves under maximum differential pressure (reactor coolant system at ambient pressure) using normal electrical power only. Conditions at the valve motor are independent of the power source for this test. The breaker response and the response of the valves to the "confirmatory open" signal is verified during the integrated safety injection actuation system test.

14.2.7.3 Regulatory Guide 1.68.2, Revision 1

The regulatory guide requires that tests on each unit be conducted which verify the following (1) capability to shut down from outside the control room and to maintain the plant in a hot shutdown condition and (2) capability to cool down the plant from outside the control room.

Testing on YGN 3 will verify both objectives; however, on YGN 4 the capability to cool down the plant from outside the control room is not necessary and hence will not be performed. On YGN 4 the capability to shut down the plant from outside the control room and maintain the plant in hot shutdown conditions will not be demonstrated.

14.2.7.4 Regulatory Guide 1.68.3, April 1982

KEPCO will comply with the intent of Regulatory Guide 1.68.3; however, for YGN 3&4 the term "safety-related" is applied rather than the term "important to safety". To meet regulatory position C.8, individual safety-related components served by instrument air that must fail to a safe position will be tested for both a sudden loss of air and a gradual loss of air. 1

Although the instrument air system is non-safety-related, the auxiliary feedwater modulating control valves and provided with a safety-related backup nitrogen supply. These features will be tested to ensure that the backup nitrogen supply functions properly upon a loss of instrument air.

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

The TWG and the PNSC are responsible for ensuring that reactor operating and testing experiences of similar power plants are utilized during the initial test program. The primary sources of experience feedback material are the USNRC Licensee Event Reports sorted by system for 2 years preceding the initial test program. The plant manager is responsible for disseminating this feedback material to individuals designated the responsibility for review of test and operation procedures. During their review of assigned test and operation procedures, TWG and PNSC members are subsequently responsible for ensuring that pertinent feedback experiences are considered.

14.2.9 Trial Use of Plant Operating and Emergency Procedures

Plant operating procedures will be demonstrated during the preoperational testing program. Although they may be used in part or in whole while performing the system preoperational test, the operating procedure and verification will not be incorporated into the preoperational test. The test procedure is prepared to stand on its own and quite often makes use of special instrumentation, valve lineups, and other modes of operation that are used only during this particular test.

The schedule for preparation, review, and approval of plant operating and emergency procedures is specified in Chapter 13. This schedule provides sufficient time for confirming procedure adequacy by trial use during the test program.

The plant operating staff is responsible for confirmation of operating and emergency procedures. The plant manager is responsible for ensuring that comments and changes identified during confirmation are incorporated into finalized procedures.

14.2.10 Initial Core Loading and Initial Criticality

14.2.10.1 Initial Core Loading

Before commencing initial core loading, the required preoperational tests must be complete, the plant shall have a NSSC operating license, and there must 582 be an appropriately licensed operating staff. Overall direction, coordination, and control of the initial fuel loading evolution will be the responsibility of the plant manager. The senior reactor operator will direct and coordinate the preparation of, and assist in the performance of, the initial fuel loading procedures as part of initial startup test program. It is intended that qualified plant personnel will actually execute the procedures. The NSSS supplier will provide technical assistance during the initial fuel loading evolution.

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

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

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

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

Minimum instrumentation for fuel loading will consist of two temporary source range channels installed in the reactor vessel or one temporary channel and one permanently installed excore nuclear channel in the event that one of the temporary channels becomes inoperative. Both temporary and permanent channels will be response checked with a neutron source. The temporary channels will display neutron count rate on a count rate meter installed in the containment and will be monitored by personnel conducting the fuel loading operation. The permanent channel will display neutron count rate on a meter and strip chart recorder located in the main control room and will be monitored by licensed operators. In addition, at least one temporary channel and one permanent channel will be equipped with audible count rate indicators in two locations, temporary in the containment and permanent or temporary in the main control room.

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

Fuel assemblies, together with inserted components, will be placed in the reactor vessel one at a time according to a previously established and approved sequence that was developed to provide reliable core monitoring with minimum possibility of core mechanical damage. The initial fuel loading procedure will include detailed instructions that prescribe successive movements of each fuel assembly from its initial position in the storage racks to its final position in the core. The procedures will establish a system and a requirement for verification of each fuel assembly movement before proceeding with the next assembly. Multiple checks will be made for fuel assembly and inserted component serial numbers to guard against possible inadvertent exchanges or substitutions.

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

14.2.10.1.1 Safe Loading Criteria

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

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

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

A fuel assembly shall not be ungrappled from the refueling machine until stable count rates have been obtained. If an unexplained increase in count rate is observed on any nuclear channel, the last fuel assembly loaded shall be withdrawn. The procedure and loading operation will be reviewed and evaluated before proceeding to ensure the safe loading of fuel.

14.2.10.1.2 Fuel Loading Procedure

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

14.2.10.2 Initial Criticality

Overall direction, coordination, and control of the initial criticality evolution will be the responsibility of the plant manager. It is, however, intended that qualified plant personnel will actually execute the procedure. The NSSS supplier will provide technical assistance during the initial criticality evolution.

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

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

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

14.2.10.2.1 Safe Criticality Criteria

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

a. That variable over-power trip setpoints be reduced to a value equivalent to 5% power or less.

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

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

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

e. That the Technical Specifications be met.

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

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

14.2.11 Test Program Schedule

The schedule, relative to the initial fuel loading date, for conducting each major test phase of the initial test program is presented in Figure 14.2-2. This figure illustrates that the preoperational test program is scheduled for 18 months duration for each unit and that the subsequent power test program is scheduled for 6 months duration for each unit. Since Unit 4 fuel load is scheduled 12 months after Unit 3 fuel load, the initial startup test programs will not overlap. However, if schedule compression occurs, the staffing and organization of the groups responsible for the initial test programs will preclude significant divisions or dilutions of responsibility. Approved test procedures are intended to be available for NSSC review at least 60 days 582
prior to scheduled implementation.

14.2.12 Individual Test Descriptions

Individual tests are listed in the Tables 14.2-1 through 14.2-5. Individual abstracts are presented to identify each test by title and number, describe the test objectives, specify the test prerequisites, provide a summary description of the test method, and establish the test acceptance criteria.

14.2.12.1 Preoperational Tests

14.2.12.1.1 Reactor Coolant Pump Motor Initial Operation

1.0 Objective

1.1 To verify the proper operation of each reactor coolant pump (RCP) motor.

1.2 To collect base data for each RCP motor.

2.0 Prerequisites

2.1 RCP motor instrumentation has been calibrated.

2.2 Each RCP motor and its respective pump are uncoupled.

2.3 Support systems required for operation of each RCP motor are operational.

3.0 Test Method

3.1 Start circulating cooling water (CCW) flow to the RCP motor and observe indicating lights and alarms.

3.2 Using a torque wrench and phase rotation meter, rotate RCP motor and verify proper wiring of motor leads and torque required to rotate the motor.

3.3 Jog RCP motor and verify proper rotation.

3.4 Determine oil level setpoints of oil reservoirs by draining oil from motor reservoirs and subsequently refilling.

3.5 Start RCP motor and verify proper operation. Record motor operating data.

3.6 Simulate oil lift pumps and CCW system starting interlocks preventing RCP motor operation and observe effects.

4.0 Acceptance Criteria

4.1 The RCP motors, support systems, alarms, indications and interlocks perform as described in Subsection 5.4.1.

14.2.12.1.2 Reactor Coolant System

1.0 Objective

1.1 To perform the initial venting of the RCPs and reactor coolant system (RCS).

1.2 To perform the initial operation of the RCPs.

1.3 To verify RCP performance.

1.4 To verify alarm setpoints.

2.0 Prerequisites

2.1 Construction activities on the RCS and RCPs system have been completed.

2.2 RCP and RCS instrumentation has been calibrated.

2.3 Component cooling water is available.

2.4 RCP motor initial operation preoperational test has been completed.

2.5 Support systems required for operation of the RCPs and RCS sample isolation valves are operational.

3.0 Test Method

3.1 Simulate temperature, pressure, and flow signals from each RCP and verify alarm setpoints.

3.2 Simulate temperature signals from each RCS resistance temperature detector (RTD) that has an alarm function and verify alarm setpoints.

3.3 Perform initial venting of RCPs, pressurizer, and reactor vessel.

3.4 Perform initial run of RCPs. Vent the RCS after each run is complete.

4.0 Acceptance Criteria

4.1 RCS and RCP performance and alarms are as described in Subsections 5.4.1 and 5.4.3.

14.2.12.1.3 Pressurizer Pressure and Level Control Systems

1.0 Objective

1.1 To verify the proper operation of the pressurizer pressure and level control systems.

2.0 Prerequisites

2.1 Construction activities on the pressurizer pressure and level control systems have been completed.

2.2 Pressurizer pressure and level control system instrumentation has been calibrated.

2.3 Support systems required for operation of components in the pressurizer pressure and level control systems are operational.

3.0 <u>Test Method</u>

3.1 Close and open backup heater breakers from the main control room. Observe breaker operation and indicating light response.

3.2 Simulate a decreasing pressurizer pressure and verify proper outputs to the heater control circuits. Verify alarm setpoints.

3.3 Simulate an increasing pressurizer pressure and verify proper outputs to the heater and spray valves control circuits. Verify alarm setpoints.

3.4 Simulate a low level error in the pressurizer and verify proper outputs to the charging pump control circuit. Verify alarm setpoints.

3.5 Simulate a high level error in the pressurizer and verify proper outputs to the pressurizer backup heater and the letdown valve control circuits. Verify alarm setpoints.

3.6 Simulate signals to pressurizer pressure and level controllers and verify proper outputs.

3.7 Simulate a low-low pressurizer level and verify proper system outputs.

3.8 Simulate a low pressurizer level and verify proper output signals to the letdown valve control circuits.

4.0 Acceptance Criteria

4.1 Pressurizer pressure and level control systems perform as described in Subsection 7.7.1.

14.2.12.1.4 Reactor Coolant System Cold Hydrostatic Test

1.0 Objective

1.1 To verify the integrity of the RCS pressure boundary and associated safety Class 1 piping.

2.0 Prerequisites

2.1 The RCS is filled, vented, and at the required temperature.

2.2 The reactor coolant pumps are operable.

2.3 Support systems are available as necessary to perform plant heat up and RCS pressurization.

2.4 Pressurizer safety valves are removed and blind flanges installed as necessary.

2.5 Permanently installed instrumentation necessary for testing is operable and calibrated.

2.6 Test instrumentation is available and calibrated.

3.0 Test Method

3.1 Operate RCPs to sweep gases from the steam generator tubes.

3.2 Vent the RCS to remove air pockets.

3.3 Operate the RCPs to increase the RCS temperature.

3.4 Increase RCS pressure using chemical and Volume control system (CVCS).

3.5 Perform the test in accordance with the ASME code.

4.0 Acceptance Criteria

4.1 The RCS hydrostatic test meets the requirements of ASME Boiler and Pressure Vessel Code, Section III.

14.2.12.1.5 Secondary Hydrostatic Test

1.0 Objective

1.1 To hydrostatically test the secondary side of the steam generators and associated portions of the main steam, feedwater, blowdown, and emergency feedwater systems.

2.0 Prerequisites

2.1 Construction activities on the steam-generator secondary side are complete.

2.2 The RCS is available to be pressurized and the RCPs are operable.

2.3 The main steam safety valves are removed and blind flange installed.

2.4 Temporary hydro pump and relief valves are installed.

2.5 Temporary instrumentation calibrated and installed.

2.6 Systems required to support the operation the RCS and RCPs are available.

2.7 Any plant instrumentation not able to withstand hydro pressure is removed from service.

3.0 Test Method

3.1 Fill and vent the steam generators and chemically treat as required.

3.2 Operate the RCS and associated systems as needed to operate the RCPs. Heat the RCS and steam generators to the required temperature.

3.3 Pressurize the primary side as required to maintain less than maximum secondary-to-primary differential pressure.

3.4 Pressurize the steam generator to the hydrostatic test pressure.

3.5 Perform an inspection of all designated items and record any discrepancies.

4.0 Acceptance Criteria

4.1 The secondary hydrostatic test meets the requirements as stated in the technical manual and the ASME Boiler and Pressure Vessel Code, Section III.

14.2.12.1.6 Reactor Coolant Gas Vent System*

1.0 Objective

1.1 To verify valve operation for the reactor coolant gas vent piping.

2.0 Prerequisites

2.1 The reactor coolant gas vent system is installed and required construction acceptance testing is complete.

2.2 Hot functional testing is in progress.

2.3 The reactor drain tank is operable.

3.0 Test Method

3.1 Demonstrate each flow path for the reactor coolant gas vent system and proper operation of system valves.

3.2 Demonstrate RCS depressurization capability.

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* Test to be done during hot functional test also.

4.0 Acceptance Criteria

Reactor coolant gas vent system flow paths and valve operations are satisfactory per Section 5.4.15.

14.2.12.1.7 Safety Injection Tank Subsystem

1.0 Objective

1.1 To demonstrate the proper operation of the safety injection tank subsystem.

2.0 Prerequisites

2.1 Construction activities on the safety injection tank subsystem have been completed.

2.2 Support systems required for the operation of the safety injection tank subsystem are complete and operational.

2.3 Adequate supply of makeup water from the refueling water tank (RWT) is available.

2.4 The reactor vessel head and internals have been removed.

2.5 The reactor vessel is filled above the hot-leg injection nozzles.

2.6 Safety injection tank subsystem instrumentation has been checked and calibrated.

3.0 Test Method

3.1 Operate control valves from all appropriate control locations and observe valve operation and position indication. Where required, measure valve opening and closing times.

3.2 Simulate failed conditions and observe valve response.

3.3 Simulate a safety injection actuation signal (SIAS) and observe valve interlock and alarm operation.

3.4 Fill the safety injection tanks from the RWT and observe level indication and alarm operation.

3.5 Pressurize the safety injection tanks and observe pressure indication and alarm operation.

3.6 Simulate an SIAS to each safety injection tank and measure the time required for the safety injection tanks to discharge their contents to the RCS.

4.0 Acceptance Criteria

4.1 The safety injection tank subsystem performs as described in Subsection 6.3.2.

14.2.12.1.8 High-Pressure Safety Injection Subsystem

1.0 Objective

1.1 To functionally test the operation and performance of the components within the high-pressure safety injection (HPSI) subsystem including valve and pump performance.

1.2 To verify proper HPSI subsystem response to simulated SIASs and recirculation actuation signals (RASs) using both normal and emergency power sources.

1.3 To flow balance the HPSI header valves.

2.0 Prerequisites

2.1 Construction activities have been completed on the HPSI subsystem.

2.2 Support systems required for operation of the HPSI subsystem are complete and operational.

2.3 The refueling water tank is filled with sufficient primary makeup water to conduct the test on the HPSI subsystem.

2.4 The reactor vessel head and internals have been removed.

2.5 Test instrumentation to be used for pump performance has been installed and calibrated.

2.6 HPSI subsystem instrumentation has been checked and calibrated.

3.0 Test Method

3.1 Operate control valves from all appropriate control locations and observe valve operation and position indication. Where required, measure opening and closing times.

3.2 Simulate failed conditions and observe valve response.

3.3 Set HPSI header discharge valves to obtain designed balanced flow.

3.4 Start each HPSI pump using a simulated SIAS and collect initial pump operating data. For this portion of the test, the pumps will be aligned to discharge to the depressurized RCS with appropriate discharge valves throttled and calibrated instrumentation installed to verify that HPSI pump flow and discharge pressure conform to the manufacturer's head-flow curve. This test shall be performed using both normal and emergency power. Suction will be taken from the RWT under maximum flow conditions in the combined suction header. Measured suction head shall conform to the manufacturer's net positive suction head (NPSH) requirements when corrected for minimum RWT level attainable during a simulated SIAS and maximum RWT fluid temperature.

3.5 Simulate an RAS and observe HPSI valve response.

4.0 Acceptance Criteria

4.1 The high-pressure safety injection system performs as described in Subsection 6.3.2 to provide adequate flow (manufacturer's curves) under minimum actual suction head to maintain RCS inventory and/or cool the core for those RCS breaks and transients in the scope of the safety analysis (Chapters 6.0 and 15.0).

4.2 HPSI pump performance is in accordance with manufacturer's NPSH and head-flow curves.

4.3 HPSI suction automatically shifts to the containment sump following simulation of depletion of the RWT inventory.

4.4 HPSI header valves have been flow balanced.

14.2.12.1.9 Low-Pressure Safety Injection Subsystem

1.0 Objective

1.1 To functionally test the operation and performance of the components within the low-pressure safety injection (LPSI) subsystem including valve and pump performance.

1.2 To verify the LPSI subsystem responds properly to a simulated SIAS and RAS using both normal and emergency flow paths.

1.3 To flow balance the LPSI header valves.

2.0 Prerequisites

2.1 Construction activities have been completed on the LPSI subsystem.

2.2 Support systems required for operation of the LPSI subsystem are complete and operational.

2.3 The refueling water tank is filled with sufficient primary makeup water to conduct the test on the LPSI subsystem.

2.4 The reactor vessel head and internals have been removed.

2.5 Test instrumentation to be used for pump performance has been installed and calibrated.

2.6 LPSI subsystem instrumentation has been checked and calibrated.

3.0 Test Method

3.1 Operate control valves from all appropriate control locations and observe valve operation and position indication. Where required measure opening and closing times.

3.2 Simulate failed conditions and observe valve response.

3.3 Set LPSI header discharge valves to obtain design balanced flow.

3.4 Start each LPSI pump using a simulated SIAS and collect initial pump operating data. For this portion of the test, the pumps will be aligned to discharge to the depressurized RCS with appropriate discharge valves throttled and calibrated instrumentation installed to verify that LPSI pump flow and discharge pressure conform to the manufacturer's head-flow curve. This test shall be performed using both normal and emergency power. Suction will be taken from the RWT under maximum flow conditions in the combined suction header. Measured suction head shall conform to the manufacturer's NPSH requirements when corrected for minimum RWT level attainable during an SIAS and maximum RWT fluid temperature.

3.5 Simulate an RAS signal and observe LPSI response.

3.6 Lineup the shutdown cooling system and observe shutdown cooling system flow indications.

4.0 Acceptance Criteria

4.1 The low-pressure safety injection system performs as described in Subsection 6.3.2 to provide adequate flow (manufacturer's curves) under minimum actual suction head to maintain RCS inventory and/or cool the core for those RCS breaks and transients in the scope of the safety analysis (Chapters 6.0 and 15.0).

4.2 LPSI pump performance is in accordance with manufacturer's NPSH and head-flow curves.

4.3 LPSI pump automatically stops on a RAS.

4.4 LPSI header valves have been flow balanced.

14.2.12.1.10 Shutdown Cooling Subsystem*

1.0 Objective

1.1 To demonstrate proper operation of the shutdown cooling subsystem.

2.0 Prerequisites

2.1 Construction activities on the shutdown cooling subsystem have been completed.

2.2 Shutdown cooling subsystem instrumentation has been checked and calibrated.

2.3 All lines in the shutdown cooling subsystem have been filled and vented.

2.4 Support systems required for the operation of the shutdown cooling subsystem are operational.

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* Test to be done during hot functional test also.

3.0 Test Method

3.1 Operate control valves from all appropriate control locations and observe valve operation and position indication.

3.2 Simulate failed conditions and observe valve response.

3.3 Simulate a high pressurizer pressure signal to the shutdown cooling system valves and observe valve response and alarm operation.

4.0 Acceptance Criteria

4.1 The shutdown cooling subsystem performs as described in Subsection 5.4.7.

14.2.12.1.11 Containment Spray Nozzle

1.0 Objective

1.1 To demonstrate that the spray nozzles in the containment spray header are clear of obstructions.

2.0 Prerequisites

2.1 The compressed air system is available to pressurize the spray headers.

3.0 Test Method

3.1 Airflow is initiated through the containment spray headers, and unobstructed flow is verified through each nozzle.

4.0 Acceptance Criteria

4.1 All containment spray nozzles are clear and unobstructed, as evidenced by air passing through each nozzle.

14.2.12.1.12 Containment Spray System

1.0 Objective

1.1 To demonstrate the operation of system components, including their response to safety signals, and verify that the associated instrumentation and controls are functioning properly. System flow characteristics in the test and simulated accident modes are also verified.

2.0 Prerequisites

2.1 Required construction acceptance tests, instrument calibration, and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The refueling water tank contains an adequate supply of demineralized water for the performance of this test.

3.0 Test Method

3.1 Performance characteristics of the containment spray pumps are verified in the test mode, recirculating to the refueling water tank.

3.2 System component control circuits are verified, including the operation of system pumps and valves on receipt of safety signals.

3.3 During system operation, the spray additive pump operations are verified.

4.0 Acceptance Criteria

4.1 Containment spray pump performance is in accordance with manufacturer's NPSH and head flow curves.

4.2 Containment spray pump, spray additive pump, and valve response to safety signals is verified, and the associated response times are in accordance with safety analysis assumptions.

4.3 Spray additive pump operates in accordance with manufacturer's performance data.

14.2.12.1.13 Combustible Gas Control System

1.0 Objectives

1.1 To demonstrate that the hydrogen recombiner performance characteristics are within design specifications. Applicable test from YGN 1&2 may be used in lieu of additional testing.

1.2 To demonstrate operability of system valves.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are operational.

3.0 Test Method

3.1 Performance characteristics are recorded while the hydrogen recombiners are operating, unless the YGN 1&2 test results are used.

3.2 System valve control circuits are verified, including the response of containment isolation valves to a CIAS.

4.0 Acceptance Criteria

4.1 Hydrogen recombiner performance characteristics are within design specifications, unless the YGN 1&2 test results are used.

4.2 Containment isolation valves close on receipt of a CIAS. Valve closure times are within the maximum time given in Subsection 6.2.4.

14.2.12.1.14 Containment Structural Integrity

1.0 Objective

1.1 To demonstrate the structural integrity of the reactor containment building.

2.0 Prerequisites

2.1 Containment penetrations are installed, and penetration leak tests are complete.

2.2 Containment penetrations, including equipment hatches, emergency airlock, and personnel airlocks, are closed.

3.0 Test Method

3.1 The containment is pressurized at 115% of the design pressure and deflection measurements, and concrete crack inspections are made to determine that the actual structural response is within the limits predicted by the design analyses.

4.0 Acceptance Criteria

4.1 The containment structural response is within the limits predicted by design analysis.

14.2.12.1.15 Containment Integrated Leak Rate : Type A

1.0 Objective

1.1 To demonstrate that the total leakage from the containment does not exceed the maximum allowable leakage rate at the calculated peak containment internal pressure.

2.0 Prerequisites

2.1 The containment penetration leakage rate tests (type B tests) and the containment isolation valve leakage tests (type C tests) are complete.

2.2 Containment isolation valves are closed by normal actuation methods.

2.3 Containment penetrations, including equipment hatches and personnel airlocks, are closed.

2.4 Portions of fluid systems that are part of the containment boundary, and which may be opened directly to the containment or outside atmosphere under postaccident conditions, are opened or vented to the appropriate atmosphere to place the containment in as close to postaccident conditions as possible.

3.0 Test Method

3.1 The integrated containment leak rate test (type A test) is conducted using the methods and provisions of ANSI/ANS-56.8. Measurements of containment atmosphere dry-bulb temperature, dewpoint, and pressure are taken to calculate the leakage rate. A standard statistical analysis of data is conducted, using a linear least squares fit regression analysis to calculate the leakage rate.

3.2 On completion of the leak rate test, a verification test is conducted to confirm the capability of the data acquisition and reduction system to satisfactorily determine the calculated integrated leakage rate. The verification test is accomplished by imposing a known leakage rate on the containment, or by pumping back a known quantity of air into the containment through a calibrated flow measurement device.

4.0 Acceptance Criteria

4.1 The containment integrated leakage does not exceed the maximum allowable leakage rate at a calculated peak containment internal pressure, as defined in 10 CFR 50, Appendix J.

14.2.12.1.16 Volume Control Tank Subsystem

1.0 Objective

1.1 To verify proper operation of the volume control tank (VCT) subsystem.

2.0 Prerequisites

2.1 Construction activities on the VCT subsystem have been completed.

2.2 VCT subsystem instrumentation has been calibrated.

2.3 Reactor makeup water (RMW) is available to the VCT.

2.4 Support systems required for operation of the VCT are complete and operational.

3.0 Test Method

3.1 Operate control valves from all appropriate control positions. Observe valve operation and position indication and, where required, measure opening and closing times.

3.2 Simulate failed conditions and observe valve response.

3.3 Partially fill the VCT with RMW and pressurize the VCT using the nitrogen pressurization system. Observe alarm operation.

3.4 Vent the VCT and repressurize using the hydrogen pressurization system. (The hydrogen system will be temporarily connected to a nitrogen supply).

3.5 Drain and refill the VCT with RMW. Observe level alarms and interlocks.

3.6 Simulate VCT temperature and observe alarms.

4.0 Acceptance Criteria

4.1 The volume control tank subsystem performs as described in Subsection 9.3.4.

14.2.12.1.17 CVCS Charging Subsystem

1.0 Objective

1.1 To verify the proper performance of the chemical and volume control system charging subsystem.

2.0 Prerequisites

2.1 Construction activities on the CVCS charging subsystem have been completed.

2.2 CVCS charging subsystem instrumentation has been calibrated.

2.3 The VCT subsystem is operational to supply charging pump suction.

2.4 The reactor vessel is ready to receive water from the charging headers.

2.5 The pressurizer is ready to receive water from the auxiliary spray line.

2.6 Reactor coolant pumps are operational.

2.7 Support systems required for operation of the reactor coolant charging subsystem are operational.

3.0 <u>Test Method</u>

3.1 Operate control valves from all appropriate control positions, observe valve operation and position indication, and where required, measure opening and closing times.

3.2 Simulate failed conditions and observe valve response.

3.3 Manually start each charging pump seal lube pump and observe the operation of the seal and lube oil system.

3.4 Manually start each charging pump. Observe charging pump operation including charging pump alarms and interlocks.

3.5 Simulate pressurizer level error signals and observe charging pump response.

3.6 With a charging pump running, open the seal injection lines and observe flow.

3.7 With a charging pump running, open the auxiliary spray valve and observe flow.

4.0 <u>Acceptance Criteria</u>

4.1 The chemical and volume control system charging subsystem performs as described in Subsection 9.3.4.

14.2.12.1.18 CVCS Letdown Subsystem

1.0 Objective

1.1 To verify the proper operation of the chemical and volume control system letdown subsystem during normal and emergency operation.

2.0 Prerequisites

2.1 Construction activities on the CVCS letdown subsystem have been completed.

2.2 CVCS letdown subsystem instrumentation has been calibrated.

2.3 Support systems required for the operation of the CVCS letdown subsystem control valves are operational.

3.0 Test Method

3.1 Operate control valves from all appropriate control positions, observe valve operation and position indications, and where required, measure opening and closing times.

3.2 Simulate failed conditions and observe valve response.

3.3 Simulate SIAS/CIAS and observe isolation valve response.

3.4 Simulate letdown temperature and observe the response of control valves. Observe alarm and interlock operation.

3.5 Simulate letdown pressure and observe the response of the back-pressure control valves. Observe alarm operation.

4.0 Acceptance Criteria

4.1 The CVCS letdown subsystem performs as described in Subsection 9.3.4.

14.2.12.1.19 CVCS Purification Subsystem

1.0 Objective

1.1 To verify flowpaths between the reactor makeup water system, the purification and deborating ion exchangers, and the solid radwaste system.

1.2 To verify flowpaths between the purification and deborating ion exchanger and room vent.

2.0 Prerequisites

2.1 Construction activities on the CVCS purification subsystem have been completed.

2.2 CVCS purification subsystem instrumentation has been calibrated.

2.3 Special test gauge has been calibrated.

2.4 Support systems required for operation of the CVCS purification subsystem are complete and operational.

3.0 Test Method

3.1 Line up the purification system ion exchangers to complete a flowpath from the reactor makeup water (RMW) subsystem through each purification ion exchanger to the solid radwaste system. Start an RMW pump and sequentially, so that only one ion exchanger is in use at a time, valve-in each ion exchanger.

Verify flow by observing RMW flow indicators and changes in RMW and spent resin tank levels. Select all possible flow paths to the solid radwaste system.

3.2 Individually connect each purification ion exchanger and the deborating ion exchanger to the plant air system and connect a pressure gauge to the ion exchanger vent. Adjust the plant air supply to required values. Start air flow to the ion exchangers and individually open each ion exchanger vent valve and valve the ion exchanger to the room vent. Observe the ion exchanger vent pressure, gas supply pressure and flowrate.

4.0 Acceptance Criteria

4.1 Verification of flowpaths between the RMW system, the radwaste purification and deborating ion exchangers, and the solid radwast system will have been demonstrated upon successful completion of Test Method 3.1.

4.2 Verification of flow paths between the purification and deborating ion exchangers and the will have been demonstrated upon successful completion of Test Method 3.2.

14.2.12.1.20 Chemical Addition Subsystem

1.0 Objective

1.1 To demonstrate that the chemical addition subsystem can inject water into the charging pump discharge line.

1.2 To verify a flowpath from the chemical addition tank to the equipment drain tank.

2.0 Prerequisites

2.1 Support systems required for operation of the chemical addition subsystem are complete and operational.

2.2 The chemical addition tank has been filled from the makeup system with a predetermined amount of RMW.

2.3 Charging subsystem is in operation.

2.4 Associated instrumentation has been calibrated.

3.0 Test Method

3.1 With a charging pump in operation, start the chemical addition pump and observe the chemical addition tank level.

3.2 Valve the chemical addition tank to drain to the equipment drain tank and observe the chemical addition tank level.

4.0 Acceptance Criteria

4.1 Chemical addition to charging pump suction is demonstrated when Test Method 3.1 is completed with a decreasing chemical addition tank level.

4.2 A flow path to the equipment drain tank is demonstrated when Test Method 3.2 is completed with a decreasing chemical addition tank level.

14.2.12.1.21 Reactor Drain Tank Subsystem

1.0 Objective

1.1 To verify the proper performance of the reactor drain tank (RDT) subsystem.

2.0 Prerequisites

2.1 Construction activities on the reactor drain tank subsystem have been completed.

2.2 Reactor drain tank subsystem instrumentation has been calibrated.

2.3 Equipment drain tank subsystem is ready to accept water from the reactor drain tank.

2.4 Plant nitrogen system is operational.

2.5 Support systems required for operation of the reactor drain tank subsystem are operational.

3.0 Test Method

3.1 Operate control valves from all appropriate control positions, observe valve operation and position indication, and where required, measure opening and closing times.

3.2 Simulate failed conditions and observe valve response.

3.3 Simulate a CIAS and observe isolation valve response.

3.4 Fill the reactor drain tank from any convenient source and observe level and pressure indications and alarms.

3.5 Using the N_2 system, pressurize the RDT and observe indication and alarms.

3.6 Lineup the reactor drain tank (RDT) to the equipment drain tank and drain the RDT using each reactor drain pump. Observe level and pressure indicators, alarms, and interlocks.

3.7 Simulate RDT temperature and observe indicators and alarms.

4.0 Acceptance Criteria

4.1 The reactor drain tank subsystem performs as described in Subsection 9.3.4.

14.2.12.1.22 Equipment Drain Tank Subsystem

1.0 Objective

1.1 To verify the proper performance of the equipment drain tank (EDT) subsystem.

2.0 Prerequisites

2.1 Construction activities on the EDT subsystem have been completed.

2.2 EDT subsystem instrumentation has been calibrated.

2.3 Holdup tank subsystem is operational.

2.4 Reactor drain tank subsystem is operational.

2.5 Reactor makeup subsystem is operational.

3.0 Test Method

3.1 Operate control valves from all appropriate control positions and observe valve operation and position indication.

3.2 Simulate fail conditions and observe valve response.

3.3 Fill the EDT from the reactor makeup water subsystem and observe indications, alarms, and interlocks.

3.4 Drain the EDT using a reactor drain pump and observe indications alarms and interlocks.

3.5 Simulate high EDT temperature and observe indications and alarms.

3.6 Simulate high EDT pressure and observe indications and alarms.

4.0 Acceptance Criteria

4.1 The equipment drain tank subsystem performs as described in Subsection 9.3.4.

14.2.12.1.23 Boric Acid Batching Tank Subsystem

1.0 Objective

1.1 To verify proper operation of the boric acid batching tank subsystem.

2.0 Prerequisites

2.1 Construction activities on the boric acid batching tank subsystem have been completed.

2.2 The refueling water tank subsystem is operational.

2.3 Support systems required for operation of the boric acid batching tank are complete and operational.

3.0 Test Method

3.1 Fill the boric acid batching tank with water from the RMW system. Energize heaters and measure the length of time required to heat the tank. Observe heater control setpoints.

3.2 Line up the boric acid batching tank to the refueling water tank, start a boric acid makeup pump, and observe the batching tank level.

3.3 Refill the boric acid batching tank, dissolve boric acid crystals, and start the batch tank mixer. Take samples as the tank is drained to the equipment drain tank and determine the boric acid concentration.

4.0 Acceptance Criteria

4.1 The boric acid batching tank subsystem performs as described in Subsection 9.3.4.

14.2.12.1.24 Refueling Water Tank Subsystem

1.0 Objective

1.1 To verify the proper performance of the refueling water tank subsystem.

2.0 Prerequisites

2.1 Construction activities on the RWT subsystems have been completed.

2.2 RWT subsystem instrumentation has been calibrated.

2.3 The CVCS charging subsystem is complete and operational.

2.4 The VCT subsystem is complete and operational.

2.5 The boric acid batching tank subsystem is complete and operational.

2.6 Support systems required for operation of the concentrated boric acid and RWT subsystems are complete and operational.

3.0 Test Method

3.1 Operate control valves from all appropriate control positions, observe valve operation and position indication, and where required, measure opening and closing times.

3.2 Simulate failed conditions and observe valve response.

3.3 Fill the RWT with RMW from the boric acid batching tank subsystem and observe level alarm setpoints.

3.4 Operate each boric acid makeup (BAMU) pump and observe pump performance.

3.5 Operate BAMU pumps utilizing all interconnections between BAMU pumps and RWT.

3.6 Line up the BAMU pumps to charging pump suction and verify the ability of the BAMU pumps to supply adequate flow to the charging pumps.

3.7 Line up the RWT to charging pump suction and verify that adequate flow is delivered to the charging pumps.

3.8 Simulate high and low RWT levels and observe alarms, indications, and interlocks.

3.9 Simulate high and low RWT temperature and observe indications and alarms.

3.10 Line up the BAMU pumps to the VCT and verify that the makeup system is capable of supplying BAMU and RMW to the VCT and charging pump suction at the selected rates and quantities in all modes of operation. Observe alarms and interlocks.

3.11 Simulate boric acid filter differential pressure and observe indication and alarm.

4.0 Acceptance Criteria

4.1 The refueling water tank subsystem performs as described in Subsection 9.3.4.

14.2.12.1.25 Reactor Makeup Subsystem

1.0 Objective

1.1 To verify the performance of the reactor makeup subsystem.

2.0 Prerequisites

2.1 Construction activities on the reactor makeup subsystem have been completed.

2.2 Reactor makeup subsystem instrumentation has been calibrated.

2.3 Plant makeup water system is operational.

2.4 Support systems required for the operation of the reactor makeup subsystem are complete and operational.

3.0 Test Method

3.1 Operate control valves from all appropriate control positions and observe valve operation and position indication.

3.2 Simulate failed conditions and observe valve response.

3.3 Fill the reactor makeup water tank and observe level indications and alarms.

3.4 Simulate reactor makeup water tank temperature and observe indications and alarms.

3.5 Drain the reactor makeup water tank using each RMW pump. Observe tank level and pump discharge pressure, indications, and alarms.

3.6 Simulate RMW filter differential pressure and observe indications and alarms.

4.0 Acceptance Criteria

4.1 The reactor makeup subsystem performs as described in Subsection 9.3.4.

14.2.12.1.26 Holdup Subsystem

1.0 Objective

1.1 To verify proper operation of the holdup subsystem.

2.0 Prerequisites

2.1 Construction activities on the hold subsystem have been completed.

2.2 Holdup subsystem instrumentation has been calibrated.

2.3 Boric acid concentrator is ready to receive water from the holdup tank.

2.4 Support systems required for operation of the holdup subsystem are complete and operational.

3.0 Test Method

3.1 Fill the holdup tank and observe level indications and alarms.

3.2 Simulate holdup tank temperature and observe indications and alarms.

3.3 Using each holdup pump, drain the holdup tank to the boric acid concentrator. Observe holdup tank level indications, alarms, interlocks, and holdup pump discharge pressure.

3.4 Refill and isolate the holdup tank. Open the holdup tank recirculation valves and start each holdup pump. Observe tank level. Line up the holdup pumps to the reactor drain filter and observe holdup tank level.

4.0 Acceptance Criteria

4.1 The holdup subsystem performs as described in Subsection 9.3.4.

14.2.12.1.27 Boric Acid Concentrator Subsystem

1.0 Objective

1.1 To verify the performance of the boric acid concentrator subsystem.

2.0 Prerequisites

2.1 Construction activities have been completed on the boric acid concentrator subsystem.

2.2 Support systems required for operation of the boric acid concentrator are complete and operational.

2.3 Boric acid concentrator subsystem instrumentation has been calibrated.

3.0 Test Method

3.1 Operate control valves from all appropriate control positions and observe valve operation and position indication.

3.2 Simulate failed conditions and observe valve response.

3.3 Simulate interlock signals from interfacing equipment and observe boric acid concentrator subsystem response observe alarms.

3.4 Line up the boric acid concentrator subsystem to interfacing systems and, using appropriate operating modes and indications, establish flow paths to these systems.

4.0 Acceptance Criteria

4.1 The boric acid concentrator subsystem performs as described in Subsection 9.3.4.

14.2.12.1.28 Gas Stripper Subsystem

1.0 Objective

1.1 To verify proper operation of the gas stripper subsystem.

2.0 Prerequisites

2.1 Construction activities have been completed on the gas stripper subsystem.

2.2 Gas stripper subsystem instrumentation has been calibrated.

2.3 Support systems required for the operation of the gas stripper subsystem are operational.

3.0 Test Method

3.1 Operate control valves from all appropriate control positions and observe valve operation and position indications.

3.2 Simulate failed conditions and observe valve response.

3.3 Simulate interlock signals from interfacing equipment and observe gas stripper subsystem response.

3.4 Line up the gas stripper subsystem to interfacing systems and, using appropriate operating modes and indications, establish flow paths to these systems.

3.5 Observe alarms.

4.0 Acceptance Criteria

4.1 The gas stripper subsystem performs as described in Subsection 9.3.4.

14.2.12.1.29 Boronometer Subsystem

1.0 Objective

1.1 To demonstrate proper operation of the boronometer electronics system.

2.0 Prerequisites

2.1 The boronometer has been calibrated and is operational.

2.2 Support systems required for boronometer subsystem operation are complete and operational.

3.0 Test Method

3.1 Utilizing the built-in test features observe boronometer indications, outputs to interface equipment, and alarm operation.

4.0 Acceptance Criteria

4.1 The boronometer subsystem performs as described in Subsection 9.3.4.

14.2.12.1.30 Letdown Process Radiation Monitor Subsystem

1.0 Objective

1.1 To demonstrate proper operation of the letdown process radiation monitor subsystem.

2.0 Prerequisites

2.1 The process radiation monitor has been installed, all interconnections have been completed, and the sample chamber has been filled with reactor makeup water.

2.2 The process radiation monitor has been calibrated.

2.3 A check source is available.

2.4 Support systems required for operation of the process radiation monitor subsystem are complete and operational.

3.0 Test Method

3.1 Utilizing the built-in test features, observe process monitor indications, outputs to interface equipment, and alarm operation.

3.2 Utilizing the check source, verify calibration of the process monitor.

4.0 Acceptance Criteria

4.1 The letdown process radiation monitor subsystem performs as described in Subsection 9.3.4.

14.2.12.1.31 Steam-Generator Blowdown System*

1.0 Objective

1.1 To demonstrate the ability of the steam-generator blowdown system, in conjunction with the chemical feed and handling system, to maintain steam generator water chemistry within the prescribed limits. Demonstrate proper system response to an auxiliary feedwater actuation signal (AFAS).

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The turbine building closed cooling water system is available.

2.4 The condensate system is available.

2.5 The nonradioactive equipment vents and drains.

2.6 The waste water transfer system is available.

2.7 The component cooling water system is available.

---

* Test to be done during hot function test also.

3.0 Test Method

3.1 Initiate an AFAS and observe operation of affected valves. Cycle all control and isolation valves and observe proper operation. Demonstrate proper operation of steam generator blowdown mixed demineralizer, flash tanks, and regenerative and nonregenerative heat exchangers, filters, and associated controls. Demonstrate the ability to process water to the condenser and to the waste water transfer system via the equipment driven system.

4.0 Acceptance Criteria

4.1 System valves respond properly to an AFAS.

4.2 Steam generator blowdown system operates as described in Subsection 10.4.8.

14.2.12.1.32 Steam-Generator Wet Lay-Up Chemical Control System

1.0 Objective

1.1 To demonstrate the ability to add ammonia or hydrazine to the steam generators and the ability to recirculate the water in the steam generators.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 Steam generators are prepared to be placed in wet lay-up condition with proper chemistry control.

3.0 Test Method

3.1 Add appropriate wet lay-up chemicals to steam generators. Recirculate each generator and record pump performance characteristics and system response. Perform steam generator water samples and change concentrations in each steam generator during wet lay-up conditions.

4.0 Acceptance Criteria

4.1 Chemicals can be added to the steam generators. The steam generator water can be recirculated in accordance with system design requirements.

14.2.12.1.33 Component Cooling Water System

1.0 Objective

1.1 To demonstrate the capability of the component cooling water system to provide cooling water during the normal, startup, shutdown, and post-LOCA modes of operation.

1.2 To demonstrate the operating characteristics of the component cooling water pumps and verify that the associated instrumentation and controls are functioning properly, including system response to safety signals.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The essential service water system is available to supply cooling water to the CCW heat exchangers.

3.0 Test Method

3.1 System operating characteristics are verified in the normal, startup, shutdown, and post-LOCA modes of operation.

3.2 Safety signals are simulated and the response of system pumps and valves is verified.

4.0 Acceptance Criteria

4.1 The performance characteristics of each component cooling water pump are in accordance with manufacturer's NPSH and head flow curves.

4.2 Components supplied by the component cooling water system receive flows that are within design specifications with the system operating in the normal, startup, shutdown, and post-LOCA modes.

4.3 Component cooling water pump and valve responses to load sequence, containment isolation, safety injection actuation signals, and recirculation actuation signals are as described in Subsection 9.2.2.

14.2.12.1.34 Essential Service Water System

1.0 Objectives

1.1 To demonstrate the capability of the essential service water system to provide cooling water during normal and emergency operating conditions.

1.2 To demonstrate the operating characteristics of the essential service water pumps and verify that the associated instrumentation function properly, including system response to safety signals.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The circulating water system discharge header is available to receive cooling water effluent.

3.0 Test Method

3.1 The system will be operated in normal and emergency modes to demonstrate proper operation. Safety signals are initiated and response of system pumps is observed.

4.0 Acceptance Criteria

4.1 The performance characteristics of each essential service water pump are in accordance with manufacturer's NPSH and head flow curves.

4.2 The component cooling heat exchangers receive flows that are within design specifications.

4.3 Essential service water pumps and valves respond to load sequence and safety injection actuation signals as described in Subsection 9.2.1.

14.2.12.1.35 Spent Fuel Pool Cooling and Cleanup System

1.0 Objectives

1.1 To demonstrate the operating characteristics of the spent fuel pool cooling pumps, spent fuel pool cleanup pumps, and pool skimmers, and verify that the associated instrumentation and controls are functioning properly.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The component cooling water system is available to provide cooling water to the spent fuel pool cooling heat exchangers.

2.4 The radioactive drain system is available to drain the refueling pool.

2.5 The spent fuel pool and fuel transfer canals are filled to their normal operating levels.

3.0 Test Method

3.1 The spent fuel pool cooling pumps, spent fuel pool cleanup pump, and pool skimmers are operated in their various modes, and pump operating data are recorded.

3.2 System component control circuits are verified.

4.0 Acceptance Criteria

4.1 The operating characteristics of the spent fuel pool cooling pumps, spent fuel pool cleanup pumps, and pool skimmers are as described in Subsection 9.1.3.

4.2 Each spent fuel pool cooling pump trips on a low-low spent fuel pool level signal.

14.2.12.1.36 Gaseous Radwaste System

1.0 Objective

1.1 To demonstrate operation of the sample pump and operability of system valves.

1.2 To verify that system instrumentation and controls function properly.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The nitrogen gas system is available.

3.0 Test Method

3.1 Evaluate operation of the sample pump.

3.2 Evaluate response of system component control circuits by system.

4.0 Acceptance Criteria

4.1 Operation of the sample pump is as described in Section 11.3.

4.2 Valve operation and system instrumentation and control circuit response is in accordance with design requirements.

14.2.12.1.37 Liquid Radwaste System

1.0 Objectives

1.1 To demonstrate operation of the liquid radwaste system (LRS) pumps and verify the operation of their associated control circuits.

1.2 To demonstrate operation of the liquid radwaste system valves.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

3.0 Test Method

3.1 Operate the liquid radwaste system pumps and record their performance.

3.2 Evaluate operability of the system pump and valve control circuits.

4.0 Acceptance Criteria

4.1 The performance characteristics of the liquid radwaste system pumps are in accordance with manufacturer's performance data.

4.2 Each pump trips on receipt of a low-level signal from its respective tank.

14.2.12.1.38 LRS Evaporator System

1.0 Objective

1.1 To demonstrate the operability of the liquid radwaste system evaporator and its associated pumps and control circuits.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The component cooling water system is available to supply water to the LRS evaporator.

2.4 The auxiliary steam system is available to supply steam to the LRS evaporator.

2.5 The instrument air and demineralized water systems are available to the LRS evaporator.

2.6 The evaporator feed tank, demineralized feed tank, low total dissolved solids (TDS) radwaste tank, auxiliary steam condensate tank, and SRS concentrate tank are available to receive LRS evaporator effluent.

3.0 Test Method

3.1 The LRS evaporator is operated, and performance data are recorded. With the LRS evaporator in operation, a low feed inlet pressure signal is initiated, and the evaporator is verified to shift to the recycle mode. The LRS evaporator distillate pump is verified to trip on a low evaporator condenser level.

4.0 Acceptance Criteria

4.1 The LRS evaporator process flow is within design requirements.

4.2 The LRS evaporator goes into the recycle mode on low feed inlet pressure.

4.3 The LRS evaporator distillate pump trips on a low evaporator condenser level.

14.2.12.1.39 Solid Radwaste System

1.0 Objectives

1.1 To demonstrate the ability to charge resins to those systems containing potentially contaminated demineralizers or absorbers. The ability of the spent resin sluice pumps to transfer resins from each of the demineralizers and absorbers is also verified.

1.2 To demonstrate the operating characteristics of the spent resin sluice pumps.

1.3 To demonstrate the operability of system valve and pump control circuits.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 Those systems containing potentially contaminated demineralizers and absorbers are available to support this test.

2.4 The reactor makeup water subsystem is available to provide a source of water for resin charging.

2.5 A means of bulk disposal is available to receive waste at the bulk disposal station.

3.0 Test Method

3.1 Resins are charged and transferred from each of the potentially contaminated demineralizers and absorbers.

3.2 The spent resin sluice pumps are operated, and performance characteristics are obtained.

3.3 Response of the spent resin sluice pumps to a low-level trip signal from their tanks is verified.

4.0 Acceptance Criteria

4.1 Operating characteristics of the spent resin sluice pumps are within design specifications.

4.2 The spent resin sluice pumps trip on receipt of a low-level trip signal from their tanks.

14.2.12.1.40 Radwaste Solidification System

1.0 Objective

1.1 To demonstrate operation of the radwaste solidification system and pumps and verify operation of their associated control circuits.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operable.

2.3 Radwaste building and auxiliary building spent resin systems are available to support this test.

3.0 Test Method

3.1 The radwaste solidification system pumps are operated and system component control circuits are verified. The ability of the radwaste solidification system to process, solidify, and handle waste is verified.

4.0 Acceptance Criteria

4.1 Operation of the radwaste solidification system pumps is in accordance with manufacturer's peformance data.

4.2 There are no free liquids present in the packaged waste.

14.2.12.1.41 Radioactive Laundry System

1.0 Objective

1.1 To demonstrate operability of radioactive laundry system pumps and system components

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

3.0 Test Method

3.1 Operate the radioactive laundry system drain tank pumps and verify response to automatic and manual control functions.

4.0 Acceptance Criteria

4.1 The radioactive laundry system and components operate in automatic and manual modes per system description.

14.2.12.1.42 Auxiliary Building Radioactive Drains

1.0 Objectives

1.1 To demonstrate the operational ability of the HPSI, LPSI, and containment spray pump room sump pumps, and the auxiliary building sump pumps and verify that their associated control circuits function properly.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 An outside source of water to affected sumps and equipment drain tanks is available.

2.4 The high TDS radwaste tanks are available.

3.0 Test Method

3.1 Operate sump pumps and record pump pressures. Verify each pump control circuit.

4.0 Acceptance Criteria

4.1 System pumps operate within system design requirements.

4.2 System automatic and local controls operate per design requirements.

14.2.12.1.43 Miscellaneous Building Radioactive Drains

1.0 Objective

1.1 To demonstrate proper operation of radioactive drain pumps and associated instrumentation and control circuitry for miscellaneous building sumps and pumps.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 A source of water is available when running pumps.

3.0 Test Method

3.1 Fill sumps by running water down various drain collectors or sumps and verify pump and instrumentation response to manual and automatic operation.

4.0 Acceptance Criteria

4.1 Pumps and associated instrumentation respond in accordance with design requirements.

14.2.12.1.44 Containment Building Radioactive Drains

1.0 Objective

1.1 To demonstrate operation of the containment and ICI cabity sump pumps and operability of related control functions and response to safety signals.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 Support systems needed to perform this test are available.

3.0 Test Method

3.1 Operate affected sump pumps, verify operation of related control circuits, and record pressures.

3.2 Initiate CIAS and verify operation of affected components.

4.0 Acceptance Criteria

4.1 Containment building sump pumps operate per system design requirements.

4.2 Safety signals operate per design specifications, and valves operate within required times.

14.2.12.1.45 Radwaste Building Radioactive Drains

1.0 Objective

1.1 To demonstrate proper operation of radwaste building sump and pumps and associated instrumentation and control circuitry.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 A source of water to allow operation of each drain pump is available.

3.0 Test Method

3.1 Fill sumps from various drainage points and verify manual and automatic operation and system response.

4.0 Acceptance Criteria

4.1 Radwaste building sump and pumps respond properly to manual and automatic signals.

14.2.12.1.46 Primary Sampling System*

1.0 Objective

1.1 To demonstrate operability of primary sampling system and verify containment isolation actuation signal (CIAS) responses of system isolation valves. Flow rates to each sample vessel are also verified.

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* Test to be done during hot functional test also.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 Component cooling water is available.

2.4 The demineralized water system is available.

2.5 N_2 system is available.

3.0 Test Method

3.1 Initiate safety signals to all related valves, verify response time, record flow rates, and observe proper sample cooler temperatures.

4.0 Acceptance Criteria

4.1 Containment isolation valves close within required times under flow and no-flow conditions. Sample cooler operates per system design and proper flow rates are recorded.

14.2.12.1.47 Main Turbine*

1.0 Objective

1.1 To demonstrate that the plant turbine is capable of operating in a safe and reliable manner.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Permanently installed equipment is properly calibrated and operable.

2.3 Test instruments are properly calibrated and operable.

2.4 An adequate steam supply is available to operate turbine generator.

2.5 Turbine generator auxiliaries needed to operate the turbine generator are available and operational.

2.6 Required electrical power supplies and control circuities are available and operational.

2.7 Main condenser is available.

2.8 The circulating water system is available and operational.

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* Test to be done during hot functional test also.

3.0 Test Methods

3.1 Roll turbine to synchronous speed with available steam source.

4.0 Acceptance Criteria

4.1 Vibration, eccentricity, and speed control are acceptable. The turbine protective systems and control systems function as per design criteria. The main turbine operates as per FSAR specifications.

14.2.12.1.48 Main Turbine Gland Seal System*

1.0 Objective

1.1 To demonstrate proper operation of the main turbine gland seal system.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The main steam system is available to supply steam.

2.4 The auxiliary steam system is available.

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* Test to be done during hot functional test also.

2.5 The main turbine is on the turning gear.

3.0 Test Method

3.1 Operate main turbine gland seal system, observing vacuum, turbine seals, and associated instrumentation.

4.0 Acceptance Criteria

4.1 Main turbine gland seal system operates as designed.

14.2.12.1.49 Hydrogen and Carbon Dioxide Gas Control System*

1.0 Objective

1.1 To demonstrate proper operation of the hydrogen supply, carbon dioxide supply, and gas control cubicle.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The gas system is available to supply gas.

2.4 The generator hydrogen seal oil system is available for operation.

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* Test to be done during hot functional test also.

3.0 Test Method

3.1 Purge air with carbon dioxide

3.2 Purge carbon dioxide with hydrogen

3.3 Verify leak tightness.

3.4 Verify system response, record data and take samples of each gas blanket for quality.

4.0 Acceptance Criteria

4.1 The main generator can be charged with carbon dioxide or hydrogen properly to within design specifications.

14.2.12.1.50 Main Turbine Lube Oil System*

1.0 Objectives

1.1 To demonstrate the ability of the turbine lube oil system to provide adequate supply of lube oil to turbine and generator bearings.

1.2 To verify operation of pressure controls, emergency backup oil sources, and lube oil temperature control.

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* Test to be done during hot functional test also.

2.0 Prerequisites

2.1 All construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The turbine building closed cooling water system is available.

2.4 Main lube oil reservoir level is adequate to support this test.

3.0 Test Method

3.1 Operate the lube oil system in normal operating fashion.

3.2 Verify and record lube oil system parameters.

3.3 Test auto-start circuits on all backup and emergency oil pumps.

3.4 Verify vapor extractor maintains negative press on lube oil reservoir.

3.5 Verify operation of the loop seal oil tank vapor extractor.

4.0 Acceptance Criteria

4.1 The lube oil system operates per design specification,. including lube oil temperature control and vapor extractors.

4.2 The lube oil pumps meet design specification of flow capacities and pressures while operating.

14.2.12.1.51 Hydrogen System

1.0 Objective

1.1 To demonstrate proper system operation, including valve operations for the hydrogen system.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Operate system valves and verify that all system pressures can be maintained.

4.0 Acceptance Criteria

4.1 The hydrogen system and associated valves and instrumentation operate within design specifications.

14.2.12.1.52 Carbon Dioxide System

1.0 Objective

1.1 To demonstrate proper system operation, including valve operations for the carbon dioxide system.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Operate system valves and verify that all system pressures can be maintained.

4.0 Acceptance Criteria

4.1 The carbon dioxide system and associated valves and instrumentation operate within design requirements.

14.2.12.1.53 Generator Stator Cooling Water System*

1.0 Objectives

1.1 To demonstrate the operation and capacities of stator cooling water pumps.

1.2 To Verify stator cooling water system components and control system operation.

1.3 To Verify operation of unloading circuits and trips.

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* Test to be done during hot functional test also.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The demineralized water system is available to support this test.

3.0 Test Method

3.1 Operate the stator cooling water system as designed.

3.2 Verify cooling water pressure and record.

3.3 Simulate a stator water cooling system high temperature condition and verify the turbine runback and trip signals are generated.

3.4 Verify water level control and water purity

4.0 Acceptance Criteria

4.1 Stator cooling water pumps operate within design requirements.

4.2 Water treatment and level controls operate as per design specifications.

4.3 All temperature control and stator cooling water pumps operate within design requirements.

14.2.12.1.54 Generator Shaft Seal Oil System*

1.0 Objective

1.1 To demonstrate proper operation of vapor extractor, system pump, and regulating valves.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The turbine building closed cooling water system is available to supply cooling water.

3.0 Test Method

3.1 Operate the seal oil system, verify the performance of system pumps, vapor extractor, and regulating valves, and check system interlocks.

4.0 Acceptance Criteria

4.1 Generator shaft seal oil system and backup air side seal oil perform as per design requirements.

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* Test to be done during hot functional test also.

14.2.12.1.55 Main Steam System*

1.0 Objective

1.1 To demonstrate proper operation of the main steam line drain valves and associated instrumentation.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The main condenser is available to receive steam during hot functional testing.

3.0 Test Method

3.1 Evaluate the control logic of each main steam drain line valve.

3.2 Operate all the main steam drain valves and traps.

4.0 Acceptance Criteria

4.1 Each steam drain line valve and trap operates within design requirements.

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* Test to be done during hot functional test also.

14.2.12.1.56 Main Steam Atmospheric Dump Valves*

1.0 Objective

1.1 To demonstrate proper operation of main steam atmospheric dump valves and related control circuits.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Evaluate operability of main steam atmospheric dump valve control circuits.

3.2 Evaluate operability of main steam atmospheric dump valve with related pressure controller.

3.3 Evaluate setpoints of the relief valves from vendor certification data or in-plant tests.

4.0 Acceptance Criteria

4.1 The main steam atmospheric dump valves operate remote manually and can be operated automatically at the selected setpoints as per design requirements.

---

* Test to be done during hot functional test also.

14.2.12.1.57 Main Steam Isolation Valves*

1.0 Objective

1.1 To demonstrate the operability of the main steam isolation valve and bypass valve during normal and emergency operating conditions.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The main steam isolation valve accumulators are charged and associated hydraulic systems are operational.

2.4 Must be performed before and during hot functional testing.

3.0 Test Method

3.1 Initiate main steam isolation signal (MSIS) and verify the operation of the main steam isolation valve and bypass valve.

3.2 Operate the main steam isolation valves and bypass valve from all local and remote points of control and verify operation of main steam isolation valves and bypass valves.

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* Test to be done during hot functional test also.

4.0 Acceptance Criteria

4.1 The main steam bypass valve operates as per design criteria upon receipt of an MSIS.

4.2 The main steam isolation valves close upon receipt of MSIS and closure times are in accordance with Subsection 6.2.4.

4.3 Main steam isolation valves close and open upon actuation of manual signals and operating times recorded.

14.2.12.1.58 Feedwater Heater Vent, Drain, and Extraction System*

1.0 Objectives

1.1 To demonstrate operability of heater drain system and major components such as high-pressure and low-pressure heaters, the respective level control and vent systems, first- and second-stage reheater drain tanks, and associated level control and vent systems.

2.0 Prerequisites

2.1 An external water source to support heaters and reheater drain tank level control test is available.

2.2 Required electrical power supplies and control circuits are available and operational.

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* Test to be done during hot functional test also.

2.3 Required construction acceptance tests and system cleaning are complete.

2.4 The condensate shaft seal water supply is available.

3.0 Test Method

3.1 Operate the heater drain system equipment from all points of control and verify the system operates as designed.

4.0 Acceptance Criteria

4.1 Heater drain pumps and major system components operate as per design criteria.

4.2 Heater drain system level controls function as per design criteria.

14.2.12.1.59 Condensate System

1.0 Objective

1.1 To demonstrate the condensate pump's operating characteristics and verify the operation of system components and associated control circuits.

2.0 Prerequisites

2.1 Required construction acceptance test and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The feedwater system is available to receive flow from the condensate pump discharge header.

2.4 The demineralized water system and the vacuum degasifier unit in the reactor makeup water system are available to provide a source of makeup to the condensate storage tank.

2.5 The condensate storage tank is available to provide makeup to the condenser hotwell.

2.6 The turbine building closed cooling water system is available to provide cooling water to the condensate pump motor bearing oil coolers.

2.7 The service air system is available for air-operated valves.

2.8 Must be performed prior to hot functional testing.

3.0 Test Method

3.1 Test and operate condensate pumps and system components in a manual mode.

3.2 Operate the condensate system as per its design criteria to test all automatic functions.

4.0 Acceptance Criteria

4.1 The condensate pumps and associated valves such as condensate miniflow control valves and suction valves operate as per system design.

4.2 Condensate pumps automatic start protective features operate as per design requirements.

14.2.12.1.60 Condensate Transfer and Storage System

1.0 Objective

1.1 To demonstrate proper operation of condensate transfer and storage pumps, valves, and associated instrumentation.

2.0 Prerequisites

2.1 Required construction acceptance test and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 A source of water is available in the condensate storage tanks.

2.4 A condenser is available to receive discharge of condensate transfer and storage pumps.

3.0 Test Method

3.1 Operate the pumps and verify that the pump and instrumentation operate in normal and automatic modes.

4.0 Acceptance Criteria

4.1 The pumps and instrumentation operate in accordance with the design requirements.

14.2.12.1.61 Condensate Polishing System

1.0 Objectives

1.1 To demonstrate operation of the condensate demineralizer pumps, transfer pumps, and associated instrumentation.

1.2 To demonstrate operability of the condensate demineralizer tanks, bulk storage tanks, and associated instrumentation.

1.3 To demonstrate proper system capacity and water quality of the condensate demineralizer system.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The condensate system is available to support the demineralizer system.

2.4 The service air system is available to provide required air to demineralizer system.

2.5 The condenser is available to receive rinse water from the demineralizer system.

3.0 Test Method

3.1 Operate system pumps under various system flow conditions to verify water chemistry and observe pump and system response.

3.2 Sample effluent water after startup and continued operation and record results.

4.0 Acceptance Criteria

4.1 System pumps and instrumentation operate properly and respond to varying conditions.

4.2 System tanks and instrumentation respond according to design.

4.3 Water effluent chemistry meets design requirements.

4.4 Demineralizer effluent capacity meets design requirements.

14.2.12.1.62 Condenser Vacuum System*

1.0 Objective

1.1 To demonstrate the operability of the condenser vacuum system vacuum pumps, air ejectors, control valves, and their associated control circuits.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The condensate storage tank is available to provide a source of water to the vacuum pump seal water reservoirs.

2.4 The turbine building open cooling water system is available to provide cooling water to the mechanical vacuum pump seal water coolers.

2.5 Main steam is available to supply the air ejectors.

2.6 Condensate system is available to supply cooling water to the inter and after condensers for the air ejectors.

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* Test to be done during hot functional test also.

3.0 Test Method

3.1 Evaluate the ability of the mechanical vacuum pumps to reduce condenser pressure during startup operation.

3.2 Operate the mechanical vacuum pumps, and their associated valves and control circuits, and evaluate their response to a low condenser vacuum signal.

3.3 Operate the air ejectors.

4.0 Acceptance Criteria

4.1 The rate at which the mechanical vacuum pumps reduce condenser pressure is within design requirements.

4.2 The mechanical vacuum pumps start automatically on receipt of a low condenser vacuum signal.

4.3 The condenser vacuum system valves operate per design specification.

4.4 The air ejectors operate per design specification.

14.2.12.1.63 Main Feedwater System (Motor-Driven Pumps)

1.0 Objective

1.1 To demonstrate the operability of the motor-driven main feedwater pump and start-up feed water pump.

1.2 To determine by full flow test their ability to supply water to the steam generators and verify their response to safety signals. The operation of system motor-operated and air-operated valves, including their response to safety signals, is also verified.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The condensate storage tank contains an adequate supply of demineralized water for the performance of this test.

2.4 The steam generators are available to receive water from the main feedwater system.

2.5 The main steam-generator blowdown system is available to maintain normal operating levels in steam generators during main feedwater pump test.

3.0 Test Method

3.1 Determine performance characteristics of the motor-driven feed-water pump and start-up feed water pump while discharging to the steam generators.

3.2 Evaluate system component control cirucits, including the operation of the motor-driven pumps and system valves on receipt of safety signals.

4.0 Acceptance Criteria

4.1 Motor-driven main feedwater pump and start-up feed water pump performance characteristics are within design requirements.

14.2.12.1.64 Main Feedwater System (Turbine-Driven pumps)

1.0 Objectives

1.1 To demonstrate the operation of the feedwater system valves and to verify the response of the feedwater system valves to a main steam isolation signal (MSIS).

1.2 To perform the initial operation of the steam generator feedwater pumps (SGFPs).

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The turbine building closed cooling water system is available to provide cooling water to the SGFP lube oil coolers.

2.4 The service air system is available to provide air to system air-operated valves.

2.5 The steam seal system is available to provide seal steam and packing exhaust for SGFP turbines.

2.6 The main turbine is available for turning gear operation.

2.7 The condensate system is available to supply suction for the SGFPs.

2.8 The main condenser is available to receive SGFP turbine exhaust.

2.9 The auxiliary steam system is available to provide steam flow to the SGFP turbine.

2.10 (Deleted) 1

3.0 Test Method

3.1 Operate feedwater system valves and verify the response of all system valves to a MSIS.

3.2 Operate the SGFPs as limited by steam, and record operating data.

3.3 (Deleted) 1

4.0 Acceptance Criteria

4.1 The steam generator feedwater isolation valves and feedwater chemical injection isolation valves close on receipt of an MSIS.

4.2 The closing time of the feedwater isolation valves in accordance with Subsection 6.2.4.

4.3 Feedwater pumps operate as per design requirements.

14.2.12.1.65 Auxiliary Feedwater System (Motor-Driven Pumps)

1.0 Objectives

1.1 To demonstrate the operability of the motor-driven auxiliary feedwater pumps.

1.2 To determine by full flow test their ability to supply water to the steam generators.

1.3 To verify their response to safety signals.

1.4 To verify the operation of system motor-operated and air-operated valves, including their response to safety signals.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The condensate storage tank contains an adequate supply of demineralized water for the performance of this test.

2.4 The steam generators are available to receive water from the auxiliary feedwater system.

2.5 The main steam generator blowdown system is available to maintain normal operating levels in steam generators during auxiliary feedwater pump test.

3.0 Test Method

3.1 Evaluate performance characteristics of the motor-driven feed-water pumps while discharging to the steam generators.

3.2 Evaluate system component control circuits, including the operation of the motor-driven pumps and system valves on receipt of safety signals.

4.0 Acceptance Criteria

4.1 Motor-driven auxiliary feedwater pump performance characteristics are in accordance with manufacturer's NPSH and head flow curves.

4.2 Motor-driven auxiliary feedwater pumps automatically start on receipt of an auxiliary feedwater actuation signal (AFAS).

14.2.12.1.66 Auxiliary Feedwater System (Diesel-Driven Pumps)

1.0 Objectives

1.1 To demonstrate the operability of the diesel-driven auxiliary feedwater pumps and verify their response to safety signals.

1.2 To demonstrate the operation of the diesel starting-air compressor on an auxiliary feedwater actuation signal (AFAS)

2.0 Prerequisites

2.1 Required construction acceptance test and system cleaning are complete

2.2 Required electrical power supplies and control circuits are operational.

2.3 The steam generator are available to receive water from the auxiliary feedwater pumps.

2.4 For the performance characteristics test of this pump, hot functional testing is in progress.

2.5 The condensate storage tank is available to supply water to the pump.

3.0 Test Method

3.1 Initiate an AFAS to verify the diesel engine automatic start signal.

3.2 Operate the diesel driven pump and record performance characteristics during hot function testing.

4.0 Acceptance Criteria

4.1 The auxiliary feedwater pump starts automatically on an AFAS.

4.2 Operating characteristics of the auxiliary feedwater pumps are in accordance with the manufacturer's NPSH and head flow curves.

14.2.12.1.67 Circulating Water System

1.0 Objectives

1.1 To demonstrate proper operation of motor-operated valve logic.

1.2 To demonstrate proper operation of circulating water pump logic.

1.3 To demonstrate proper operation of the circulating water system.

2.0 <u>Prerequisites</u>

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The raw water system service water pumps are available to supply bearing lubrication to the circulating water pumps.

2.4 The turbine building chilled water system is available for cooling of the water box priming pumps. 1

2.5 Water is available from the condensate system and storage tank for tube sheet seal water and water priming pump makeup seal water. 1

3.0 <u>Test Method</u>

3.1 Operate circulating water motor-operated valves from all points of control.

3.2 Operate circulating water pumps and record system parameters.

3.3 Operate system debris filter units.

4.0 Acceptance Criteria

4.1 Circulating water motor-operated valves operate as designed.

4.2 Circulating water pumps operate as designed.

4.3 Circulating water system performs its function as designed.

4.4 Debris filters operate per design requirements.

14.2.12.1.68 Amertap Condenser Tube Cleaning System

1.0 Objective

1.1 To demonstrate proper operation of the system.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The circulating water system is available for operation.

3.0 Test Method

3.1 Operate the Amertap system in all modes.

4.0 Acceptance Criteria

4.1 The Amertap system functions as designed.

14.2.12.1.69 Screens Wash and Traveling Screen

1.0 Objective

1.1 To demonstrate the proper operation of the screens wash and traveling screen pumps.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The circulating water and essential service water forebay is flooded.

3.0 Test Method

3.1 Operate the control logic of each traveling screen and screen wash pump.

3.2 Operate each traveling screen and screen wash pump.

3.3 Verify that the shear pin protective device is installed in each traveling screen.

4.0 Acceptance Criteria

4.1 Each traveling screen and screen wash pump operates per design requirements.

14.2.12.1.70 Turbine Building Open Cooling Water System

1.0 Objectives

1.1 To demonstrate the ability of the turbine building open cooling water pumps to operate per design specifications.

1.2 To verify operation of pump and motor-operated valve logics and related control circuits.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available.

2.3 The circulating water system discharge header is available to receive flow.

2.4 Essential service water system discharge header is available to receive flow.

3.0 Test Method

3.1 Operate each turbine building open cooling water pump and demonstrate valve logic.

3.2 Use in-line flow elements to record system flow rates.

4.0 Acceptance Criteria

4.1 The turbine building open cooling water pumps operate per design requirements.

4.2 System flow rates to each component are per design requirements.

14.2.12.1.71 Turbine Building Closed Cooling Water System

1.0 Objectives

1.1 To demonstrate the ability of turbine building closed cooling water system to provide corrosion inhibited cooling water to each component heat exchanger.

1.2 To demonstrate the operating parameters of the turbine building closed cooling water pumps.

1.3 To demonstrate that the associated controls and instrumentation are functioning properly.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available.

2.3 The turbine building open cooling water system is available to provide cooling water to the TBCCW heat exchangers.

3.0 Test Method

3.1 Operate the turbine building closed cooling water pumps in as near to normal operating conditions as possible. Check for proper flow paths.

4.0 Acceptance Criteria

4.1 The turbine building closed cooling water pumps operate per design requirements.

4.2 System flow rates to each component are per design requirements.

14.2.12.1.72 Auxiliary Steam System

1.0 Objectives

1.1 To demonstrate proper operation of the auxiliary steam and associated instrumentation.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The fuel oil system is available.

2.4 Service air is available.

3.0 Test method

3.1 Operate auxiliary steam generator and system components in the manual and automatic modes to demonstrate operation of the auxiliary steam generator.

4.0 Acceptance Criteria

4.1 The auxiliary steam generator and associated components operate per design requirements.

4.2 The chemical feed equipment operates per system design.

14.2.12.1.73 Raw Water System

1.0 Objectives

1.1 To demonstrate the ability of the raw water treatment system to make water at acceptable quality and quantity levels and verify operation of its related components and control functions.

1.2 To demonstrate operability of service water pumps and raw water system.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operable.

2.3 A source of raw water is available.

3.0 Test Method

3.1 Operate the raw water treatment plant in a normal operating mode. Verify operability of related control circuits.

3.2 Operate service water pumps to verify pressure and operation of relative automatic and manual control circuits.

4.0 Acceptance Criteria

4.1 The ability of the raw water system to produce water at acceptable quantities and quality levels is as per design requirements.

14.2.12.1.74 Makeup Water Demineralizer System

1.0 Objectives

1.1 To demonstrate operation of the makeup water demineralizer pumps, transfer pumps, and associated instrumentation.

1.2 To demonstrate operability of the makeup water demineralizer tanks, bulk storage tanks, and associated instrumentation.

1.3 To demonstrate proper output of makeup water demineralizer system.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The raw water system is available to supply water.

2.4 Instrument air is available to supply air for controls.

2.5 A discharge tank or sump is available to receive regenerant waste from regenerant waste sump.

3.0 Test Method

3.1 Operate system pumps, show changes in demand or concentration of chemistry, and observe pump and system response.

3.2 Sample output water after start and after continued operation.

4.0 Acceptance Criteria

4.1 System pumps and instrumentation operate properly and respond to varying conditions within the design.

4.2 System tank and instrumentation respond according to design.

4.3 Water effluent chemistry meets design requirements.

14.2.12.1.75 Domestic Water System

1.0 Objective

1.1 To demonstrate operation of the domestic water system and pumps.

2.0 Prerequisites

2.1 Required construction acceptance test and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Operate domestic water pump to verify all logic.

4.0 Acceptance Criteria

4.1 Operation of the domestic water pump are within design requirements.

14.2.12.1.76 Class 1E Diesel Generator System (Mechanical)

1.0 Objectives

1.1 To demonstrate performance characteristics of the diesel generators and associated auxiliaries, and verify that each diesel reaches rated speed within the required time.

1.2 To verify operability of control circuits associated with the diesel generator and diesel auxiliaries, including the control circuit response to safety signals.

1.3 To demonstrate the capability of each air storage tank to provide five diesel cranking cycles without being recharged.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The component cooling water system is available to provide cooling water to the diesel engine heat exchanger.

2.4 The diesel fuel oil system is available to provide fuel oil to the diesel generators.

2.5 The fire protection system is available to support this test.

3.0 Test Method

3.1 Start the diesel generators and record the time required to reach rated speed.

3.2 Evaluate performance characteristics with the diesel generators and associated auxiliaries operating.

3.3 Evaluate the operability of all control circuits associated with the diesel generator and diesel auxiliaries, including the control circuit response to safety signals.

3.4 Evaluate the ability of each air storage tank to provide five diesel cranking cycles, without being recharged.

4.0 Acceptance Criteria

4.1 The time required for each diesel generator to reach rated speed is in accordance with Section 8.3.

4.2 Performance characteristics of the diesel generators and associated auxiliaries are within design requirements.

4.3 Each diesel generator starts automatically on receipt of a safety injection actuation signal or a bus undervoltage signal.

4.4 Each diesel generator trips automatically on receipt of each of the following signals:

a. Generator differential
b. Lube oil pressure low
c. Crankcase pressure high
d. Start failure
e. Engine overspeed

4.5 Each air storage tank is capable of providing five diesel cranking cycles without being recharged.

14.2.12.1.77 Closs 1E Diesel Generator Sysem (Electrical)

1.0 Objectives

1.1 To demonstrate the ability of each diesel generator to carry the continuous rated load, the short-time rated load, and design rated load.

1.2 To demonstrate the ability of each diesel generator to attain and stabilize frequency and voltage within the rated limits and time.

1.3 To demonstrate that each diesel generator starts automatically on an engineered safety feature actuation signal and/or 4.16-kV bus loss of voltage and that the associated diesel-generator feeder breaker closes when, on an under-voltage signal received from the respective 4.16-kV bus, the diesel-generator rated voltage and frequency has been attained.

1.4 To demonstrate the capability of each diesel generator to withstand a maximum rate load rejection without exceeding speeds or voltages that cause tripping or damage.

1.5 To demonstrate the operability of each diesel-generator feeder breaker and associated interlocks.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available.

2.3 Required mechanical system associated with the diesel generators are available.

2.4 The respective 4.16-kV (Class 1E) buses are available for loading to support this test.

3.0 <u>Test Method</u>

3.1 Demonstrate the continuous rated load, short-time rated load, and design rated load tests.

3.2 Evaluate the ability of each diesel generator to attain and stabilize frequency and voltage within the rated limits and time.

3.3 Evaluate the ability of each diesel generator to start automatically on an engineered safety feature actuation signal and/or 4.16-kV bus loss of voltage. Evaluate the ability of the associated feeder breaker to close on an undervoltage signal received on the respective 4.16-kV bus when the diesel-generator rated voltage and frequency has been attained.

3.4 Evaluate the ability of each diesel generator to withstand a maximum rated load rejection, without exceeding speeds or voltages.

3.5 Evaluate the operability of each diesel generator feeder breaker and associated interlocks.

4.0 <u>Acceptance Criteria</u>

4.1 The continuous rated load, short-time rated load, and design rated load tests are in accordance with Section 8.3.

4.2 Each diesel generator can attain and stabilize frequency and voltage within specifications.

4.3 Each diesel generator starts automatically on an engineered safety feature actuation signal and/or 4.16-kV bus loss of voltage and the associated feeder breaker closes on receipt of an undervoltage signal from the respective 4.16-kV bus when the diesel generator has attained its rated voltage and frequency.

4.4 Each diesel generator is capable of withstanding the maximum rated load rejection without exceeding frequency or voltage design limits.

4.5 The controls and interlocks associated with the diesel generator feeder breakers operate in accordance with system design.

14.2.12.1.78 Class 1E Diesel-Generator Load Sequencing

1.0 Objectives

1.1 To demonstrate that diesel generators are capable of providing the required power to equipment vital to safe reactor shutdown under emergency conditions.

1.2 To verify proper load shedding and load sequencing.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available.

2.3 Required mechanical systems associated with the diesel generator systems are available.

2.4 Required Class 1E 4.16 kV systems, 480 V load centers, and 480V motor control centers are available.

3.0 Test Method

3.1 Demonstrate automatic diesel generator starting, and shedding, and load sequencing for a simulated engineered safety feature actuation signal, a loss of preferred power signal, and combined engineered safety feature and loss of preferred power simulated signals.

4.0 Acceptance Criteria

4.1 Automatic starting, loading shedding, and load sequencing of each diesel generator are accomplished per Section 8.3.

4.2 Controls, interlocks, indications, and alarms function in accordance with system design.

14.2.12.1.79 Diesel-Generator Load Group Assignments

1.0 Objective

1.1 To demonstrate the ability of the emergency diesel generators to provide reliable emergency power and verify the independence of emergency redundant onsite power sources and their load groups.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available.

2.3 Required mechanical systems associated with the diesel generator systems are available.

2.4 Required Class 1E 4.16-kV systems, 480-Volt load centers, and 480-Volt motor-control centers are available.

3.0 Test Method

3.1 Energize each 4.16-kV (Class 1E) bus from its respective diesel generator by simulated engineered safety features actuation system (ESFAS) signals and a loss-of-offsite-power signal. The independence of emergency onsite redundant power sources and load groups is verified.

4.0 Acceptance Criteria

4.1 Each emergency redundant onsite power source and its load group function as designed without dependence upon any other redundant load group or portion thereof.

4.2 DC and onsite ac buses and related loads not under test verify the absence of voltage from the respective load group.

14.2.12.1.80 Non-Class 1E Diesel Generator

1.0 Objectives

1.1 To demonstrate the ability of the diesel generator to carry the design-rated load within design specifications.

1.2 To demonstrate the ability of the diesel generator to attain and stabilize frequency and voltage within the rated limits and time.

1.3 To demonstrate that the diesel generator starts automatically and the diesel-generator feeder breaker closes when an undervoltage signal is received from the bus.

1.4 To demonstrate the capability of the diesel generator to withstand a maximum rated load rejection and sequencing without exceeding speeds or voltages that cause tripping or damage.

1.5 To demonstrate the operability of the diesel generator feeder breaker and associated interlocks.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available.

2.3 Bus 3-813-EAP-13SN, 3-812-EAP-19EN and 3-812-EAP-20EN is available for loading to support this test.

3.0 Test Method

3.1 Perform the design rated load test.

3.2 Evaluate the ability of the diesel generator to attain and stabilize frequency and voltage within the rated limits and time.

3.3 Evaluate the ability of the diesel generator to start automatically and the feeder breaker to close when an undervoltage signal is received on the bus.

3.4 Evaluate the ability of the diesel generator to withstand a maximum rate load rejection without exceeding speeds or voltages.

3.5 Evaluate the operability of the diesel generator feeder breaker and associated interlocks.

4.0 Acceptance Criteria

4.1 The design rated load test is within system design requirements.

4.2 The diesel generator can attain and stabilize frequency and voltage within design requirements.

4.3 The diesel generator starts automatically and the feeder breaker closes on receipt of an undervoltage signal from the bus.

4.4 Diesel generator is capable of withstanding the maximum rated load sequencing and rejection without exceeding frequency or voltage design limits.

4.5 Controls and interlocks associated with the diesel generator feeder breakers operate in accordance with system design.

14.2.12.1.81 Instrument Air System

1.0 Objectives

1.1 To demonstrate the ability of the air compressors to provide instrument and service air at proper pressures.

1.2 To demonstrate automatic control features of the air compressors and associate system control valves.

1.3 To demonstrate safety signal operation of associated containment isolation valves.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power systems and control circuits are operational.

2.3 Turbine building closed cooling water is available.

3.0 Test Method

3.1 Operate the system air compressors in all operating configurations. Verify pressures and control system automatic starts and stops.

3.2 Operate instrument air dryers and verify operation. Verify system valves for proper operation.

3.3 Initiate safety signals to each containment isolation valve and record closing times.

4.0 Acceptance Criteria

4.1 The air compressor and system components operate per design specifications.

4.2 Containment isolation valves close upon receipt of safety signal within specified times.

14.2.12.1.82 Diesel Fuel Oil System

1.0 Objective

1.1 To demonstrate the operability of the diesel fuel oil transfer pumps. Verify all system control functions.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 Fuel oil is available to support this test.

3.0 Test Method

3.1 Operate the diesel fuel oil transfer pumps.

3.2 Initiate all automatic system function signals and verify required responses.

4.0 Acceptance Criteria

4.1 Diesel fuel oil transfer pumps operate per system design specifications.

4.2 Control functions are operable per system design requirements.

14.2.12.1.83 Bearing Oil Transfer and Purification System

1.0 Objectives

1.1 To demonstrate the ability of the lube oil storage and transfer system to supply oil to, and pump oil from, the main turbine lube oil reservoir and lube oil conditioner.

1.2 To demonstrate the ability of the purification system to purify dirty lube oil.

1.3 To demonstrate the ability of the clean lube oil tank system operation.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 Main turbine lube oil reservoirs are available to receive oil.

2.4 Main turbine lube oil conditioner are available to receive oil.

3.0 Test Method

3.1 Operate the transfer pumps and observe oil flow to lube oil reservoir.

3.2 Demonstrate the ability of dirty lube oil transfer pumps to transfer oil from related reservoirs to the dirty oil storage tank and the clean oil transfer pump to transfer oil to the related reservoirs.

3.3 Operate the temporary lube oil centrifuge as per design requirements.

4.0 Acceptance Criteria

4.1 The lube oil storage, transfer, and purification system operates as per design requirements.

14.2.12.1.84 Reactor Cavity Cooling System

1.0 Objective

1.1 To demonstrate the operation of reactor cavity air handling units and verify that their associated instrumentation and controls function properly.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The plant chilled water and component cooling water systems are available to support this test.

2.4 The containment vessel is closed.

2.5 The reactor cavity cooling air handling unit fans have been air balanced.

3.0 Test Method

3.1 Operate reactor cavity air handling units, record flow data, and calculate fan capacities.

4.0 Acceptance Criteria

4.1 Reactor cavity air handling units operate within design requirements.

14.2.12.1.85 Containment Fan Coolers

1.0 Objective

1.1 To demonstrate the operation of the reactor containment fan coolers and verify that their associated instrumentation and controls function properly, including fan response to safety signals.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The plant chilled water system and component cooling water system are available to supply water to the containment coolers.

2.4 The containment cooling system has been air balanced.

2.5 The containment vessel is closed.

3.0 Test Method

3.1 Operate each containment fan cooler from all points of control, record flow data, and calculate fan capacities.

3.2 Evaluate the response of the containment cooling fans to safety signals.

4.0 Acceptance Criteria

4.1 The operation of the containment cooling fans is within design requirements.

4.2 The containment cooling fans properly respond to safety signals in accordance with system design.

14.2.12.1.86 CEDM Cooling AHU System

1.0 Objective

1.1 To demonstrate the operation of the control element drive mechanism (CEDM) cooling air-handling unit (AHU), and verify that their associated instrumentation and controls function properly.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The CEDM cooling AHU unit is air balanced.

3.0 Test Method

3.1 Operate the CEDM cooling AHU and record data.

4.0 Acceptance Criteria

4.1 The operation of the CEDM cooling AHU is within design specifications.

14.2.12.1.87 Laboratory HVAC System

1.0 Objective

1.1 To demonstrate proper operation of the laboratory HVAC components and related control circuits.

2.0 Prerequisites

2.1 Required construction acceptance test are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Operate each supply fan and heater in manual and automatic mode.

4.0 Acceptance Criteria

4.1 The supply fans and heaters operate per system design requirements.

14.2.12.1.88 ESF Swtichgear Room HVAC System

1.0 Objective

1.1 To demonstrate proper operation of the ESF switchgear room HVAC components and related control circuits.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The compressed air system is available to supply air to system air operated valves.

3.0 Test Method

3.1 Operate each supply fan and heater in manual and automatic mode.

4.0 Acceptance Criteria

4.1 The supply fans and heaters operate per system design requirements.

14.2.12.1.89 Turbine Building HVAC System

1.0 Objective

1.1 To demonstrate the operation of the turbine building HVAC system and verify that the associated instrumentation and controls are functioning properly.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The turbine building HVAC system is balanced.

3.0 Test Method

3.1 Operate HVAC supply and exhaust fans.

3.2 Evaluate all heater operations.

4.0 Acceptance Criteria

4.1 System can be operated from all points of control.

4.2 Each fan, DX cooling coil, condensing unit, and unit heaters operates per design requirements.

14.2.12.1.90 Control Room HVAC System

1.0 Objective

1.1 To demonstrate the operation of the control room HVAC system.

1.2 To verify the system instrumentation and controls, including the component response to safety and fire signals.

2.0 Prerequisites

2.1 Required construction acceptance tests and system air balancing are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The instrument air system is available to supply air to system air-operated dampers. 1

3.0 Test Method

3.1 Operate the control room HVAC system fans from all points of control.

3.2 Evaluate response of system components to control room emergency ventilation actuation signals (CREVAS), safety injection actuation signals (SIAS), and fire signals.

4.0 Acceptance Criteria

4.1 The control room HVAC system operation is per Subsection 9.4.1.

4.2 The control room HVAC system fans and dampers properly respond to CREVAS, SIAS, and fire signals, in accordance with system design.

14.2.12.1.91 Auxiliary Building HVAC System

1.0 Objective

1.1 To demonstrate the operation of the auxiliary building HVAC system.

1.2 To verify the system instrumentation and controls, including component response to safety and fire signals.

2.0 Prerequisites

2.1 Required construction acceptance tests and system air balancing are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The plant chilled water system and the station hot water heating system are available to support this test.

3.0 Test Method

3.1 With the auxiliary building closed, operate the system in its normal configuration, and evaluate the system operation.

3.2 Evaluate responses of system components to safety injection and fire signals.

4.0 Acceptance Criteria

4.1 The auxiliary building fan operation is per design specifications.

4.2 The auxiliary building fans and dampers properly respond to safety injection and fire signals in accordance with system design.

14.2.12.1.92 Radwaste Building HVAC System

1.0 Objectives

1.1 To verify the operation of radwaste building HVAC system and verify their associated controls and instrumentation function properly.

1.2 To demonstrate operation of the radwaste building AHU and fans and verify that the associated instrumentation and controls function properly.

2.0 Prerequisites

2.1 Required construction acceptance tests and system air balancing are complete.

2.2 Plant chilled water and station hot water heating systems are available.

2.3 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Evaluate the radwaste building air handling units and fan operation.

3.2 Evaluate the operability of the radwaste building supply and exhaust fan control circuits.

4.0 Acceptance Criteria

4.1 The radwaste building HVAC system operates per design requirements.

4.2 The radwaste building supply air unit will not operate unless either radwaste exhaust fan is operating.

4.3 A low flow on the operating radwaste building exhaust fan will cause the standby fan to start.

14.2.12.1.93 Station Heating System

1.0 Objectives

1.1 To demonstrate proper operation of the station heating system and verify associated instrumentation and controls function properly.

2.0 Prerequisties

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available.

2.3 The demineralized water system is available.

2.4 The auxiliary steam system is available.

3.0 Test Method

3.1 Operate the station heating system components in all modes and record data.

4.0 Acceptance Criteria

4.1 The station heating system and components operate per system design.

14.2.12.1.94 Containment Purge System

1.0 Objectives

1.1 To demonstrate the operation of each high- and low-volume purge supply and exhaust fan.

1.2 To demonstrate operation of the post-LOCA purge subsystem.

1.3 To demonstrate proper operation and response of system instrumentation and controls, including the response of system fans and dampers to safety signals.

1.4 To demonstrate each containment isolation valve response to safety signals.

2.0 Prerequisties

2.1 Required construction acceptance tests and system air balancing are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The service air system is available.

2.4 The plant chilled water system is available.

3.0 Test Method

3.1 Operate system fans and evaluate response of the fans and containment isolation valves to safety signals.

3.2 Initiate safety signals to each containment isolation valve.

4.0 Acceptance Criteria

4.1 Containment purge system high volume, low volume, and post-LOCA purge fans operate within design requirements.

4.2 System fans and dampers properly respond to safety signals.

4.3 Containment isolation valves respond to safety signal and closure times are within design requirements.

14.2.12.1.95 Fuel Building HVAC System

1.0 Objectives

1.1 To demonstrate that the emergency exhaust fans are capable of maintaining a negative pressure in the fuel building.

1.2 To demonstrate the capacities of the fuel building HVAC components.

1.3 To verify the operability of system instrumentation and controls including the component response to safety signals.

2.0 Prerequisties

2.1 Required construction acceptance tests and system air balancing are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The plant chilled water system and the essential chilled water system are available to support this test.

3.0 Test Method

3.1 With the fuel building closed, operate the system in its normal configuration, and evaluate the fuel building HVAC components and control operation.

3.2 The fuel building at a slight negative pressure is verified.

3.3 With a fuel building emergency ventilation actuation system signal (FBEVAS) present, evaluate the emergency exhaust ACU operation and negative fuel building pressures.

4.0 Acceptance Criteria

4.1 The slight negative pressure in the fuel building is maintained by the normal and emergency exhaust fans.

4.2 The fuel building HVAC components operate within design requirements.

4.3 The fuel building HVAC system fans and dampers properly respond to FBEVAS and SIAS, in accordance with system design.

14.2.12.1.96 Intake Structure Pumphouse Ventilation

1.0 Objective

1.1 To demonstrate proper operation of the intake structure pumphouse HVAC components and related control circuits.

2.0 Prerequisties

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Operate each supply fan, exhaust fan and heater in manual and automatic mode.

4.0 Acceptance Criteria

4.1 The supply and exhaust fans and heaters operate per system design requirements.

14.2.12.1.97 Water Treatment and Chlorination Building HVAC System

1.0 Objective

1.1 To demonstrate proper operation of the water treatment and chlorination building HVAC system and related control circuits.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Operate each supply fan, exhaust fan, and heater in manual and automatic mode.

4.0 Acceptance Criteria

4.1 The supply and exhaust fans and heaters operate per system design requirements.

14.2.12.1.98 Essential Chilled Water System

1.0 Objectives

1.1 To demonstrate the essential chilled water system functions as per design requirements.

1.2 To verify the operability of system instrumentation and controls.

1.3 To verify that the system responds to internal safeties.

2.0 Prerequisties

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The component cooling water system is available to support this test.

2.4 The demineralizer water system is available to support this test.

2.5 The service air system is available.

2.6 The N_2 system is available to support this test.

3.0 Test Method

3.1 Operate the chilled water pumps and the chiller per design specifications.

3.2 Initiate internal safeties to the chiller and evaluate its response.

4.0 Acceptance Criteria

4.1 The chilled water system operates per design requirements.

4.2 The chiller responds to internal safeties.

14.2.12.1.99 Plant Chilled Water System

1.0 Objectives

1.1 To demonstrate proper operation of the plant chilled water system and verify associated instrumentation and controls function properly.

1.2 To verify that the chiller responds to internal safeties.

1.3 To demonstrate each containment isolation valve responds to a safety signal.

2.0 Prerequisties

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available.

2.3 The demineralized water system is available.

2.4 The nitrogen gas system is available.

2.5 The instrument air system is available. 1

2.6 The turbine building closed cooling water system is available.

3.0 Test Method

3.1 Operate the plant chilled water system components in all modes and all lineups.

3.2 Initiate safety signals to containment isolation valves and record data.

4.0 Acceptance Criteria

4.1 The plant water system and components operate per system design.

4.2 The chiller responds to internal safeties.

4.3 Recorded closing times of containment isolation valves are within design requirements.

14.2.12.1.100 Miscellaneous Control Room HVAC System

1.0 Objective

1.1 To demonstrate proper operation of the miscellaneous control room HVAC components and related control circuits.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The demineralized water system is available.

3.0 Test Method

3.1 Operate each HVAC component in manual and automatic mode.

4.0 Acceptance Criteria

4.1 The miscellaneous control room HVAC system operation is within design requirements.

14.2.12.1.101 Machine Shop HVAC System

1.0 Objective

1.1 To demonstrate proper operation of the machine shop HVAC components and related control circuits.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Station heating system is available to support the operation of supply AHU heating coil.

2.3 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Operate each HVAC component in manual and automatic mode.

4.0 Acceptance Criteria

4.1 The machine shop HVAC system operation is within design requirements.

14.2.12.1.102 Diesel-Generator Building HVAC System

1.0 Objectives

1.1 To demonstrate the operation of the diesel generator room supply and exhaust fans.

1.2 To verify that the system instrumentation and controls function properly, including the response of fans and associated dampers to a diesel generator start signal, room temperature signals, and a CO_2 initiation signal.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The diesel generator building HVAC system is air balanced.

2.4 The respective diesel generator is not operating while the room is under test.

3.0 Test Method

3.1 Evaluate the response of the diesel generator room supply and exhaust fans and dampers to a diesel generator start signal, to room temperature signals and to a CO_2 initiation signal.

4.0 Acceptance Criteria

4.1 The operation of the diesel generator room supply dampers and exhaust fans and dampers are per design requirements.

4.2 The diesel generator room dampers close on receipt of CO_2 initiation signal.

4.3 The diesel generator room supply fans stop on a low room temperature signal.

4.4 Electric duct and unit heaters operate as per design.

14.2.12.1.103 ECCS Equipment Room HVAC System

1.0 Objective

1.1 To demonstrate proper operation of the ECCS equipment room HVAC components and related control circuits.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Operate each supply fan and heater in manual and automatic mode.

4.0 Acceptance Criteria

4.1 The ECCS equipment room HVAC system operation is within design requirements.

14.2.12.1.104 Miscellaneous Unoccupied Room HVAC System

1.0 Objective

1.1 To demonstrate proper operation of the miscellaneous unoccupied room HVAC system components and verify system instrumentation and control function properly.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Operate each supply and exhaust fan and heater in manual and automatic mode.

4.0 Acceptance Criteria

4.1 The supply and exhaust fans and heaters operate per system design requirements.

14.2.12.1.105 Access Control Building HVAC System

1.0 Objective

1.1 To demonstrate operation of the access control building HVAC system components and verify system instrumentation and controls function properly.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The plant chilled water system is available to support the operation of FCU and cooling coils in the AHU.

3.0 Test Method

3.1 Operate the system in its normal configuration and evaluate system operation.

3.2 Operate duct heaters and evaluate operation.

3.3 Evaluate operation of system controls.

4.0 Acceptance Criteria

4.1 The access control building HVAC system and related components and controls operate within design requirements.

14.2.12.1.106 Chemical Feed and Handlinhg System

1.0 Objective

1.1 To demonstrate the ability of the hydrazine and ammonia pumps to inject chemicals into the condensate and feedwater system.

1.2 To verify the ability of the chemical control system to control the chemical parameters of the condensate and feedwater systems. (will be accomplished during hot functional testing).

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuities are operational.

3.0 Test Method

3.1 Operate the chemical pumps in the manual and automatic mode and evaluate operation.

4.0 Acceptance Criteria

4.1 The chemical feed pumps' capacity can be varied to maintain steam generator chemistry within design requirements.

4.2 The control circuits maintain chemical balance with system parameters during hot preoperational testing and layup condition.

14.2.12.1.107 Chlorination System

1.0 Objective

1.1 To demonstrate the ability of the circulating water and essential service water chlorination control system to operate as per design criteria.

2.0 Prerequisites

2.1 Seawater supply is available to the sodium hypochlorite generator.

2.2 The circulating water system is available to receive chemical injection.

2.3 Required construction acceptance test and system cleaning are complete.

2.4 Required electrical power supplies and control circuits are operational.

2.5 Instrument air and raw water supply systems are available to the chlorination system.

3.0 Test Method

3.1 Operate chlorination system to demonstrate the generation of sodium hypochlorite and injection of chemicals into the circulating water system, and essential service water system.

4.0 Acceptance Criteria

4.1 Chlorination system generates sodium hypochlorite per design criteria.

4.2 Chlorination system properly chlorinates and seawater cooling system.

14.2.12.1.108 Waste Water Transfer System

1.0 Objective

1.1 To demonstrate operation of waste sumps, pumps, valves, and instrumentation in the turbine building and water treatment building.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 Water is available to fill sumps to allow pump operation.

3.0 Test Method

3.1 Operate each sump pump in manual and automatic modes.

4.0 Acceptance Criteria

4.1 The waste sumps, pumps, and valves in the turbine building and water treatment building operate in manual and automatic as designed.

14.2.12.1.109 Fuel Oil System

1.0 Objective

1.1 To demonstrate proper operation of the fuel oil feed pumps, storage tank, and associated instrumentation.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Operate each fuel oil feed pump to verify system logic, storage tank controls, and system response.

4.0 Acceptance Criteria

4.1 Pump logic is verified.

4.2 Storage tank and system instrumentation respond per design requirements.

14.2.12.1.110 Nitrogen System

1.0 Objective

1.1 To demonstrate proper system operation, including valve operations for the nitrogen system.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Operate system valves and verify that all system pressures can be maintained.

4.0 Acceptance Criteria

4.1 The nitrogen system and associated valves and instrumentation operate within design requirements. 1

14.2.12.1.111 Miscellaneous Building Drains

1.0 Objective

1.1 To demonstrate proper operation of sump pits and pumps and associated instrumentation and control circuitry.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 A source of water to allow operation of each pump is available.

3.0 Test Method

3.1 Fill the sumps from various points and verify manual and automatic operation and system response.

4.0 Acceptance Criteria

4.1 The sump pits and pumps properly operate to automatic and manual signals.

14.2.12.1.112 Polar Crane

1.0 Objective

1.1 To demonstrate that the containment polar crane is capable of performing as designed.

2.0 Prerequisites

2.1 Construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 Test equipment and materials are available.

2.4 Handling adaptors and accessories are available.

2.5 The ASME load test at 125% of design load has been performed.

3.0 Test Method

3.1 Evaluate control logic operation.

3.2 Evaluate alarms, interlocks, and instrumentation.

3.3 Evaluate all travel limits.

3.4 Evaluate suitability of adaptors and accessories for reactor component handling.

4.0 Acceptance Criteria

4.1 The polar crane performs as described in the design requirements.

14.2.12.1.113 Fire Protection System (Water)

1.0 Objectives

1.1 To demonstrate operability of the preaction sprinkler system, wet-pipe sprinkler system, and the automatic water spray system, including system instrumentation, alarms, and interlocks.

1.2 To demonstrate operability of the system valves, including response to a safety signal from the motor and diesel-driven fire pump.

1.3 To verify spray to the applicable electrical system transformers.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 Water is available to the fire protection system headers.

3.0 Test Method

3.1 Evaluate response of the preaction sprinkler system, wet-pipe sprinkler system, and automatic water spray system to fire detection signals, including the operability of associated alarms, instrumentation, and interlocks.

3.2 Operate the fire protection system containment isolation valves under flow conditions and record operating times, including response to a containment isolation signal.

3.3 Operate motor and diesel-driven pumps and obtain associated instrumentation response.

3.4 Spray to the applicable electrical transformers is verified.

4.0 Acceptance Criteria

4.1 The preaction sprinkler system, wet-pipe sprinkler system, automatic water spray system and associated alarms, instrumentation, and interlocks operate in accordance with system design requirements.

4.2 The fire protection system containment isolation valves closure time is within design specifications.

4.3 The fire protection system containment isolation valves close on receipt of a CIAS.

4.4 The spray to applicable electrical transformers is within design specifications.

4.5 Operability of the motor- and diesel-driven pumps and associated instrumentation is within design specifications.

14.2.12.1.114 Seismic Fire Protection System

1.0 Objective

1.1 To verify proper operation of the seismic Category I fire protection pumps.

1.2 (Deleted) 1

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The freshwater tanks or seismic fire water tanks are available to support this test. 1

3.0 Test Method

3.1 Manually start fire pumps and verify operation. 1

4.0 Acceptance Criteria

4.1 Fire pumps operate per system design requirements.

4.2 (Deleted) 1

14.2.12.1.115 CO_2 Suppression

1.0 Objective

1.1 To demonstrate proper system operation, including valve operations for the CO_2 suppression system.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 Adequate supply of CO_2 from the liquid CO_2 storage tank is available.

3.0 Test Method

3.1 Operate system valves and verify that all system pressures can be maintained.

4.0 Acceptance Criteria

4.1 The CO_2 suppression system and associated valves and instrumentation operate within design requirements.

14.2.12.1.116 Breathing Air

1.0 Objectives

1.1 To demonstrate proper system operation, including valve operations for the breathing air system.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Operate system valves and verify that all system pressures can be maintained.

4.0 Acceptance Criteria

4.1 The breathing air system and associated valves and instrumentation operate within design requirements.

14.2.12.1.117 Fire Detection and Alarm System

1.0 Objective

1.1 To demonstrate the operability of the fire protection system detectors and alarms.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Evaluate actuation of system alarms upon receipt of fire detection signals.

4.0 Acceptance Criteria

4.1 Fire protection system detectors and alarms operate in accordance with system design requirements.

14.2.12.1.118 Plant Protection System

1.0 Objective

1.1 To demonstrate the proper operation of the plant protection system (PPS).

1.2 To determine the reactor protection system and the engineering safety features actuation system (ESFAS) response times.

2.0 Prerequisites

2.1 Construction activities on the trip circuit breaker and plant protection system and ESF auxiliary relay cabinets have been completed.

2.2 PPS system instrumentation has been calibrated.

2.3 External test instrumentation is available and calibrated.

2.4 Support systems required for operation of the trip circuit breakers, ESF auxiliary relay cabinet and plant protection system are operational.

3.0 Test Method

3.1 Energize power supplies and verify output voltage.

3.2 Simulate ground faults and observe operation of the ground fault detectors.

3.3 Using simulated reactor trip signals, trip each reactor trip circuit breaker with the breaker in the test position. Observe circuit breaker operation.

3.4 Repeat Step 3.3 with the reactor trip circuit breakers in the operate position.

3.5 Operate the bistable comparators and observe the setpoints and operation of the appropriate ESF circuit.

3.6 Check the operation of trip channel bypass features including, where applicable, observation of the setpoints at which the trip bypasses are cancelled automatically.

3.7 Test manual trips and observe relay operation.

3.8 Check that low pressurizer pressure and low steam generator pressure trip setpoints track the process variable at the prescribed rate and can be manually reset to the proper margin below the process variable.

3.9 Utilizing the installed testing devices, observe test matrix relay and log operation.

3.10 Utilizing all combinations of two-of-four logic, trip the reactor trip circuit breakers and ESF auxiliary relay cabinet logics and observe interlock, alarm, and interface operation.

3.11 Verify proper operation of the core protection and control assembly calculator subsystems by input/output and internal function tests.

3.12 Inject signals into appropriate sensors or sensor terminals and measure the elapsed time to achieve tripping of the reactor trip circuit breakers or actuation of the actuation relays. Trip or actuation paths may be tested in several segments.

4.0 Acceptance Criteria

4.1 The plant protection system performs as described in Subsection 7.3.1.

4.2 The total response time of each RPS and EFAS trip or actuation path is verified to be conservative with respect to the times used in the safety analysis.

14.2.12.1.119 Core Operating Limit Supervisory System

1.0 Objective

1.1 To verify proper operation of the core operating limit supervisory system (COLSS).

2.0 Prerequisites

2.1 The on-line computer system is functioning properly.

2.2 COLSS has been implemented into the on-line computer system.

2.3 Test cases have been generated and adopted to interface with the on-line computer test program.

2.4 Results of the test case runs performed on the COLSS Fortran code are available.

3.0 Test Method

3.1 Using the test program contained in the on-line computer system, simulate the COLSS inputs for each test case.

4.0 Acceptance Criteria

4.1 The core operating limit supervisory system performs as described in Subsection 7.7.1.

14.2.12.1.120 Control Element Drive Mechanism Control System

1.0 Objective

1.1 To demonstrate proper input signals and proper sequencing of input signals to control element drive mechanism (CEDM) coils.

1.2 To demonstrate proper operation of the control element drive mechanism control system (CEDMCS) in MI (Manual Individual) mode. 1

1.3 To verify proper operation of the CEDMCS interlocks and alarms.

2.0 Prerequisites

2.1 Construction activities on the CEDMCS have been completed.

2.2 Cable continuity tests have been completed.

2.3 Special test instrumentation has been calibrated and is operational.

2.4 Special test equipment is operational.

2.5 Support systems required for operation of the CEDMCS are operational.

3.0 Test Method

3.1 Using special test instrumentation, observe the sequence in which withdraw and insert signals are passed to the appropriate CEDM coil. Observe operation of the digital CEA position indicators.

3.2 Operate the CEDMCS in all modes. Simulate input signals and observe operation of interlocks and alarms.

4.0 Acceptance Criteria

4.1 The control element drive mechanism control system performs as described in Subsection 7.7.1.

14.2.12.1.121 Feedwater Control System

1.0 Objective

1.1 To demonstrate the proper operation of the feedwater control system (FWCS).

2.0 Prerequisites

2.1 Construction activities on the FWCS and interfacing equipment have been completed.

2.2 FWCS instrumentation has been calibrated.

2.3 External test equipment has been calibrated and is operational.

2.4 Support systems required for the operation of the FWCS are operational.

2.5 Cabling has been completed between the FWCS and interfacing equipment.

3.0 Test Method

3.1 Utilizing actual or simulated interface inputs to the FWCS, observe receipt of these signals at the FWCS.

3.2 Utilizing installed and external test instrumentation, vary all input signals to the system and observe output responses at the FWCS and at interfacing equipment.

4.0 Acceptance Criteria

4.1 The feedwater control system performs as described in Subsections 7.7.1 and 10.4.7.

14.2.12.1.122 Steam Bypass Control System

1.0 Objective

1.1 To demonstrate the proper operation of the steam bypass control system (SBCS).

2.0 Prerequisites

2.1 Construction activities on the steam bypass control system (SBCS) and interfacing equipment have been completed.

2.2 Steam bypass control system instrumentation has been calibrated.

2.3 External test equipment has been calibrated and is operational.

2.4 Support systems required for operation of the steam bypass control system are operational.

3.0 Test Method

3.1 Utilizing actual or simulated interface inputs to the SBCS, observe receipt of these signals at the SBCS.

3.2 Utilizing installed and external test equipment, vary system inputs and observe output responses at the SBCS and at interfacing equipment.

3.3 Verify proper response of the steam bypass valves and position indicators.

Notes 1) Dynamic operation of the steam bypass valves will be demonstrated during hot functional testing.

2) Capacity testing of the steam bypass valves will be demonstrated during power ascension testing.

4.0 Acceptance Criteria

4.1 The steam bypass control system performs as described in Subsections 7.7.1 and 10.4.4.

14.2.12.1.123 Reactor Regulating System

1.0 Objective

1.1 To demonstrate the proper operation of the reactor regulating system (RRS).

2.0 Prerequisites

2.1 Construction activities on the RRS have been completed.

2.2 RRS instrumentation has been calibrated.

2.3 External test equipment has been calibrated and is operational.

2.4 Support systems required for operation of the RRS are operational.

2.5 Cabling has been completed between the RRS and interface equipment.

3.0 Test Method

3.1 Utilizing actual or simulated interface inputs to the RRS, observe receipt of these signals at the RRS.

3.2 Utilizing installed and external test instrumentation, vary all input signals to the system and observe output responses at the RRS and at interfacing equipment.

4.0 Acceptance Criteria

4.1 The reactor regulating system performs as described in Subsection 7.7.1.

14.2.12.1.124 Area Radiation Monitoring System

1.0 Objective

1.1 To demonstrate the operation of the area radiation monitors and verify that a high radiation signal at each monitor will initiate an alarm.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Utilizing a calibration source, actuate the area radiation monitors and verify their operability and associated alarms.

4.0 Acceptance Criteria

4.1 Each area radiation monitor actuates the associated alarms on receipt of a high radiation signal.

14.2.12.1.125 Process Radiation Monitoring System

1.0 Objective

1.1 To demonstrate the ability of the process radiation monitoring system to provide alarm and isolation signals, as applicable, upon receipt of high radiation signals. Operability of the radioactivity monitoring control room microprocessor is verified.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Remotely position the check source for each monitor, and evaluate the actuation of each monitor and the operability of its associated alarms and isolation signals.

3.2 Evaluate the operability of the radioactivity monitoring control room microprocessor.

4.0 Acceptance Criteria

4.1 The process radiation monitoring system provides alarm and isolation signals, in accordance with system design requirements.

14.2.12.1.126 Seismic Instrumentation

1.0 Objective

1.1 To demonstrate the operability of the seismic triggers and switches and strong motion accelerometers, including their associated alarms and recording and playback systems.

2.0 Prerequisites

2.1 Required construction acceptance tests and instrument calibration are complete.

2.2 Required electrical power supplies and control circuits are operational.

3.0 Test Method

3.1 Initiate a test signal and evaluate the operability of the seismic triggers, switches, and strong motion accelerometers, including their associated alarms, recording, and playback systems.

4.0 Acceptance Criteria

4.1 The seismic triggers, switches, and strong motion accelerometers, including their associated alarms, recording, and playback systems, operate in accordance with system design requirements.

14.2.12.1.127 Loose Parts Monitoring System

1.0 Objective

1.1 To demonstrate that the loose parts monitoring system is properly installed and operates as designed.

2.0 Prerequisites

2.1 All construction activities on the loose parts monitoring system are complete.

2.2 All associated instrumentation have been calibrated.

2.3 Appropriate test instrumentation is available and calibrated.

3.0 Test Method

3.1 Evaluate system response to simulated loose parts.

3.2 Evaluate the proper operation and installation of all recording devices.

3.3 Check and calibrate all system alarms and indicators.

4.0 Acceptance Criteria

4.1 The loose parts monitoring system operates per system design.

4.2 The loose parts alarms setpoint are adjusted for power operations.

14.2.12.1.128 Containment Monitoring System

1.0 Objective

1.1 To demonstrate the operability of the containment monitoring system.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Evaluate whether containment system continuously monitors containment status and provides input signal to the plant protection system.

4.0 Acceptance Criteria

4.1 The containment monitoring system operates in accordance with system design requirements.

14.2.12.1.129 Excore Neutron Flux Monitoring System

1.0 Objectives

1.1 To verify the proper functional performance of the system.

1.2 To verify the proper performance of audio and visual indicators.

2.0 Prerequisites

2.1 Construction activities on the excore neutron flux monitor system have been completed.

2.2 Excore neutron flux monitor system instrumentation has been calibrated.

2.3 External test equipment has been calibrated and is operational.

2.4 Support systems required for operation of the excore neutron flux monitor system are operational.

3.0 Test Method

3.1 Utilizing built-in test instrumentation, simulate and vary input signals to the startup, safety and control channels of the excore neutron flux monitor system.

3.2 Monitor and record all output signals as a function of variable inputs provided by test instrumentation.

3.3 Record the performance of audio and visual indicators in response to changing input signals.

4.0 Acceptance Criteria

4.1 The excore neutron flux monitoring system performs as described in Subsections 7.2.1 and 7.7.1.

14.2.12.1.130 Fixed Incore Nuclear Signal Channel

1.0 Objectives

1.1 To measure cable insulation resistance.

1.2 To verify proper amplifier operation.

2.0 Prerequisites

2.1 Construction activities on the incore nuclear instrumentation system are complete. (Detectors do not need to be installed).

2.2 Fixed incore nuclear signal channel instrumentation has been calibrated.

2.3 External test equipment has been checked and calibrated.

2.4 Support systems required for operation of the incore nuclear instrumentation System are operational.

3.0 Test Method

3.1 Measure and record cabling insulation resistance.

3.2 Using external test instrumentation, simulate incore detector signals into the signal conditioning (amplifier) circuits.

3.3 Vary the simulated inputs to the amplifier and record its outputs to the plant computer.

4.0 Acceptance Criteria

4.1 The fixed incore nuclear signal channel cables and instrumentation performs as described in Subsection 7.7.1.

14.2.12.1.131 CEDM Motor-Generator

1.0 Objectives

1.1 To demonstrate proper operation of each CEDM motor-generator (MG) set.

1.2 To verify MG set load carrying capabilities.

1.3 To demonstrate MG set parallel operation.

2.0 Prerequisites

2.1 Installation activities on CEDM MG sets are complete.

2.2 External test equipment has been checked and calibrated.

3.0 Test Methods

3.1 Simulate input signals and observe operation of local and remote alarms.

3.2 Measure and record insulation resistance on MG set windings.

3.3 Operate each MG set and record full rated power of each MG set.

3.4 Operate both MG sets in parallel.

4.0 Acceptance Criteria

4.1 The CEDM MG sets perform as described in Section 7.7. 1

14.2.12.1.132 AAC Diesel-Generator Load Sequencing

1.0 Objective

1.1 To demonstrate that the AAC diesel generator is capable of providing the required power to equipment vital to safe reactor shutdown within the required time under station blackout of one unit (Unit 3 or Unit 4). 1

1.2 To verify proper load sequencing.

1.3 To verify interlocking to permit control of the AAC diesel generator from only one unit at a time.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available.

2.3 Required mechanical systems associated with the AAC diesel generator systems are available.

2.4 Required Class 1E 4.16-kV systems, 480-volt load centers, and 480-volt motor-control centers are available.

2.5 The emergency diesel generator circuit breaker is not connected to the Class 1E 4.16-kV bus which will be connected to the AAC diesel generator.

3.0 Test Method

3.1 Demonstrate manual AAC diesel generator starting and load sequencing. Record the time required to supply power to the Class 1E 4.16-Kv bus. 1

4.0 Acceptance Criteria

4.1 Manual starting and load sequencing of an AAC diesel generator are accomplished per Section 8.3. And also the time required for AAC diesel-generator to supply power to the class 1E 4.16kV bus is in accordance with Section 8.3. 1

4.2 Controls, interlocks, indications, and alarms function in accordance with system design.

14.2.12.1.133 AAC Diesel-Generator Building HVAC System

1.0 Objective

1.1 To demonstrate the operation of the AAC diesel-generator room supply and exhaust fans and verify that the system instrumentation and controls function properly, including the response of fans to an AAC diesel-generat control permissive or room temperature signals.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

2.3 The AAC diesel-generator building HVAC system is air balanced.

2.4 The respective diesel generator is not operating while the room is under test.

3.0 Test Method

3.1 Evaluate the response of the AAC diesel generator room supply fans and exhaust fans to an AAC diesel-generator control permissive signals.

4.0 Acceptance Criteria

4.1 The operation of the AAC diesel generator room supply fans and exhaust fans are per design specifications.

4.2 The AAC diesel-generator room fire dampers close on receipt of a CO_2 initiation signal.

4.3 The diesel-generator room high-volume supply exhaust fans stop on a low room temperature signal.

4.4 Electric unit heaters operate as per design.

14.2.12.1.134 Diverse Protection System

1.0 Objective

1.1 To demostrate the proper operation of the diverse protection system (DPS).

2.0 Prerequisites

2.1 Construction activities on the CEDM motor generators and the diverse protection system have been completed.

2.2 DPS instrumentation has been calibrated.

2.3 External test instrumentation is available and calibrated.

2.4 Support systems required for operation of CEDM motor generators and DPS are operational.

3.0 Test Methods

3.1 Simulate local, remote, and automatic input signals and observe trip initiations.

3.2 Using simulated signals, trip each CEDM motor generator. Observe output contact operation.

4.0 Acceptance Criteria

4.1 The diverse protection system operates per system design.

14.2.12.1.135 Internals Vibration Monitoring System

1.0 Objective

1.1 To verify the proper operation of the internals vibration monitoring system (IVMS).

2.0 Prerequisites

2.1 Construction activities on the IVMS are completed.

2.2 Sensors, cables, and signal conditioning electronics are installed and operable.

2.3 Power cabinets, test circuits, and amplifiers are ready to support testing.

2.4 Required test equipment is operable.

2.5 Data analysis software programs are installed and operable.

3.0 Test Methods

3.1 Apply simulated signals to the core internal motion channels to verify the ability to detect and record reactor core internal motion.

3.2 Observe all alarm functions.

3.3 Evaluate whether data analysis software programs receive appropriate data and perform specified analysis functions.

4.0 Acceptance Criteria

4.1 The IVMS operates per system design.

14.2.12.1.136 Inadequate Core Cooling Monitoring System

1.0 Objectives

1.1 To verify that the inadequate core cooling monitoring system (ICCMS) is properly installed, responds correctly to external inputs, and displays plant safety parameters on plasma display units.

1.2 Saturation margin, reactor vessel level, core exit thermocouples and self diagnostics are common to both Channels A and B . Inputs are unique to each channel; therefore, either channel will operate independent of themselves or plant computer system.

2.0 Prerequisites

2.1 Construction activities are complete on each system to be tested.

2.2 Vendor and owner manuals are available and up to date.

2.3 Test instumentation is available and calibrated.

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

3.0 Test Methods

3.1 Introduce inputs into system, compare with required displays, and ensure that they meet accuracy specifications.

3.2 Verify pages, alarms, calculations, display updates, and data links operate per design requirements.

3.3 Functionally check software program to ensure no errors.

3.4 Compare ICCMS and PMS readouts for selected inputs to verify that the ICCMS and PMS programs are compatible.

4.0 Acceptance Criteria

4.1 Inadequate core cooling monitoring system performs per system design.

14.2.12.1.137 Acoustic Leak Monitoring System

1.0 Objectives

1.1 To verify proper operation of the acoustic leak monitoring system (ALMS).

1.2 To adjust the alarm setpoints under operational conditions.

1.3 To verify automated calibration features.

2.0 Prerequisites

2.1 Construction activities on the ALMS are complete.

2.2 Sensors, cables, and signal conditioning electronics are installed and operable.

2.3 Power cabinets, test circuits, and amplifiers are ready to support testing.

2.4 Required test equipment is operable.

2.5 Data analysis, storage, and trending software is operable.

3.0 Test Methods

3.1 Evaluate the calibration and alarm setpoints using simulated signals to the acoustic monitoring channels.

3.2 Observe all alarm functions.

3.3 Establish baseline monitoring data under operating conditions for a cold, subcritical plant.

3.4 Observe the automated electronics calibration functions.

4.0 Acceptance Criteria

4.1 The ALMS operates per system design.

4.2 The alarm setpoints have been established.

14.2.12.1.138 Plant Annunciator System

1.0 Objective

1.1 To demonstrate the operability of the plant annunciator system alarms.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available and operational.

3.0 Test Method

3.1 Evaluate actuation of system alarms upon receipt of plant abnormal conditions.

4.0 Acceptance Criteria

4.1 Plant annunciator system alarms operate in accordance with system design requirements.

14.2.12.1.139 Process Sampling System*

1.0 Objectives

1.1 To domonstrate the operating characteristics of the steam generator blowdown sample system, feedwater, and condensate sample system, and the GRS, LRS, STS sample system, and verify the operability of their associated control circuits.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

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* Test to be done during hot functional test also.

2.2 Required electrical power supplies and control circuits are operational.

2.3 Plant conditions are established and systems are available as necessary, to facilitate drawing samples from the sample points.

2.4 The turbine plant closed cooling water system is available to provide cooling water to the system sample coolers.

2.5 The service water system is available to supply water to precise cooling system.

3.0 Test Method

3.1 Evaluate the operability of the smaple systems and of the associated control circuits.

3.2 Obtain system samples and record flows.

4.0 Acceptance Criteria

4.1 The operability of the sample systems is as per design.

4.2 Sample system flows are within design requirements.

14.2.12.1.140 Engineered Safety Features Auxiliary Relay Cabinet

1.0 Objective

1.1 To demonstrate the proper operation of the engineered safety features auxiliary relay cabinet.

2.0 Prerequisites

2.1 Construction activities on the ESFAS have been completed.

2.2 ESFAS instrumentation has been calibrated.

2.3 External test instrumentation is available and calibrated.

2.4 Support systems required for operation of the ESFAS are operational.

3.0 Test Method

3.1 Energize power supplies and observe output voltages.

3.2 Simulate ground faults and observe operation of the ground fault detectors.

3.3 Individually deenergize each group relay and monitor contact operation.

3.4 Test manual trips and monitor relay operation.

3.5 Deenergize all combinations of the two-out-of four trip logic for each of the actuation systems (SIAS, CIAS, CSAS, RAS, MSIS, AFAS) and observe actuation of the appropriate trip circuit and associated alarms.

3.6 Simulate analog inputs to the appropriate circuits and observe trip initiations.

4.0 Acceptance Criteria

4.1 The engineered safety features auxiliary relay cabinet performs as described in Subsection 7.3.1.

14.2.12.1.141 Reactor Power Cutback System

1.0 Objective

1.1 To demonstrate proper operation of the reactor power cutback system (RPCS).

2.0 Prerequisites

2.1 Construction activities on the RPCS have been completed.

2.2 RPCS instrumentation has been calibrated.

2.3 External test equipment has been checked and calibrated.

2.4 Support systems required for the operation of the RPCS are operational.

3.0 Test Method

3.1 Utilizing actual or simulated interface inputs to the RPCS, observe receipt of these signals at the RPCS.

3.2 Utilizing installed and external instrumentation, vary all input signals to the system and observe output responses at the RPCS and at interfacing equipment.

4.0 Acceptance Criteria

4.1 The reactor power cutback system performs as described in Subsection 7.7.1.

14.2.12.1.142 Refueling Equipment*

1.0 Objective

1.1 To demonstrate the proper functional performance of the following refueling equipment:

a. Refueling machine

b. Fuel transfer system

c. CEA change mechanism

d. Spent fuel handling machine

e. New fuel elevator

f. TV system

g. Fuel building overhead crane

2.0 Prerequisites

2.1 Construction activities have been completed on the refueling equipment.

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* Test to be done during hot functional test also.

2.2 Refueling equipment instrumentation has been calibrated.

2.3 Reactor vessel head has been removed.

2.4 Core support barrel has been installed and aligned.

2.5 Dummy fuel assembly is available.

3.0 Test Method

3.1 Operate the refueling machine bridge and trolley and observe position indicators, limit switch, and interlock operation.

3.2 Operate the refueling machine hoist and underwater TV camera tilt mechanism. Observe hoist speeds, loads, position indications, cable limit switch, and interlock operation.

3.3 Operate the fuel transfer system and observe upender and fuel carriage operation, indications, limit switch, and interlock operation.

3.4 Operate the CEA change mechanism and observe its operation.

3.5 Operate the spent fuel handling machine and observe its operation.

3.6 Perform a static load test at 125% of rated load and a dynamic load test at 100% of rated load for the refueling machine, spent fuel handling machine, reactor vessel head lifting rig, the reactor internals lifting rig and fuel building overhead crane.

3.7 Position a dummy fuel assembly in the new fuel elevator and, using the new fuel elevator, fuel transfer machine, and refueling machine, position the dummy assembly in each core position in the reactor vessel. During these operations, observe general operation and interlock operation. Record the x-y coordinates of each core position.

4.0 Acceptance Criteria

4.1 The refueling equipment performs as described in Subsection 9.1.4.

4.2 The refueling and spent fuel handling machines, reactor vessel head and reactor internals lifting rigs, and fuel building overhead crane lift and hold 125% of rated load under static conditions and are capable of full operation at 100% of rated load.

4.3 Simulated fuel handling operations have been conducted using the dummy fuel assembly.

14.2.12.1.143 Plant Computer

1.0 Objectives

1.1 To verify that all system hardware is installed and operating properly and that all system software responds correctly to external inputs and provides proper outputs to the computer peripheral equipment.

2.0 Prerequisites

2.1 All construction and installation activities are completed on the items to be tested.

2.2 Required manufacturer's and/or owner's manuals are available.

2.3 Internal and external test instrumentation is calibrated and available.

2.4 Support systems required for operation of the plant computer are operational.

3.0 Test Method

3.1 Run test programs, sequenced as specified by the manufacturer, to ascertain the reliability of computer systems to perform all required hardware functions.

3.2 Simulate external inputs to the system and measure the outputs using the external test instrumentation.

3.3 Use proper software and/or control panel inputs, as applicable, to verify computer functional programs.

3.4 Use the computer system instrumentation and/or the external test measurements, as applicable, to verify alarm and indication functions.

4.0 Acceptance Criteria

4.1 Plant computer system operates as described in Subsection 7.7.1.

14.2.12.1.144 Main and Auxiliary Transformers

1.0 Objective

1.1 To demonstrate the capability of the main and unit auxiliary transformers to supply electrical power to the 345-kV switchyard and the 13.8-kV and 4.16-kV buses. Operation of protection devices and functional operation of controls and interlocks is also verified.

2.0 Prerequisites

2.1 Meters, relays, and protective devices are calibrated and tested.

2.2 Required electrical power supplies and control circuits are operational.

2.3 Erection work on transformers and switchgear is complete.

2.4 The transformer oil system is available.

2.5 Isolated phase bus support systems are available.

2.6 Required construction acceptance tests are complete.

3.0 Test Method

3.1 Simulate signals to temperature controls and verify operation of transformer oil pumps and fans.

3.2 Simulate signals to verify annunciators for transformer protective devices.

4.0 Acceptance Criteria

4.1 Transformers provide reliable source of electrical power to the 345-kV switchyard and the 13.8-kV and 4.16-kV buses in accordance with design requirements.

14.2.12.1.145 Generator Excitation and Voltage Regulation

1.0 Objectives

1.1 To demonstrate the ability of the excitation system to control output voltage of the main generator.

1.2 To demonstrate the stability of the automatic regulator.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 Main turbine and generator and 345-kV switchyard, and switchgear are available for synchronized operation.

3.0 Test Method

3.1 Operate the individual components of the main generator excitation control system and document data to satisfy the acceptance criteria.

4.0 Acceptance Criteria

4.1 Main generator excitation control system functions in accordance with design requirements.

14.2.12.1.146 Startup Transformer (03XN)

1.0 Objective

1.1 To demonstrate the capability of the 345-kV startup transformer to supply electrical power to the 13.8-kV, non-Class 1E 4.16-kV, and Class 1E 4.16-kV buses. Operation of protection devices and functional operation of controls and interlocks is verified.

2.0 Prerequisites

2.1 Meters, relays, and protective devices are calibrated and tested.

2.2 Required electrical power supplies and control circuits are operational.

2.3 Erection work on transformers and switchgear is complete.

2.4 Transformer oil and gas systems are available.

2.5 Required construction acceptance tests are complete.

2.6 The 345-kV system has been energized.

2.7 Nonsegregated phase bus is tested and ready for service.

3.0 Test Method

3.1 Simulate signals to temperature controls and verify operation of transformer fans.

3.2 Simulate signals to each transformer protective device to verify transformer protective logic.

4.0 Acceptance Criteria

4.1 Transformers provide a reliable source of electrical power to 13.8-kV, non-Class 1E 4.16-kV, and Class 1E 4.16-kV buses in accordance with design requirements. System protective devices operate per design requirements.

14.2.12.1.147 Startup Transformer (04XN)

1.0 Objective

1.1 To demonstrate the capability of the 345-kV startup transformer to supply electrical power to the 13.8-kV, non-Class 1E 4.16-kV, and Class 1E 4.16 kV buses. Operation of protection devices and functional operation of controls and interlocks are verified.

2.0 Prerequisites

2.1 Meters, relays, and protective devices are calibrated and tested.

2.2 Required electrical power supplies and control circuits are operational.

2.3 Erection work on transformers and switchgear is complete.

2.4 Transformer oil and gas systems are available.

2.5 Isolated phase bus is tested and ready for service.

2.6 Required construction acceptance tests are complete.

2.7 The 345-kV system has been energized.

3.0 Test Method

3.1 Simulate signals to temperature controls and verify operation of transformer fans.

3.2 Simulate signals to each transformer protective device to verify transformer protective logic.

4.0 Acceptance Criteria

4.1 Transformers provide a reliable source of electrical power to 13.8-kV, non-Class 1E 4.16-kV, and Class 1E 4.16-kV buses in accordance with design requirements. System protective devices operate per design requirements.

14.2.12.1.148 Non-Class 1E 13.8-kV System

1.0 Objectives

1.1 To demonstrate that the 13.8-kV buses can be energized from the respective startup transformer.

1.2 To demonstrate that automatic fast transfer of the buses from the unit auxiliary transformers to the startup transformers is within design specifications. Proper operation of system instrumentation and controls is verified. 1

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available.

2.3 The 13.8-kV system has been energized.

3.0 Test Method

3.1 Energize the 13.8-kV buses from the respective startup transformer and record the bus voltage and phase rotation.

3.2 Observe automatic fast transfer from the respective unit auxiliary transformer to the startup transformer.

3.3 (Deleted) 1

3.4 Simulate electrical fault signals and operate the 13.8-kV auxiliary and startup transformer breakers.

4.0 Acceptance Criteria

4.1 The 13.8-kV bus voltage and phase rotation are within design requirements.

4.2 Automatic fast transfer from the unit auxiliary transformers to the startup transformers is within design requirements.

4.3 The 13.8-kV auxiliary transformer and startup transformer breakers trip on receipt of an electrical fault signal.

14.2.12.1.149 Class 1E 4.16-kV System

1.0 Objectives

1.1 To demonstrate that the 4.16-kV (Class 1E) buses can be energized from their respective normal and alternate preferred power sources.

1.2 To verify that the preferred power sources undervoltage condition trips the associated feeder breakers. Proper operation of system instrumentation and controls is verified.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available.

2.3 The 4.16-kV (Class 1E) system has been energized.

3.0 Test Method

3.1 Energize individual 4.16-kV (Class 1E) buses from their respective normal and alternate preferred power sources.

3.2 Create undervoltage conditions and observe operation of the normal and alternate feeder breakers.

3.3 Simlate electrical fault signals and operate the 4.16-kV (Class 1E) normal and alternate feeder breakers. 1

4.0 Acceptance Criteria

4.1 The voltage and phasing of each 4.16-kV (Class 1E) bus, when supplied from its normal preferred power source, are within design requirements.

4.2 The voltage and phasing of each 4.16-kV (Class 1E) bus, when supplied from its alternate preferred power source, are within design requirements.

4.3 The 4.16-kV (Class 1E) normal and alternate feeder breakers trip and lock open on receipt of normal and alternate preferred power source undervoltage or electrical fault signals. 1

14.2.12.1.150 Non-Class 1E 4.16-kV System

1.0 Objectives

1.1 To demonstrate that the 4.16-kV (non-Class 1E) buses can be energized from the respective startup transformer.

1.2 To demonstrate that automatic fast transfer of the buses from the unit auxiliary transformer to the startup transformer is within design specifications. Proper operation of system instrumentation and controls is verified.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available.

2.3 The 4.16-kV (non-Class 1E) system has been energized.

3.0 Test Method

3.1 Energize the 4.16-kV (non-Class 1E) buses from the startup transformer and record the bus voltage and phase rotation.

3.2 Observe automatic fast transfer from the respective unit auxiliary transformer to the startup transformer.

3.3 Simulate electrical fault signals and operate the 4.16-kV auxiliary transformer and startup transformer breakers.

4.0 Acceptance Criteria

4.1 The 4.16 kV (non-Class 1E) bus voltage and phase rotation are within design requirements.

4.2 Automatic fast transfer of the buses from the unit auxiliary transformer to the startup transformer is within design requirements.

4.3 The 4.16-kV (non-Class 1E) auxiliary transformer and startup transformer breakers trip and lock out on receipt of an undervoltage or electrical fault signal.

14.2.12.1.151 480-Volt (Class 1E) System

1.0 Objective

1.1 To demonstrate the capability of the 480-Volt (Class 1E) system to provide proper voltage and phasing to plant (Class 1E) motor control centers and auxiliaries.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical control circuits are available.

2.3 4.16-kV (Class 1E) systems are in service.

3.0 Test Method

3.1 Energize each individual 480-volt (Class 1E) load center from its respective 4.16-kV power supply. Demonstrate the operation of load center transformer, feeder breakers, metering and relaying devices.

4.0 Acceptance Criteria

4.1 480-volt (Class 1E) load center breaker interlocks operate in accordance with the system design.

4.2 Indication, alarms, metering, and protective relays function properly in accordance with system design.

4.3 The voltage and phasing of each 480-volt (Class 1E) load center, when energized, is within design requirements.

14.2.12.1.152 480-volt (Non-Class 1E) System

1.0 Objective

1.1 To demonstrate the capability of the 480-volt (non-Class 1E) system to provide proper voltage and phasing to plant (non-Class 1E) motor control centers and auxiliaries.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical control circuits are operational.

2.3 The 4.16 kV (non-Class 1E) and 13.8-kV systems are energized and in service.

3.0 Test Method

3.1 Energize each individual 480-volt (non-Class 1E) load center from the respective 4.16-kV or 13.8-kV supply. Demonstrate the operation of load center transformers, normal and alternate feeder breakers, metering and relaying device operation, and interlocks.

4.0 Acceptance Criteria

4.1 480-volt (non-Class 1E) load center feeder breaker interlocks operate in accordance with the system design.

4.2 All indication, alarms, metering, and protective relays function properly in accordance with the system design.

4.3 The voltage and phasing of each 480-volt (non-Class 1E) load center, when supplied from its normal source and alternate source, is within design requirements.

14.2.12.1.153 250-Vdc System

1.0 Objective

1.1 To demonstrate the ability of the battery and battery chargers, principal and backup, to provide power to the buses.

1.2 To demonstrate the battery chargers ability to recharge its respective battery. Proper operation of system instrumentation and controls is verified.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 Ventilation for the battery room is available.

2.4 The 250-Vdc system has been energized.

3.0 Test Method

3.1 Discharge the battery, using a test load, at the design duty cycle discharge rate.

3.2 Fully discharge the battery to determine its capacity factor.

3.3 Evaluate the ability of each battery charger to charge the battery to normal conditions, after the battery has been fully discharged while simultaneously supplying power at a rate equivalent to the largest continuous current load.

4.0 Acceptance Criteria

4.1 The battery is capable of maintaining output voltage above the design minimum during a design duty cycle.

4.2 The battery capacity factor is within design requirements.

4.3 The battery chargers are able to recharge the battery to normal conditions, after the battery has been fully discharged, while simultaneously supplying power at a rate equivalent to the total continuous current load.

4.4 Spare battery charger is verified for proper substitution of regular battery chargers.

14.2.12.1.154 125-Vdc (Class 1E) System

1.0 Objectives

1.1 To demonstrate the ability of the batteries and chargers to provide power during normal and abnormal conditions.

1.2 To demonstrate the battery charger's ability to recharge its respective battery. Proper operation of the system instrumentation and controls is verified.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available.

2.3 Ventilation for the respective battery rooms is available.

3.0 Test Method

3.1 Discharge each battery, using a test load at the design duty cycle discharge rate, and determine its capacity factor.

3.2 Evaluate the ability of each battery charger to charge its respective batteries to normal conditions, after the batteries have undergone a design duty cycle, while simultaneously supplying power at a rate equivalent to the design emergency loading.

4.0 Acceptance Criteria

4.1 Each battery is capable of maintaining output voltage above the design minimum during a design duty cycle.

4.2 Each battery capacity factor is in accordance with design requirements.

4.3 The battery chargers are able to recharge the batteries to normal conditions, after the batteries have undergone a design duty cycle, while simultaneously supplying power at a rate equivalent to the design emergency loading.

14.2.12.1.155 125-Vdc (Non-Class 1E) System

1.0 Objectives

1.1 To demonstrate the ability of the batteries and chargers, normal and backup, to provide power to the buses.

1.2 To verify the battery charger's ability to recharge its respective battery and the proper operation of system instrumentation and controls.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 Ventilation for the battery room is available.

3.0 Test Method

3.1 Discharge each battery, using a test load at the design duty cycle discharge rate, and determine the battery capacity factor.

3.2 Evaluate the ability of each battery charger to charge its respective battery to normal conditions, after the battery has undergone a design duty cycle while simultaneously supplying power at a rate equivalent to the design instrumentation loading.

4.0 Acceptance Criteria

4.1 Each battery is capable of maintaining output voltage above the design minimum during a design duty cycle.

4.2 Each battery capacity factor is within design requirements.

4.3 The battery chargers are able to recharge the batteries to normal conditions, after the battery has undergone a design duty cycle, while simultaneously supplying power at a rate equivalent to the design load.

4.4 Spare battery chargers are verified for proper substitution of regular battery chargers.

14.2.12.1.156 Class 1E 120-Vac I&C Power

1.0 Objectives

1.1 To demonstrate that the 120-Vac (Class 1E) distribution panels can be supplied from their normal source inverters and from their backup source regulated transformers by static transfer.

1.2 To verity the operability of system instrumentation and controls, including breaker protective.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available.

3.0 Test Method

3.1 Energize the 120-Vac (Class 1E) distribution panels from their normal source inverters and record the distribution panel voltages.

3.2 Energize the 120-Vac (Class 1E) distribution panels from their backup source regulated transformers by static transfer and record distribution panel voltages.

3.3 Operate the system breakers and evaluate the breaker interlocks.

4.0 Acceptance Criteria

4.1 Each 120-Vac (Class 1E) distribution panel voltage and frequency, when supplied from the normal source inverters of the distribution panel, is within design requirements.

4.2 Each 120-Vac (Class 1E) distribution panel voltage, when supplied from the backup source regulated transformers, is within design requirements.

4.3 System breaker interlocks operate in accordance with system design.

14.2.12.1.157 Non-Class 1E 120-Vac Computer Power

1.0 Objectives

1.1 To demonstrate that the 120-Vac computer power supply system can be fed from its normal and alternate sources.

1.2 To verify proper operation of the power sources (inverters), protective devices, alarms and control.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available.

3.0 Test Method

3.1 Energize computer power supply distribution panels from the normal source and automatically transfer them to backup source. Verify interlocks, indication, and relay devices of the feeder breakers.

4.0 Acceptance Criteria

4.1 Normal source power supply for plant computer voltage and frequency are within design requirements.

4.2 Alternate source power supply for plant computer voltage and frequency are within design requirements.

14.2.12.1.158 Non-Class 1E 120-Vac I&C Power

1.0 Objectives

1.1 To demonstrate that the 120-Vac (non-Class 1E) distribution panels can be supplied from their normal source inverters and from their backup source regulated transformers by static transfer.

1.2 To verify the operability of system instrumentation and controls, including breaker protective.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Required electrical power supplies and control circuits are available.

3.0 Test Method

3.1 Energize the 120-Vac (non-Class 1E) distribution panels from their normal source inverters and record the distribution panel voltages.

3.2 Energize 120-Vac (non-class 1E) distribution panels from their backup source regulated transformers by static transfer and record the distribution panel voltages.

3.3 Operate the system breakers and evaluate the breaker interlocks.

4.0 Acceptance Criteria

4.1 Each 120-Vac (non-Class 1E) distribution panel voltage and frequency, when supplied from the normal source inverters of the distribution panel, is within design requirements.

4.2 Each 120-Vac (non-Class 1E) distribution panel voltage, when supplied from the backup source regulated transformers, is within design requirements.

4.3 System breaker interlocks operate in accordance with system design.

14.2.12.1.159 Emergency Lighting System

1.0 Objective

1.1 To demonstrate the transfer capability from ac power source to dc power source of each power pack of the emergency lighting, the transfer capability to 125-Vdc system incandescent fixture, and the adequacy of the lighting provided.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 The notmal, essential, and emergency lighting systems have been energized.

3.0 Test Method

3.1 Remove the ac power source to the emergency lighting system and evaluate transfer of each power pack unit to dc power source and transfer to 125-Vdc system incandescent fixture.

3.2 Evaluate whether acceptable lighting levels are provided when all other ac lighting systems are turned off.

4.0 Acceptance Criteria

4.1 The emergency lighting system is capable of supplying adequate lighting levels in the event of loss of normal and essential lighting ac power, and operates in accordance with system design requirements.

14.2.12.1.160 Heat Tracing (Freeze Protection) System

1.0 Objectives

1.1 To demonstrate the ability of the heat tracing (freeze protection) system to automatically control the associated heat tracing circuits.

1.2 To verify proper annuciation of alarm conditions.

2.0 Prerequisites

2.1 Required component testing and instrument calibration is complete.

2.2 Required electrical power supplies and control circuits are in operation.

3.0 Test Method

3.1 Produce simulated variations of temperature signals and verify the automatic on-off switching of heaters within the system.

3.2 Simulate alarm conditions and verify proper annunciation.

4.0 Acceptance Criteria

4.1 The heat tracing (freeze protection) system automatically controls its associated heat tracing circuits to maintain temperatures in a specified range.

4.2 Alarm conditions are properly annunciated.

14.2.12.1.161 Heat Tracing (Special Process) System

1.0 Objectives

1.1 To demonstrate the ability of the special process heat tracing system to automatically control the associated heat tracing circuits.

1.2 (Deleted) 1

1.3 To verify proper annunciation of alarm conditions.

2.0 Prerequisites

2.1 Required component testing and instrument calibration are complete.

2.2 Required electrical power supplies and control circuits are operational.

3.0 Test Method

3.1 Produce simulated variations of temperature signals and verify the automatic on-off switching of heaters within the system.

3.2 (Deleted) 1

3.3 Simulate alarm conditions and verify proper annunciation.

4.0 Acceptance Criteria

4.1 The special process heat tracing system automatically controls its associated heat tracing circuits to maintain temperatures in a specified range.

4.2 (Deleted) 1

4.3 Alarm conditions are properly annunciated.

14.2.12.1.162 Piping Steady-State and Transient Vibration

1.0 Objective

1.1 To demonstrate that flow-induced vibrations produced in selected system piping during normal operation is acceptable.

1.2 To demonstrate that transient effects during normal operations do not produce excessive vibrations in selected systems of piping and components.

2.0 Prerequisites

2.1 Required component testing and instrument calibrations are complete.

2.2 Applicable systems have been walked through and verified complete to the extent required to conduct this test.

2.3 All temporary hangers have been removed and replaced with permanently installed hangers for the systems involved, prior to starting the test on the particular system.

3.0 Test Method

3.1 Visully inspect the applicable piping while the system is operating at normal steady-state conditions. If vibration is visually detected, test it with a portable vibration moniytor and consult a qualified stress engineer to determine the acceptability of the piping or system under test.

3.2 Induce transients by starting and stopping pumps or charging flow paths in applicable systems, and visually observe results. Perform instrumented analysis of line/component if necessary for further verification.

4.0 Acceptance Criteria

4.1 No unacceptable vibrations exist in the applicable system piping during normal steady-state or transient operations.

4.2 Spring-hanger movement remains within the hot and cold setpoints, and snubbers are neither fully retracted or expanded.

4.3 Piping and components return to their approximate baseline position on cooldown.

14.2.12.1.163 CVAP Inspection* and In-Situ Measurements** 1

1.0 Objective

1.1 To verify the integrity of the reactor vessel internals.

2.0 Prerequisites

2.1 The reactor vessel internals have been cleaned.

2.2 Temporary instruments have been installed on the reactor vessel internals.** The instruments have been calibrated and connected to a data acquisition system.** 1

3.0 Test Method

3.1 Perform pre- and post-hot functional inspections on the reactor vessel internals.

3.2 Record data at the specified temperature plateaus and with specified reactor coolant pumps is operation. 1

4.0 Acceptance Criteria

4.1 The reactor vessel internals are structurally adequate and sound for operation per Subsection 3.9.2.4 and the approved test procedure.

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* Test to be done during hot function test also.

** In-situ measurements to be performed on YGN Unit 4 only. 1

14.2.12.1.164 Gas Stripper Process Radiation Monitor Subsystem Test

1.0 Objective

1.1 To demonstrate proper operation of the gas stripper process radiation monitor Subsystem.

2.0 Prerequisites

2.1 The gas stripper process radiation monitor has been installed, all interconnections have been completed, and the sample chamber has been filled with reactor makeup water.

2.2 The gas stripper process radiation monitor has been calibrated.

2.3 Support systems required for operation of the gas stripper process radiation monitor subsystem are complete and operational.

2.4 A check source is available.

3.0 Test Method

3.1 Utilizing the built-in test features, observe process radiation monitor indications, outputs to interface equipment, and alarm operation.

3.2 Utilizing a check source, verify calibration of the process monitor.

4.0 Accepance Criteria

4.1 The gas stripper process radiation monitor performs as described in Subsection 9.3.4.

14.2.12.1.165 (Deleted)

1

1

14.2.12.1.166 Safety Depressurization System

1.0 Objective

1.1 To demonstrate the proper operation of the safety depressurization system.

2.0 Prerequisites

2.1 Construction activities on the safety depressurization system have been completed.

2.2 Support systems required for operation of the safety depressurization system are completed and operational.

2.3 Safety depressurization system instrumentation has been installed and calibrated. 1

3.0 Test Method

3.1 Operate all SDS valves and observe correct valve operation and position indication. Valve open and close stroke times are recorded.

3.2 Simulate failed conditions and observe valve responds as designed.

3.3 Simulate a high temperature condition and verify that the SDS line temperature instrument alarm setpoints have been correctly installed.

4.0 Acceptance Criteria

4.1 The safety depressurization system performs as described in Subsection 5.4.16

14.2.12.2 Pre-Core Hot Functional Tests

14.2.12.2.1 Pre-Core Hot Functional Test Controlling Document

1.0 Objectives

1.1 To demonstrate the proper integrated operation of plant systems when in simulated, or actual, operating configurations. This shall include a demonstration that reactor coolant temperature and Pressure can be lowered to permit operation of the shutdown cooling system and that the shutdown cooling system can be used to achieve cold shutdown at a cool-down rate not exceeding Technical Specification limits and a demonstration of the operation of the steam bypass valves.

2.0 Prerequisites

2.1 All construction activities on the systems to be tested are completed.

2.2 All permanently installed instrumentation on systems to be tested have been properly calibrated and are operational.

2.3 All necessary test instrumentation is available and properly calibrated.

2.4 Hydrostatic testing has been completed.

2.5 Steam generators are in wet layup in accordance with the NSSS Chemistry manual.

2.6 Reactor internals, as appropriate for pre-core hot functional testing, have been installed.

3.0 Test Method

3.1 Specify plant conditions and coordinate the execution of the related pre-core hot functional test appendices.

4.0 Acceptance Criteria

4.1 Integrated operation of the RCS, secondary, and related auxiliary systems perform in accordance with design criteria.

4.2 RCS temperature and pressure can be lowered to permit operation of the shutdown cooling system.

4.3 The shutdown cooling system can be used to achieve cold shutdown at a cool-down rate not in excess of Technical Specification limits.

4.4 The steam bypass valves can be operated to control RCS temperature.

4.5 Criteria as specified by the individual precore hot functional test procedures.

14.2.12.2.2 Pre-Core Test Data Record

1.0 Objectives

1.1 To monitor instrumentation during integrated plant operation.

1.2 To verify, by cross checking channels, the satisfactory tracking of process instrumentation.

1.3 To provide a permanent record of plant precore loading parameter indication.

2.0 Prerequisites

2.1 Instrumentation has been calibrated and is operational.

3.0 Test Method

3.1 Record control room instrumentation steady-state readings as directed by the pre-core hot functional test controlling document.

4.0 Acceptance Criteria

4.1 All like instrumentation readings shall agree within the accuracy limits of the instrumentation.

14.2.12.2.3 Pre-core Reactor Coolant System Expansion Measurements

1.0 Objective

1.1 To demonstrate that the reactor coolant (RC) system components are free to expand thermally as designed during initial plant heatup and return to their baseline cold position after the initial cooldown to ambient temperatures.

2.0 Prerequisites

2.1 All construction activities have been completed on the RC system components.

2.2 Initial ambient dimensions have been set on the steam generator and RC pump hydraulic snubbers, upper and lower steam generator and reactor vessels keys, and RC pump columns.

2.3 Initial ambient dimensions for the steam generator, reactor vessel, and reactor coolant pump supports have been recorded.

3.0 Test Method

3.1 Check clearances at hydraulic snubbers joints keys, and column clevises at 25°C increments during heatup, and record at 50°C increments.

3.2 At stabilized conditions, record all steam generator, reactor vessel, and reactor coolant pump clearances.

4.0 Acceptance Criteria

4.1 Unrestricted expansion is available for selected points on components.

4.2 Components return to their base-line ambient position.

4.3 Proper gaps exist for selected points on components.

14.2.12.2.4 Pre-Core Reactor Coolant and Secondary Water Chemistry Data

1.0 Objective

1.1 To demonstrate that proper water chemistry for the RCS and steam generator can be maintained.

2.0 Prerequisites

2.1 Primary and secondary sampling systems are operable.

2.2 Chemicals to support hot functional testing are available.

2.3 The primary and secondary chemical addition systems are operable.

2.4 Purification ion exchangers are charged with resin.

3.0 Test Method

3.1 Minimum sampling frequency for the steam generator and RCS is specified by the chemistry manual. Modify the sampling frequency as required to ensure the proper RCS and steam generator water chemistry.

3.2 Perform RCS and steam generator sampling and chemistry analysis after every significant change in plant conditions (i.e. heatup, cooldown, chemical additions).

4.0 Acceptance Criteria

4.1 RCS and steam generator water chemistry can be maintained as described in Subsections 9.3.4 and 10.3.5.

14.2.12.2.5 Pre-core Pressurizer Performance

1.0 Objectives

1.1 To demonstrate that the pressurizer pressure and level control systems function properly.

1.2 To demonstrate proper operation of the auxiliary spray valves and pressurizer heaters.

1.3 To demonstrate proper operations of the letdown flow control valves and charging pumps.

2.0 Prerequisites

2.1 Pressurizer pressure and level control system instrumentation has been calibrated.

2.2 Support systems required for the operation of the pressurizer pressure and level control systems are operational.

2.3 Test equipment is available and calibrated.

3.0 Test Method

3.1 Decease Pressurizer pressure and observe heater response and alarm and interlock setpoints.

3.2 Increase pressurizer pressure and observe heater and spray valve response and alarm and interlock setpoints.

3.3 Decrease level to initiate a low level error in the pressurizer and observe proper charging pump response and alarm and interlock setpoints.

3.4 Increase level to initiate a high level error in the pressurizer and observe proper charging pump response and alarm and interlock setpoints.

3.5 Decrease level to initiate a low pressurizer level and observe operation of the letdown control valves.

3.6 Decrease level to initiate a low-low pressurizer level and observe heater response and alarm and interlock setpoints.

4.0 Acceptance Criteria

4.1 The pressurizer performs as described in Subsections 7.7.1 and 5.4.10.

14.2.12.2.6 Pre-core Control Element Drive Mechanism Performance

1.0 Objectives

1.1 To determine the effectiveness of the CEDM cooling system by measurement of coil resistance at several temperature plateaus during RCS heatup.

1.2 To determine the operating temperature of the upper gripper coils.

1.3 To verify proper operation and sequencing of the CEDM armatures.

2.0 Prerequisites

2.1 CEDM coil stacks are assembled and associated cabling is connected.

2.2 Cabling between the reactor bulkhead and the CEDM control system is disconnected.

2.3 CEDM "cold" coil resistance has been measured and recorded.

2.4 Individual CEDM cable resistance has been measured and recorded.

2.5 CEDM cooling system is operational.

2.6 Test equipment is available and calibrated.

2.7 Support systems required for operation of the CEDM are operational.

3.0 Test Method

3.1 At the specified RCS temperature and pressure, measure and record the loop resistance for each of the CEDM coils.

3.2 Balance CEDM cooling system as required to maintain the coil temperatures within the specified limits.

3.3 Connect cabling between the reactor bulkhead and the CEDMCS cabinets and energize the CEDM. Measure and record the dc voltage across the upper gripper coil and across the shunt on the CEDMCS power switch assembly panel.

3.4 Operate the CEDM and observe count totalizer operation.

4.0 Acceptance Criteria

4.1 The control element drive mechanism performs as described in Subsection 7.7.1.

14.2.12.2.7 Pre-Core Instrument Correlation

1.0 Objectives

1.1 To demonstrate that the inputs and appropriate outputs between the PPS, process instrumentation, and plant monitoring system are in agreement.

1.2 To verify narrow range temperature and pressure instrumentation accuracy and operation by comparing similar channels of instrumentation.

2.0 Prerequisites

2.1 Instrumentation has been calibrated and is operational.

3.0 Test Method

3.1 Record wide range process instrumentation and plant monitoring system readings as directed by the pre-core hot functional test.

3.2 Record narrow range process instrumentation and plant monitoring system readings as directed by the pre-core hot functional test.

4.0 Acceptance Criteria

4.1 All narow range instrument readings agree within the accuracy of the instrumentation.

4.2 All wide range instrument readings agree within the accuracy of the instrumentation.

14.2.12.2.8 Pre-Core Reactor Coolant System Flow Measurements

1.0 Objective

1.1 To determine the precore RCS flow rate.

1.2 To establish baseline RCS pressure drops.

2.0 Prerequisites

2.1 All permanately installed instrumentation has been properly calibrated and is operational.

2.2 All test instrumentation has been checked and calibrated.

2.3 RCS operating at nominal hot, zero power conditions.

2.4 Desired reactor coolant pumps operating.

2.5 COLSS, CPCs and Plant Monitoring System in operation.

3.0 Test Method

3.1 Obtain RCS flow, pressure drops and the data necessary to calculate RCS flows for four reactor coolant pump operations.

4.0 Acceptance Criteria

4.1 The RCS flow exceeds the value necessary to ensure that post-core flow is in excess of that used for analysis in Chapter 15, but less than the flow which could cause core uplift.

14.2.12.2.9 Pre-Core Reactor Coolant System Heat Loss

1.0 Objective

1.1 To verify that RCS heat loss under hot, zero-power conditions is acceptable.

1.2 To verify that pressurizer heat loss under hot, zero-power conditions is acceptable.

2.0 Prerequisites

2.1 Test instrumentation is available and calibrated.

2.2 Construction activities on the RCS and associated systems are completed.

2.3 All permanently installed instrumentation on the system to be tested is available and calibrated.

3.0 Test Method

3.1 Determine the RCS heat loss using the steam-down method.

a. Stabilize the steam generator levels with the RCS at hot, zero power conditions.

b. Secure steam generator feedwater and blowdown.

c. Measure both the pressurizer heater power required to maintain RCS temperature and pressure and RCP power.

d. Perform a heat balance calculation to determine heat loss.

3.2 Determine the pressurizer heat loss, without continuous spray flow, by measuring the pressurizer heater power required to maintain the RCS at hot, zero-power conditions and then performing a heat balance calculation.

3.3 Determine the pressurizer heat loss with continuous spray flow by measuring the pressurizer heater power required to maintain the RCS at hot, zero-power conditions and then performing a heat balance calculation. The determination of pressurizer heat loss with spray flow should be performed during post-core hot functional testing after bypass spray valve have been adjusted.

4.0 Acceptance Criteria

4.1 The measured heat loss is less than or equal to the anticipated heat loss or an engineering evaluation finds the results acceptable.

14.2.12.2.10 Pre-Core Reactor Coolant System Leak Rate Measurement

1.0 Objective

1.1 To verify that the reactor coolant leakage, at hot, zero-power conditions, is acceptable.

2.0 Prerequisites

2.1 Hydrostatic testing of the RCS and associated systems has been completed.

2.2 The RCS and the CVCS are operating as a closed system.

2.3 The RCS is at hot, zero power conditions.

3.0 Test Method

3.1 Measure and record the changes in water inventory of the RCS and CVCS for a specified interval of time.

4.0 Acceptance Criteria

4.1 Identified and unidentified leakage is within the limits described in the Technical Specification.

14.2.12.2.11 Pre-Core Chemical and Volume Control System Integrated Test

1.0 Objective

1.1 To verify proper operation of the letdown subsystem and ion exchangers.

2.0 Prerequisites

2.1 The CVCS is in operation.

2.2 Selected ion exchanger has been filled with mixed bed resin. 1

2.3 Ion exchangers not to be used have been bypassed.

2.4 Associated instrumentation has been checked and calibrated.

3.0 Test Method

3.1 Taking manual control of the letdown control valve controller, position the letdown flow control valve to obtain various letdown flow rates between 0% and 100% flow, inclusive.

3.2 Measure and record the pressure drops across the ion exchanger, filter, and strainer.

4.0 Acceptance Criteria

4.1 The chemical and volume control system performs as described in Subsection 9.3.4.

14.2.12.2.12 Pre-Core Safety Injection Check Valve

1.0 Objective

1.1 To verify that the safety injection tank discharge check valve will pass flow with the RCS at hot, zero-power conditions.

1.2 To verify that the safety injection loop check valves will pass flow with the RCS at hot, zero-power conditions

2.0 Prerequisites

2.1 RCS is at hot, zero-power conditions.

2.2 Safety injection tanks are filled and pressurized to their normal operating conditions.

2.3 CVCS is in operation.

3.0 Test Method

3.1 Line the CVCS charging pumps to discharge into the safety injection discharge header and evaluate flow through the safety injection loop check valves.

3.2 Evaluate flow through each safety injection tank discharge check valve by directing flow back to the refueling water tank.

4.0 Acceptance Criteria

4.1 The loop check valves and safety injection tank discharge check valves pass flow with the RCS at hot, zero-power conditions.

14.2.12.2.13 Pre-Core Boration/Dilution Measurements

1.0 Objective

1.1 To demonstrate the ability of the CVCS to control the boron concentration of the reactor coolant system by the feed and bleed method.

1.2 To demonstrate the ability of the CVCS to supply concentrated boric acid to the reactor coolant system during emergency boration.

2.0 Prerequisites

2.1 Refueling water tank is filled with borated water.

2.2 The boron addition system is operational.

2.3 The boronometer is operational.

2.4 RCS and CVCS boron concentration is zero (0) ppm.

3.0 Test Method

3.1 Line up the boric acid makeup (BAMU) pumps to take suction from the refueling water tank (RWT) and discharge to the charging pump suction and to the RCS, and observe operation of the boron addition system.

3.2 Line up the charging pumps to take suction directly from the RWT and observe operation.

3.3 Perform boration and dilution operation of the reactor coolant system (RCS) by operating the BAMU control system in its various modes of operation.

3.4 Sample the RCS during boration and dilution operations and observe operation of the boronometer.

4.0 Acceptance Criteria

4.1 The boration subsystem performs as described in Subsection 9.3.4.

14.2.12.2.14 Downcomer Feedwater System Waterhammer

1.0 Objective

1.1 To demonstrate the absence of any significant waterhammer during steam generator water level recovery following the exposure of the downcomer feedwater sparger to a steam environment.

2.0 Prerequisites

2.1 Construction activities on the auxiliary feedwater system (AFWS) and those sections of the main feedwater system (MFWS) that are affected have been completed.

2.2 Feedwater control system instrumentation and other appropriate permanently installed instrumentation has been calibrated.

2.3 Main steam system is available.

2.4 Appropriate ac and dc power sources are available.

2.5 RCS operating at nominal hot, zero-power conditions (hot standby).

3.0 Test Method

3.1 Lower the steam generator water level to below the feedwater sparger by terminating feedwater flow.

3.2 Maintain the steam generator water level below the feedwater sparger, but it will take about 20 minutes or more to drain a steam generator sparger with top-discharge J-tubes (no feedwater 1 will be introduced into the generator through the sparger during this period).

3.3 Monitor for noise or vibration (by station personnel as appropriate*)

3.4 Initiate auxiliary feedwater flow to restore steam generator level in a manner that simulates automatic AFW actuation.

4.0 <u>Acceptance Criteria</u>

4.1 Visual inspection indicates that the integrity of feedwater piping, supports, and sparger** have not been violated.

14.2.12.2.15 <u>Pressurizer Safety Valve</u>

1.0 <u>Objective</u>

1.1 To verify the popping pressure of the pressurizer safety valves.

2.0 <u>Prerequisites</u>

2.1 Construction activities on the pressurizer have been completed and all associated instrumentation has been checked and calibrated.

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* Personnel safety will limit proximity of feedwater system.

* Visually inspect during next regular steam-generator inspection following testing

2.2 Reactor coolant system is at hot, zero-power temperature and pressure.

2.3 Support systems required for the testing of the pressurizer safety valves are operational.

2.4 Lifting device with associated support equipment and calibration data is available.

3.0 <u>Test Method</u>

3.1 Using the lifting device, increase the lifting force on the safety valve until the safety valve starts to simmer.

3.2 Determine popping pressure from the lifting device correlation data.

3.3 Adjust valve popping set pressure if necessary and retest.

4.0 <u>Acceptance Criteria</u>

4.1 Safety valves perform as described in section 5.4.13.

14.2.12.2.16 <u>Steam-Generator Blowdown System</u>

1.0 <u>Objectives</u>

1.1 To demonstrate the ability of the steam-generator blowdown system, in conjunction with the chemical feed and handling system, to maintain steam generator water chemistry within the prescribed limits.

1.2 To demonstrate proper system response to an AFAS.

2.0 Prerequisites

2.1 Required construction acceptance tests and system cleaning are complete.

2.2 Required electrical power supplies and control circuits are operational.

2.3 The turbine building closed cooling water system is available.

2.4 The condensate system is available.

2.5 The nonradioactive equipment vents and drains system is available.

2.6 The waste water transfer system is available.

2.7 Hot functional testing is in progress for applicable parts of the preoperational test.

2.8 The compenent cooling water system is available.

3.0 Test Method

3.1 Initiate an AFAS and observe operation of affected valves.

3.2 Cycle all control and isolation valves and observe proper operation.

3.3 Operate the steam generator blowdown mixed demineralizer flash tank and regenerative and nonregenerative heat exchangers, filters, and associated controls.

3.4 Evaluate the ability to process water to the condenser as well as the waste water transfer system via the equipment drain system.

4.0 Acceptance Criteria

4.1 System valves respond properly to an AFAS.

4.2 Steam generator blowdown system operate as per design requirement.

14.2.12.2.17 Turbine-Generator Startup Sequence and Initial Turbine Operation

1.0 Objective

1.1 To verify proper operation of turbine-generator.

2.0 Prerequisites

2.1 The main turbine has been installed and checked out.

2.2 A normal condenser vacuum has been established.

2.3 Hot functional testing is in progress.

3.0 Test Method

3.1 Perform initial turbine roll and turbine checks.

4.0 Acceptance Criteria

4.1 Initial turbine roll and turbine checks are completed without exceeding the guidelines and restrictions detailed in the approved test procedure.

14.2.12.2.18 Main Steam Safety Valves

1.0 Objective

1.1 To verify the pressure relief set points of the main steam safety valves.

2.0 Prerequisites

2.1 Required construction acceptance tests are complete.

2.2 Hot functional testing is in progress.

2.3 A source of compressed air is available to provide air to the air set pressure device installed on the valve under test.

3.0 Test Method

3.1 Adjust main steam pressure within the required range, and admit air to the air set pressure device on the safety valve under test.

3.2 Calculate actual lift pressure using the steam pressure and converted air pressure at the time of lift.

3.3 Evaluate setpoints of safety valves from vendor bench test certification data.

4.0 Acceptance Criteria

4.1 Each main steam safety valve lifts within its respective setpoint tolerances.

14.2.12.2.19 Thermal Expansion (Balance of Plant)

1.0 Objectives

1.1 To demonstrate during the heatup to hot functional temperature that the systems' piping can expand without obstruction, and that expansion is in accordance with design.

1.2 To demonstrate that during the subsequent cooldown to ambient temperature the piping returns to its approximate cold position.

2.0 Prerequisites

2.1 Reference points for measurement of the systems are established.

2.2 Thermocouples and strain-monitoring instrumentation are calibrated and installed.

2.3 All temporary hangers are removed and permanent hangers are installed with lock pins removed and expansion clearances set to the proper cold values.

2.4 All subject systems are available for heatup during hot functional testing.

3.0 Test Method

3.1 Record cold baseline data.

3.2 Obtain measurement data at various specified temperature plateaus during heatup. Stop the heatup if any excessive movement is encountered.

3.3 On completion of cooldown to ambient temperature, obtain measurement data.

4.0 Acceptance Criteria

4.1 There is no evidence of blocking of the thermal expansion of any piping or components, other than by design.

4.2 Pipe stresses, pipe support, and nozzle loads, measured at the monitored areas, do not exceed their code-allowable limits at the test or design conditions.

4.3 Spring hanger movement remains within the hot and cold setpoints, and snubbers do not become fully retracted or expanded.

4.4 Piping and components return to their approximate baseline position on cooldown.

14.2.12.2.20 Reactor Coolant Loop and Pressurizer Steady-State and Transient Vibration

1.0 Objective

1.1 To verify satisfactory pipe support and restraints for various

NSSS systems during steady-state and transient conditions.

2.0 Prerequisites

2.1 Required pipe supports and restraints necessary to perform this test have been installed, and required Phase I testing has been completed.

2.2 Hot functional testing is in progress.

3.0 Test Method

3.1 Visually examine various NSSS systems during both steady-state and transient conditions during hot functional testing (by qualified observer).

3.2 Evaluate the long-term effects of any system vibration on the structural integrity of the system.

4.0 Acceptance Criteria

4.1 Structural integrity will not be degraded below an acceptable limit; otherwise corrective action will be tanks.

14.2.12.2.21 Steam Bypass Valves

1.0 Objective

1.1 To verify proper operation of steam bypass valves.

2.0 Prerequisites

2.1 Steam bypass control system is operational.

2.2 Steam bypass valves are operational.

2.3 Condenser is available.

3.0 Test Method

3.1 Stroke each steam bybass valve to measure opening and closing times.

3.2 Operable the steam bybass valves to maintain steam generator pressure.

4.0 Acceptance Criteria

4.1 Steam bypass valve opening and closing times are within design requirements.

4.2 The steam bypass valves operate properly to maintain steam-generator pressure at desired valves.

14.2.12.2.22 Pressurizer Surge Line Piping Differential Temperature and Displacements Measurements*

1.0 Objective

1.1 To verify pressurizer surge line differential temperature and

* This test will be performed for YGN 3 only.

displacement are within design limits.

2.0 Prerequisites

2.1 All construction and installation activities are complete.

2.2 Temporary measuring devices such as thermocouple, are installed in the appropriate locations on the surge line.

2.3 Automatic data recording system is operable.

2.4 The RCS is at ambient conditions at the beginning of the test.

3.0 Test Methods

3.1 As specified in Subsection 3.6.3, record pressurizer surge line pipe temperatures and displacement measurements during plant heatup, steady-state operations, and plant cooldown. Plant data (such as reactor coolant pump operations) which could result in changes in surge line temperature will also be recorded.

4.0 Acceptance Criteria

4.1 The pressurizer surge line piping differential temperatures and displacements meet design requirement, as specified in Section 3.6.3. Meeting this acceptance criteria may require analyses of the data collected during the test.

14.2.12.2.23 Heated Junction Thermocouple

1.0 Objective

1.1 To measure cable insulation resistance of the heated junction thermocouple (HJTC) system.

2.0 Prerequisites

2.1 Installation activities on the HJTC detectors are complete.

2.2 External test equipment has been checked and calibrated.

3.0 Test Method

3.1 Measure and record cabling insulation resistance.

4.0 Acceptance Criteria

4.1 The HJTC nuclear signal channel cables perform as described in Subsection 7.5.1.

14.2.12.2.24 NSSS Integrity Monitoring System

1.0 Objectives

1.1 To obtain baseline data for the loose parts monitoring system and the acoustic leak monitoring system during pre-core hot functional tests.

1.2 To verify, or reestablish if necessary, that the existing alarm setpoints are acceptable.

2.0 Prerequisites

2.1 Plant is stable at the required temperature and pressure plateau.

2.2 The NSSS integrity monitoring system is operational.

3.0 Test Methods

3.1 collect baseline data during pre-core hot functional tests.

3.2 Adjust setpoints, if required, based on the data collected.

4.0 Acceptance Criteria

4.1 Baseline data have been collected during pre-core hot functional tests.

4.2 The NIMS alarm setpoints have been adjusted as necessary.

14.2.12.2.25 Cooldown From Outside the Main Control Room

(Note : The capability to maintain hot standby from outside the main control room is demonstrated during power ascension testing.)

1.0 Objectives

1.1 To demonstrate the capability to maintain hot standby conditions from the remote shutdown panel and local controls.

1.2 To demonstrate the capability to perform plant cooldown from remote shutdown panel and local controls.

2.0 Prerequisites

2.1 Remote shutdown panel is operational.

2.2 All local controls necessary to demonstrate cooldown capability are available.

3.0 Test Method

3.1 Transfer plant control from main control room to the remote shutdown panel.

3.2 Maintain stable plant conditions from remote shutdown panel and local controls.

3.3 Initiate a plant cooldown from the remote shutdown panel and local controls.

4.0 Acceptance Criteria

4.1 Stable plant conditions can be maintained and the cooldown operations can be performed from the remote shutdown panel and local controls.

14.2.12.3 Post-Core Hot Functional Tests

14.2.12.3.1 Post-Core Hot Functional Test Controlling Document

1.0 Objective

1.1 To demonstrate the proper integrated operation of plant primary, secondary, and auxiliary systems with fuel loaded in the core.

2.0 Prerequisites

2.1 All pre-core hot functional testing has been completed as required.

2.2 Fuel loading has been completed.

2.3 All permanently installed instrumentation on systems to be tested is available and calibrated in accordance with technical specifications and test procedures.

2.4 All necessary test instrumentation is available and calibrated in accordance with technical specifications and test procedures.

2.5 All cabling between the CEDMs and the CEDM control system is connected.

2.6 Steam generators are in wet layup in accordance with the NSSS chemistry manual.

2.7 RCS has been borated to the proper concentration.

3.0 Test Method

3.1 Specify plant conditions and coordinate the execution of the related postcore hot functional test appendices.

4.0 Acceptance Criteria

4.1 Integrated operation of the primary, secondary, and related auxiliary systems is in accordance with the system descriptions.

4.2 Criteria as specified by the individual postcore hot functional test appendices.

14.2.12.3.2 Post-Core Instrument Correlation

1.0 Objective

1.1 To demonstrate the proper operation of the plant protection system (PPS), core protection calculators (CPCs), and plant monitoring system (PMS).

2.0 Prerequisites

2.1 Core protection calculators are in operation.

2.2 Plant monitoring system and core operating limit supervisory system (COLSS) are in operation.

2.3 Permanently installed control room instrumentation for the CPC, COLSS, PPS, and PMS have been calibrated and is in operation.

3.0 Test Method

3.1 When specified, obtain PPS, CPC, and PMS readouts.

3.2 Obtain control room instrument readings.

4.0 Acceptance Criteria

4.1 The PMS, PPS, and CPCs perform as described in Subsection 7.7.1.3.

14.2.12.3.3 Post-Core Reactor Coolant System Flow Measurements

1.0 Objective

1.1 To determine the post-core RCS flow rate and flow coastdown characteristics.

1.2 To establish reference post-core RCS pressure drops.

1.3 To make adjustments to the flow-related constants of the CPCs as required.

1.4 To collect data on the operation of the flow-related portions of the COLSS and the CPCs for steady-state and transient conditions.

2.0 Prerequisites

2.1 Construction activities completed.

2.2 All permanently installed instrumentation is properly calibrated and operational.

2.3 All test instrumentation is available and properly calibrated.

2.4 The RCS operating at nominal hot, zero-power conditions.

2.5 Required reactor coolant pumps are operational.

2.6 The COLSS and CPCs are in operation.

3.0 Test Method

3.1 Measure the RCS flow for the four-pump reactor coolant pump combination and collect the necessary data to calculate RCS flow.

3.2 Perform RCS flow coastdown measurements by tripping the allowable reactor coolant pump(s) for collection of coastdown data.

3.3 Compare CPCs and COLSS flow-related data with measured flows.

4.0 Acceptance Criteria

4.1 Measured RCS flow exceeds the flowrates used in the safety analysis in Chapter 15.

4.2 Measured RCS flow coastdown is conservative with respect to the coastdown used in the safety analysis.

4.3 CPC and COLSS flow algorithms are adjusted to be conservative with respect to the measured flows.

4.4 (Deleted) 1

14.2.12.3.4 Post-Core Control Element Drive Mechanism Performance

1.0 Objective

1.1 To demonstrate the proper operation of the CEDMs and CEAs under hot shutdown and hot, zero power conditions.

1.2 To verify proper operation of the CEA position indicating system and alarms.

1.3 To measure CEA drop times.

2.0 Prerequisites

2.1 The CEDMCS pre-core performance test has been completed.

2.2 All test instrumentation is available and calibrated.

2.3 The plant monitoring system is operational.

2.4 The CEDM cooling system is operational.

2.5 CEDM coil resistances have been measured.

3.0 Test Method

3.1 Perform the following at hot shutdown conditions:

a. Withdraw and insert each CEA to verify proper operation of CEDM.

3.2 Perform the following at hot, zero-power conditions:

a. Withdraw and insert each CEA to verify proper operation of CEDM.

b. Measure and record drop time for each CEA.

c. Perform three measurements of drop time for each of those CEAs falling outside the two-sigma limit for similar CEAs.

3.3 Perform the following at any time:

a. Withdraw and insert each CEA while recording position indications and alarms.

4.0 Acceptance Criteria

4.1 The CEDM/CEAs and their associated position indications operate as described in Subsection 7.7.1.

4.2 CEA drop times are in agreement with the Technical Specifications.

14.2.12.3.5 Post-Core Reactor and Secondary Water Chemistry Data

1.0 Objective

1.1 To maintain the proper water chemistry for the RCS and steam generators during post-core hot functional testing.

2.0 Prerequisites

2.1 Primary and secondary sampling systems are operable.

2.2 Chemicals to support hot functional testing are available.

2.3 The primary and secondary chemical addition system are operable.

2.4 Purification ion exchangers are charged with resin.

3.0 Test Method

3.1 Minimum sampling frequency for the steam generator and RCS is as specified by the chemistry manual. Modify the sampling frequency as required to ensure the proper RCS and steam generator water chemistry.

3.2 Perform RCS and steam generator sampling and chemistry analysis after every significant change in plant conditions (e.g., heatup, cooldown, chemical additions).

4.0 Acceptance Criteria

4.1 RCS and steam generator water chemistry can be maintained as described in Subsections 9.3.4 and 10.3.5.

4.2 Baseline data for the steam generators and RCS is established.

14.2.12.3.6 Post-Core Pressurizer Spray Valve and Control Adjustments

1.0 Objective

1.1 To establish the proper settings of continuous spray valves.

1.2 To measure the rate at which pressurizer pressure can be reduced using pressurizer spray.

2.0 Prerequistes

2.1 The RCS is being operated at norminal hot, zero power conditions.

2.2 All permanently installed instrumentation is available and calibrated.

2.3 Test instrumentation is available and calibrated.

3.0 Test Method

3.1 Adjust continuous spray valves to obtain specified T betwen the RCS temperature and pressurizer spray line temperature.

3.2 Using various combinations of pressurizer spray valves, measure and record the rate at which the pressurizer pressure can be reduced.

4.0 Acceptance Criteria

4.1 The pressurizer performs as described in Subsections 7.7.1 and 5.4.10.

14.2.12.3.7 Post-Core Reactor Coolant System Leak Rate Measurement

1.0 Objective

1.1 To measure the post-core load RCS leakage, at hot, zero power conditions.

2.0 Prerequisites

2.1 Hydrostatic testing of the RCS and associated systems has been completed.

2.2 The RCS and the CVCS are operating as a closed system.

2.3 The RCS is at hot, zero power conditions.

2.4 All permanently mounted instrumentation is properly calibrated.

3.0 Test Method

3.1 Measure and record the changes in water inventory of the RCS and CVCS for a specified interval of time.

4.0 Acceptance Criteria

4.1 Identified and unidentified leakage is within the limits described in the Technical Specifications.

14.2.12.3.8 Post-Core Incore Instrumentation

1.0 Objective

1.1 To measure the leakage resistance of the fixed incore detectors.

2.0 Prerequisites

2.1 All permanently installed instrumentation is properly calibrated.

2.2 Installation and preoperational checkout of the incore instrumentation is completed.

2.3 Incore instrumentation to the plant data acquisition system has been installed.

2.4 The PMS is operational.

2.5 Special test equipment is available and calibrated.

3.0 Test Method

3.1 Measure and record the leakage resistance of each incore detector at the nominal hot, zero-power conditions.

4.0 Acceptance Criteria

4.1 Leakage resistance of the incore detectors is as described in manufacture's recommendations.

14.2.12.3.9 NSSS Integrity Monitoring System

1.0 Objectives

1.1 To obtain baseline data for the loose parts monitoring system, the internals vibration monitoring system, and the acoustic leak monitoring system during post-core hot functional tests.

1.2 To verify, or reestablish if necessary, that the existing alarm setpoints are acceptable.

2.0 Prerequisites

2.1 Plant is stable at the required temperature and pressure plateau.

2.2 The NSSS integrity monitoring system is operational.

3.0 Test Methods

3.1 Collect baseline data during post-core hot functional tests.

3.2 Adjust setpoints, if required, based on the data collected.

4.0 Acceptance Criteria

4.1 Baseline data have been collected during post-core hot functional tests.

4.2 The NIMS alarm setpoints have been adjusted as necessary.

14.2.12.3.10 Heated Junction Thermocouple

1.0 Objective

1.1 To measure cable insulation resistance of the heated Junction Thermocouple (HJTC) system.

2.0 Prerequisites

2.1 Installation activities on the HJTC detectors are complete.

2.2 External test equipment has been checked and calibrated.

3.0 Test Method

3.1 Measure and record cabling insulation resistance.

4.0 Acceptance Criteria

4.1 The HJTC nuclear signal channel cables perform as described in Subsection 7.5.1.

14.2.12.4 Low-Power Physics Tests

14.2.12.4.1 Low-Power Biological Shield Survey*

1.0 Objective

1.1 To measure radiation in accessible locations of the plant outside of the biological shield.

1.2 To obtain base line levels for comparison with future measurements of level buildup with operation.

2.0 Prerequisites

2.1 Radiation survey instruments have been calibrated.

2.2 Background radiation levels have been measured in designation locations prior to initial criticality.

3.0 Test Method

3.1 Measure gamma and neutron dose rates during low-power physics tests.

4.0 Acceptance Criteria

4.1 Radiation levels are comparable to those measured in previous CE plants.

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* The low power biological shielding survey test for YGN 3 will be performed at both 320°F (160°C) and 565°F (296°C) plateaus. The 320°F (160 °C) measurement will not be performed for YGN 4, since this measurement will not be critical.

14.2.12.4.2 CEA Symmetry

1.0 Objective

1.1 To demonstrate that no loading or fabrication errors that result in measurable CEA worth asymmetries have occurred. This objective can be satisfied by performing CEA group worth measurement and by performing low power (≤ 20% power) power distribution measurements. 1

2.0 Prerequisites

2.1 The reactivity computer is in operation.

2.2 The reactor is critical at the desired conditions with the controlling CEA group partially inserted and in manual control.

3.0 Test Method

3.1 Conduct CEA symmetry test (at hot, zero-power conditions - 565°F (296°C), 2250 psia (158.2 kg/cm^2).

a. Insert the first CEA of a symmetric group with all remaining CEAs withdrawn except the controlling group, which is positioned for zero reactivity. 1

b. Withdraw the inserted CEA while another CEA in the symmetric group is inserted, and determine the differences in worth (net reactivity) of the CEAs from the reactivity computer.

c. Sequentially swap the remainder of the CEAs in the symmetric group until the relative worths of each CEA in the symmetric group has been determined.

d. Repeat steps a, b, and c for the remainder of the groups.

4.0 Acceptance Criteria

4.1 The relative worth of symmetric CEAs are within the acceptance criteria specified in Table 14.2-8.

14.2.12.4.3 Isothermal Temperature Coefficient

1.0 Objective

1.1 To measure the isothermal temperature coefficients for various RCS temperatures, pressures, and CEA configurations*.

1.2 To determine the moderator temperature coefficient from the measured ITC.

2.0 Prerequisites

2.1 The reactor is critical with a stable boron concentration and the desired CEA configuration and RCS temperature and pressure.

2.2 The reactivity computer is operable.

3.0 Test Method

3.1 Introduce changes in RCS temperature and measure the resultant changes in reactivity.

* For YGN 4, this test will be performed only at 565°F (296°C) and 2250 psia (158.2kg/cm^2).

3.2 Limit reactivity and power swings by compensation with CEA motion when necessary.

4.0 Acceptance Criteria

4.1 The measured isothermal temperature coefficients agree with the predicted values within the acceptance criteria specified in Table 14.2-8.

4.2 The moderator temperature coefficients derived from the measured isothermal temperature coefficients are in compliance with the technical specifications.

14.2.12.4.4 Shutdown and Regulating CEA Group Worth

1.0 Objective

1.1 To determine regulating and shutdown CEA group worths necessary to demonstrate shutdown margin (i.e., worth of all CEAs less the highest worth CEA).

1.2 To demonstrate that the shutdown margin is adequate.

2.0 Prerequisites

2.1 The reactor is critical.

2.2 The reactivity computer is operating.

3.0 Test Method

3.1 Perform a 320°F (160 °C) measurement of regulating and shutdown

CEA groups down to the net shutdown configuration (for YGN 3 only).

3.2 Perform a Hot, zero-power measurement of regulating CEA groups.*

a. The CEA group worths by dilution/boration of the RCS, or by using the CEA exchange method**.

b. Where dilution/boration is not feasible, determine worths by CEA drop and/or by use of alternate CEA configurations.

4.0 Acceptance Criteria

4.1 The measured CEA group worths agree with predictions within the acceptance criteria specified in Table 14.2-8.

4.2 Evaluation of the measurements verifies shutdown margin.

14.2.12.4.5 Differential Boron Worth***

1.0 Objective

1.1 To measure the differential boron reactivity worth for various CEA configurations.

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* On YGN 4 the net shutdown measurement is made at 565°F (296°C).

** If CEA exchange methods are used, worth measurements will be performed for both shutdown and regulating CEA groups.

*** This test will be performed at both 320°F (160°C) and 565°F (296°C) for YGN 3, but at 565°F (296°C) only for YGN 4.

2.0 Prerequisites

2.1 CEA group worth tests are completed.

2.2 Critical configuration boron concentration tests are completed.

3.0 Test Method

3.1 Determine the differential boron worths from the measured boron concentrations associated with state points measured during the CEA group worth tests.

4.0 Acceptance Criteria

4.1 The measured boron worths agree with the predicted values within the acceptance criteria specified in Table 14.2-8.

14.2.12.4.6 Critical Boron Concentration*

1.0 Objective

1.1 To measure critical boron concentrations for various CEA configurations at appropriate temperatures and associated pressures.

2.0 Prerequisites

2.1 The reactor is critical at the test conditions.

* This test will be performed at both 320°F (160°C) and 565°F (296°C) for YGN 3, but at 565°F (296°C) only for YGN 4.

2.2 The reactor is critical with the desired CEA configuration (arrived at as endpoints for selected plateaus in the CEA group worth tests).

3.0 Test Method

3.1 Maximize circulation through the pressurizer and the volume control tank so as to bring their boron concentrations to equilibrium with the RCS.

3.2 Tank coolant samples and analyze chemically for boron content until it is established that an equilibrium state has been achieved.

4.0 Acceptance Criteria

4.1 The measured critical boron concentrations agree with the predictions within the acceptance criteria specified in Table 14.2-8.

14.2.12.4.7 Pseudo Dropped and Ejected CEA Worth*

1.0 Objective

1.1 To measure the worth of the "dropped" CEA.

1.2 To measure the worth of the "ejected" CEA from the zero power dependent insertion limit (ZPDIL).

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* This test will be performed only on YGN 3.

2.0 Prerequisites

2.1 Reactor is critical at hot, zero-power conditions with appropriate CEA configurations.

2.2 The reactivity computer is in operation.

3.0 Test Method

3.1 Perform pseudo worst "dropped" CEA measurement.

a. Establish the pseudo worst and next worst "dropped" CEA worths on the basis of predictions and verified during the symmetry check.

b. Measure the worths of the worst and next worst dropped CEAs by dilution/boration and/or CEA compensation.

3.2 Perform pseudo worst "dropped" PSCEA measurement.

a. Establish the pseudo worst "dropped" PSCEA by prediction. 1

b. Measure the worths of the worst single PSCEA by boron dilution/boration and/or CEA compensation.

3.3 Perform pseudo worst "ejected" CEA measurement

a. Establish the worth of the pseudo worst "ejected" CEA by means of a prediction.

b. Measure the worths of the worst and next worst "ejected" CEAs by boration/dilution and/or CEA compensation from the ZPIL CEA configuration.

4.0 Acceptance Criteria

4.1 The measured worths agree with the predicted worths within the acceptance criteria specified in Table 14.2-8.

14.2.12.5 Power Ascension Tests

14.2.12.5.1 Natural Circulation*

1.0 Objective

1.1 To evaluate natural circulation flow conditions.

2.0 Prerequisites

2.1 The reactor is at ≥ 80% power. Previous power history is such that the loop differential temperature (T_H - T_C) under natural circulation is not expected to drop below 10°F (5.6°C) during the performance of the test.

3.0 Test Method

3.1 Trip the reactor coolant pumps.

3.2 Trip the plant.

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* This test will be performed for YGN 3 only.

3.3 Determine the natural circulation power to flow ratio.

4.0 Acceptance Criteria

4.1 The natural circulation power to flow ratio is less than 1.0.

14.2.12.5.2 Variable Tavg (Isothermal Temperature Coefficient and Power Coefficient)

1.0 Objective

1.1 To measure the isothermal temperature coefficient (ITC) and power coefficient of reactivity at selected power levels.

2.0 Prerequisites

2.1 The reactor is at the desired power level with equilibrium Xe and boron concentration and the desired CEA configuration.

3.0 Test Method

3.1 Measure the ITC by changing the core average temperature and using CEA movement to maintain the power essentially constant and/or by balancing temperature against power changes.

3.2 Measure the power coefficient by changing the core power using CEA movement to maintain the core average temperature essentially constant.

4.0 Acceptance Criteria

4.1 Measured values agree with predictions within the acceptance criteria specified in Table 14.2-8 and conform with the Technical Specifications.

14.2.12.5.3 Unit Load Transient

1.0 Objective

1.1 To demonstrate that load changes can be made at the desired rates.

2.0 Prerequisites

2.1 The reactor is operating at the desired power level.

2.2 The reactor regulating system (RRS), main feedwater control system (FWCS), steam baypass control system (SBCS), reactor power cutback system (RPCS), and the pressurizer level and pressure control systems are in automatic operation.

3.0 Test Method

3.1 Perform load increases and decreases (steps and ramps) in accordance with the NSSS supplier's fuel preconditioning guidelines and as allowed by the RRS at power levels in the 75% to 95% range and in the 25% to 50% power range.

4.0 Acceptance Criteria

4.1 The step and ramp transients demonstrate that the plant performs load changes allowed by NSSS supplier's fuel preconditioning guidelines, and data have been taken that will demonstrate the plant's ability to meet unit load swing design transients.

4.2 No audible noise or significant vibration due to waterhammer is observed in the economizer or in the rest of the feedwater and auxiliary feedwater systems. This acceptance criterion can be satisfied by performing a system walkdown after the test.

14.2.12.5.4 Control Systems Checkout

1.0 Objective

1.1 To demonstrate that the automatic control systems operate satisfactorily during steady-state and transient conditions.

2.0 Prerequisites

2.1 The reactor is operating at the desired conditions.

2.2 The RRS, FWCS, SBCS, RPCS, and the pressurizer level and pressure controls are in automatic operation.

3.0 Test Method

3.1 Monitor the performance of the control systems during steady-state and transient conditions to demonstrate that the systems are operating satisfactorily.

4.0 Acceptance Criteria

4.1 The control systems maintain the reactor power, RCS temperature, pressurizer pressure and level, and steam generator levels and pressures within their control bands during steady-state operation and are capable of returning these parameters to within their control bands in response to transient operation.

14.2.12.5.5 Reactor Coolant System and Secondary Chemistry and Radiochemistry

1.0 Objective

1.1 To conduct chemistry tests at various power levels with the intent of gathering corrosion data and determining activity buildup.

1.2 To verify proper operation of the process radiation monitor.

1.3 To verify the adequacy of sampling and analysis procedures.

2.0 Prerequisites

2.1 The reactor is stable at the desired power level.

2.2 Sampling systems for the RCS and CVCS are operable.

3.0 Test Method

3.1 Collect samples from the RCS and secondary system at various power levels and analyze them in the laboratory using applicable sampling and analysis procedures.

3.2 Collect samples at the process radiation monitor at various power levels, analyze them in the laboratory, and compare them with the process radiation monitor to verify proper operation.

4.0 Acceptance Criteria

4.1 Measured activity levels are within their limits.

4.2 The process radiation monitors agree with the laboratory analyses within measurement uncertainties.

4.3 Procedures for sample collection and analysis are verified.

14.2.12.5.6 Turbine Trip

1.0 Objective

1.1 To demonstrate that the plant responds and is controlled as designed following a 100% turbine trip without RPCS in service.

2.0 Prerequisites

2.1 The reactor is operating above 95% power.

2.2 The SBCS, FWCS, RRS, and pressurizer pressure and level control systems are in automatic operation.

2.3 The RPCS is in the auto-actuate out-of service mode.

3.0 Test Method

3.1 Trip the turbine.

3.2 Monitor the plant behavior to assure that the RRS, SBCS, FWCS, and pressurizer pressure and level control systems maintain the NSSS within operating limits.

4.0 Acceptance Criteria

4.1 The test should not open primary or secondary safety valves.

14.2.12.5.7 Unit Load Rejection

1.0 Objective

1.1 To demonstrate that the plant responds and is controlled as designed following a 100% load rejection with RPCS in service.

2.0 Prerequisites

2.1 The reactor is operating above 95% power.

2.2 The SBCS, FWCS, RRS, control element drive mechanism control system (CEDMCS), RPCS, and pressurizer pressure and level control are in automatic operation.

3.0 Test Method

3.1 Trip a breaker(s) to subject the turbine to the maximum credible overspeed condition.

3.2 Monitor the plant behavior to assure that the RRS, CEDMCS, SBCS, RPCS, FWCS, and pressurizer pressure and level control systems maintain the monitored parameters.

4.0 Acceptance Criteria

4.1 The test should not initiate a realtor trip and should not open primary or secondary safety valves.

14.2.12.5.8 Shutdown from Outside the Main Control Room

1.0 Objective

1.1 To demonstrate that the plant can be maintained in the hot standby condition from outside the main control room following a reactor trip.

2.0 Prerequisites

2.1 The reactor is operating at ≥ 10% of rated power.

2.2 The capability to cooldown the plant from the remote shutdown panel has been demonstrated during pre-or post-core hot functional tests.

2.3 The remote shutdown panel instrumentation is operating properly.

2.4 The communication systems between the main control room and remote shutdown location have been demonstrated to be operational.

2.5 The remote shutdown instrumentation, controls, and systems have been preoperationally tested.

3.0 Test Method

3.1 Evacuate the main control room of the operating crew (standby crew remains in the control room).

3.2 Trip the reactor from outside the main control room.

3.3 Bring the reactor to the hot standby condition by the operating crew from outside the main control room and maintain the reactor in this condition for at least 30 minutes.

4.0 Acceptance Criteria

4.1 The ability to achieve and control the reactor at the hot standby condition from outside the control room is demonstrated.

14.2.12.5.9 Loss-of-Offsite Power

1.0 Objective

1.1 To verify that the reactor can be shut down and maintained in the hot standby condition in the event of loss-of-offsite power.

2.0 Prerequisites

2.1 Reactor operating at $\geq$ 10% rated power.

3.0 Test Method

3.1 Trip the plant in a manner to produce a loss of generator and offsite power.

3.2 Maintain the plant is maintained in the hot standby conditon for at least 30 minutes before restoring power.

4.0 Acceptance Criteria

4.1 The reactor is shut down and maintained in the hot standby conditon on emergency power for at least 30 minutes during a simulated loss-of-offsite power.

14.2.12.5.10 Biological Shield Survey

1.0 Objective

1.1 To measure the radiation levels in accessible locations of the plant outside of the biological shield.

1.2 To determine occupancy times for these areas during power operation.

2.0 Prerequisites

2.1 Radiation survey instruments have been calibrated.

2.2 Results of the radiation surveys performed at zero power conditions are available.

3.0 Test Method

3.1 Measure gamma and neutron dose rates at 20, 50, 80, and 100% power levels.

4.0 Acceptance Criteria

4.1 Accessible areas and occupancy times during power operation have been defined.

14.2.12.5.11 Xenon Oscillation Control (PSCEA)*

1.0 Objective

1.1 To demonstrate a technique for damping xenon oscillations.

2.0 Prerequisites

2.1 The reactor is greater than or equal to 50% power.

2.2 The COLSS and the incore detector system are in operation.

3.0 Test Method

3.1 Establish a free oscillation.

3.2 Use the PSCEAs, CEAs, or both to dampen the oscillation.

4.0 Acceptance Criteria

4.1 The technique necessary to damp xenon oscillations using the PSCEAs and/or CEAs has been demonstrated.

14.2.12.5.12 "Ejected" CEA*

1.0 Objective

1.1 To determine the power distribution associated with the pseudo CEA ejection from the full-power-dependent insertion limit (FPDIL) CEA configuration.

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* This test will be performed only on the YGN 3.

2.0 Prerequisites

2.1 The fuel has been preconditioned (per the NSSS supplier fuel preconditioning guidelines) at 80% power.

2.2 The reactor is at approximately 50% power with equilibrium conditions for the desired CEA configuration.

2.3 The incore detector system is in operation.

3.0 Test Method

3.1 Fully withdraw the "worst-case" CEA (selected by calculation).

3.2 Take incore detector maps before and after withdrawal of the static "ejected" CEA.

3.3 (Deleted)

3.4 (Deleted) 1

3.5 Return the CEAs to normal configuration.

4.0 Acceptance Criteria

4.1 The difference between the measured and predicted ratios of the post-ejected CEA to pre-ejected CEA power distributions are within the acceptance band specified in Table 14.2-8.

14.2.12.5.13 Dropped CEA Test*

1.0 Objective

1.1 To determine the power distribution resulting from a "dropped" CEA.

2.0 Prerequisites

2.1 The fuel has been preconditioned (per NSSS supplier fuel preconditioning guidelines) at 80% power.

2.2 The reactor is at approximately 50% power with equilibrium conditions for the desired CEA configuration.

2.3 The incore detector system is in operation.

3.0 Test Method

3.1 Select a full-length CEA, based on calculations, which will best verify the dropped rod assumptions used in the safety analyses.

a. Raprdly inseat the selected CEA to the full-in position.

b. Leave the CEA inserted for a preselected time.

c. Record excore and incore instrument signals before and after the CEA insetion.

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* This test will be performed only on YGN 3.

3.2 Select a full-length PSCEA, based on calculations, which will best verify the dropped rod assumptions used in the safety analyses.

a. Rapidly insert the PSCEA to the full-in position.

b. Leave the PSCEA inserted for a preselected time.

c. Record excore and incore instrument signals before and after the CEA insertion.

4.0 Acceptance Criterira

4.1 The difference betwen the measured and predicted ratios of the post-dropped CEA to pre-dropped CEA power distributions are within the acceptance band specified in Table 14.2-8.

14.2.12.5.14 Steady-State Core Performance

1.0 Objective

1.1 To determine core power distributions using incore instrumentation.

2.0 Prerequisites

2.1 The reactor is operating at the desired power level and CEA configuration with equilibrium Xe.

2.2 The incore instrumentation system is in operation.

3.0 Test Method

3.1 Record selected plant computer outputs and CPC outputs.

3.2 Determine reactor power by performing a heat balance.

3.3 Obtain the core power distribution using the incore detectors.

4.0 Acceptance Criteria

4.1 Agreement between the predicted and measured power distributions and core peaking factors are within the acceptance criteria specified in Table 14.2-8.

14.2.12.5.15 Intercomparison of PPS, CPCs, and (PMS Inputs)

1.0 Objective

1.1 To verify that process variable inputs/outputs of the PPS, the CPCs, the PMS, and the console instruments are consistent.

2.0 Prerequisites

2.1 The plant is operating at the desired conditions.

2.2 All CPCs and CEACs and the PMS are operable.

3.0 Test Method

3.1 Read process variable inputs/outputs of the PPS, the CPCs, the PMS, and console instruments as near to simultaneously as practical.

4.0 Acceptance Criteria

4.1 The process variable inputs/outputs from the PPS, the CPCs, the PMS, and the console instruments are within the uncertainties assumed for them in the CPC, PPS and the PMS.

14.2.12.5.16 Verification of CPC Power Distribution-Related Constants

1.0 Objectives

1.1 To verify the planar radial peaking, temperature annealing, and CEA shadowing factors, and the shape annealing matrix and boundary point power correlation constants.

1.2 To verify the algorithms used in the CPCs to relate excore signals to incore power distribution.

2.0 Prerequisites

2.1 The reactor is at the desired power level and CEA configuration with equilibrium Xe.

2.2 The incore detector system is in operation.

2.3 The safety channels have been properly calibrated.

3.0 Test Method

3.1 Compare CPC values with values measured with the incore detector system to verify planar radial peaking factors for various CEA configurations.

3.2 Compare excore detector responses for various CEA configurations with the unrodded excore responses to verify the CEA shadowing factors.

3.3 Compare incore power distributions and excore detector responses during a free Xe oscillation to measure the shape annealing factors.

3.4 Compare core power and excore detector responses for various RCS temperatures to verify the temperature shadowing factors.

4.0 Acceptance Criteria

4.1 Measured radial peaking factors determined from incore flux maps are no higher than the corresponding values used in the CPCs.

4.2 The CEA shadowing factors, and temperature shadowing factors used in the CPCs agree within the acceptance criteria specified in the CPC test requirements.

4.3 The shape annealing matrix has been measured and the boundary point correlation constants used in the CPCs are within the limits specified by the test requirements.

14.2.12.5.17 Main and Auxiliary Feedwater System

1.0 Objective

1.1 To demonstrate that the operation of the main feedwater and auxiliary feedwater systems during hot standby, startup and other normal operations, transients, and plant trips is satisfactory.

2.0 Prerequisites

2.1 The SBCS, FWCS, RRS, RPCS, and pressurizer pressure and level controls are operable in either manual or automatic modes.

3.0 Test Method

3.1 Monitor the performance of the feedwater systems during normal operation, transients, and trips. Specifically, monitor the downcomer to economizer transfer for noise or vibration due to water hammer.

3.2 Check for waterhammer noise utilizing appropriately placed personnel or check for waterhammer vibration utilizing suitable instrumentation.

4.0 Acceptance Criteria

4.1 The main and auxiliary feedwater systems perform as designated by the system description.

4.2 No effects due to waterhammer are detected. This acceptance criterion can also be satisfied by performing a system walkdown after the test.

14.2.12.5.18 CPC Verification

1.0 Objective

1.1 To verify DNBR and Local Power Density (LPD) calculations of the CPCs.

2.0 Prerequisites

2.1 The reactor is at the desired power level and CEA configuration with equilibrium Xe.

2.2 The CPCs are operational.

2.3 The incore detector system is operational.

3.0 Test Method

3.1 Record specified values from the CPCs.

3.2 Compare the values for LPD and DNBR obtained from the CPCs with the values calculated for the same conditions using the CPC FORTRAN simulator.

4.0 Acceptance Criteria

4.1 The values of DNBR and LPD calculated by the CPCs are consistent with the values calculated by the CPC Fortran code.

14.2.12.5.19 Steam Bypass Valve Capacity

1.0 Objective

1.1 To demonstrate that the maximum steam flow cpacity of each atmospheric steam dump valve upstream of the main steam isolation valves is less than that assumed for the the safety analysis.

1.2 To measure the capacity of each steam bypass valve individually to determine that the capacity of each steam bypass valve is less than the value used in the safety analysis.

2.0 Prerequisites

2.1 The reactor power is > 15% full power.

2.2 Control systems are in automatic where applicable.

2.3 The operation of the atmospheric steam dump, turbine by-pass and shutdown cooling system have been demonstrated as part of the hot functional testing.

3.0 Test Method

3.1 Measure the individual steam flows through each of the atmospheric dump valves upsteam of the MSIVs.

3.2 Measure the capacity of each steam bypass valve.

4.0 Acceptance Criteria

4.1 The capacities of the individual steam dump valves are less than the values used in the safety analysis but greater than the values required for a safe cooldown.

4.2 The capacity of each steam bypass valve has been measured, and the capacity of each steam bypass valve is less than the value used in the safety analysis.

14.2.12.5.20 Incore Detector

1.0 Objective

1.1 To verify conversion of the fixed incore detector signals to voltages for input to the plant computer.

2.0 Prerequisites

2.1 The reactor is at the speicfied power level and conditions.

2.2 The plant computer is operable.

2.3 The incore detector system is operable.

3.0 Test Method

3.1 Fixed incore detector signal verification.

a. Measure amplifier output signals based on test input signals.

b. Measure group symmetric instrument signals.

c. Record background detector signals.

4.0 Acceptance Criteria

4.1 The plant computers input signals for group symmetric instruments are within the measurement and power distribution uncertainties.

4.2 Background detector signals are within tolerances specified by the NSSS supplier.

14.2.12.5.21 COLSS Verification

1.0 Objective

1.1 To verify DNBR and local power density (LPD) calculations of the COLSS.

2.0 Prerequisites

2.1 The reactor is at the desired power level and CEA configuration with equilibrium Xe.

2.2 The COLSS is operable.

2.3 The incore detector system is operable.

3.0 Test Method

3.1 Record specified values from the COLSS.

3.2 Compare the values for LPD and DNBR obtained from the COLSS with independently calculated values using the COLSS algorithms.

4.0 Acceptance Criteria

4.1 The values of DNBR and LPD obtained from the COLSS agree with the independently calculated values within the uncertainties in computer processing contained in the COLSS uncertainty analysis.

14.2.12.5.22 NSSS Integrity Monitoring System (NIMS)

1.0 Objectives

1.1 To obtain baseline data for loose parts monitoring system, internal vibration monitoring system, and acoustic leak monitoring system at various power levels.

1.2 To verify, or reestablish if necessary, that the existing alarm setpoints are acceptable.

2.0 Prerequisites

2.1 Plant is stable at the applicable power level (0, 20, 50, 80, and 100%).

2.2 NSSS integrity monitoring system is operational.

3.0 Test Method

3.1 Collect baseline data at the applicable power levels.

3.2 Adjust setpoint (if required) based on the data collected.

4.0 Acceptance Criteria

4.1 Baseline data have been collected at various power levels.

4.2 The NIMS alarm setpoints have been adjusted (as necessary) for power operations.

14.2.12.5.23 (Deleted)

1

TABLE 14.2-1 (Sh. 1 of 7)
PREOPERATIONAL TESTS

FSAR Subsection	Title
14.2.12.1.1	Reactor Coolant Pump Motor Initial Operation
14.2.12.1.2	Reactor Coolant System
14.2.12.1.3	Pressurizer Pressure and Level Control Systems
14.2.12.1.4	Reactor Coolant System Cold Hydro Static Test
14.2.12.1.5	Secondary Hydrostatic Test
14.2.12.1.6	Reactor Coolant Gas Vent System
14.2.12.1.7	Safety Injection Tank Subsystem
14.2.12.1.8	High-Pressure Safety Injection Subsystem
14.2.12.1.9	Low-Pressure Safety Injection Subsystem
14.2.12.1.10	Shutdown Cooling Subsystem
14.2.12.1.11	Containment Spray Nozzle
14.2.12.1.12	Containment Spray System
14.2.12.1.13	Combustible Gas Control System
14.2.12.1.14	Containment Structural Integrity
14.2.12.1.15	Containment Integrated Leak Rate (Type A)
14.2.12.1.16	Volume Control Tank Subsystem
14.2.12.1.17	CVCS Charging Subsystem
14.2.12.1.18	CVCS Letdown Subsystem
14.2.12.1.19	CVCS Purification Subsystem
14.2.12.1.20	Chemical Addition Subsystem
14.2.12.1.21	Reactor Drain Tank Subsystem
14.2.12.1.22	Equipment Drain Tank Subsystem
14.2.12.1.23	Boric Acid Batching Tank Subsystem
14.2.12.1.24	Refueling Water Tank Subsystem
14.2.12.1.25	Reactor Makeup Subsystem
14.2.12.1.26	Holdup Subsystem

TABLE 14.2-1 (Sh. 2 of 7)

FSAR Subsection	Title
14.2.12.1.27	Boric Acid Concentrator Subsystem
14.2.12.1.28	Gas Stripper Subsystem
14.2.12.1.29	Boronometer Subsystem
14.2.12.1.30	Letdown Process Radiation Monitoring Subsystem
14.2.12.1.31	Steam-Generator Blowdown System
14.2.12.1.32	Steam-Generator Wet Lay-Up Chemical Control System
14.2.12.1.33	Component Cooling Water System
14.2.12.1.34	Essential Service Water System
14.2.12.1.35	Spent Fuel Pool Cooling and Cleanup System
14.2.12.1.36	Gaseous Radwaste System
14.2.12.1.37	Liquid Radwaste System
14.2.12.1.38	LRS Evaporator System
14.2.12.1.39	Solid Radwaste System
14.2.12.1.40	Radwaste Solidification System
14.2.12.1.41	Radioactive Laundry System
14.2.12.1.42	Auxiliary Building Radioactive Drains
14.2.12.1.43	Miscellaneous Building Radioactive Drains
14.2.12.1.44	Containment Building Radioactive Drains
14.2.12.1.45	Radwaste Building Radioactive Drains
14.2.12.1.46	Primary Sampling System
14.2.12.1.47	Main Turbine
14.2.12.1.48	Main Turbine Gland Seal System
14.2.12.1.49	Hydrogen and Carbon Dioxide Gas Control System
14.2.12.1.50	Main Turbine Lube Oil System
14.2.12.1.51	Hydrogen System

TABLE 14.2-1 (Sh. 3 of 7)

FSAR Subsection	Title
14.2.12.1.52	Carbon Dioxide System
14.2.12.1.53	Generator Stator Cooling Water System
14.2.12.1.54	Generator Shaft Seal Oil System
14.2.12.1.55	Main Steam System
14.2.12.1.56	Main Steam Atmospheric Dump Valves
14.2.12.1.57	Main Steam Isolation Valves
14.2.12.1.58	Feedwater Heater Vent, Drain, and Extraction System
14.2.12.1.59	Condensate System
14.2.12.1.60	Condensate Transfer and Storage System
14.2.12.1.61	Condensate Polishing System
14.2.12.1.62	Condenser Vacuum System
14.2.12.1.63	Main Feedwater System (Motor-Driven Pumps)
14.2.12.1.64	Main Feedwater System (Turbine-Driven Pumps)
14.2.12.1.65	Auxiliary Feedwater System (Motor-Driven Pumps)
14.2.12.1.66	Auxiliary Feedwater System (Diesel-Driven Pumps)
14.2.12.1.67	Circulating Water System
14.2.12.1.68	Amertap Condenser Tube Cleaning System
14.2.12.1.69	Screen Wash and Traveling Screen
14.2.12.1.70	Turbine Building Open Cooling Water System
14.2.12.1.71	Turbine Building Closed Cooling Water System
14.2.12.1.72	Auxiliary Steam System
14.2.12.1.73	Raw Water System
14.2.12.1.74	Makup Water Demineralizer System
14.2.12.1.75	Domestic Water System
14.2.12.1.76	Class 1E Diesel Generator System (Mechanical)

TABLE 14.2-1 (Sh. 4 of 7)

FSAR Subsection	Title
14.2.12.1.77	Class 1E Diesel Generator System (Electrical)
14.2.12.1.78	Class 1E Diesel-Generator Load Sequencing
14.2.12.1.79	Diesel Generator Load Group Assignments
14.2.12.1.80	Non-Class 1E Diesel Generator
14.2.12.1.81	Instrument Air System
14.2.12.1.82	Diesel Fuel Oil System
14.2.12.1.83	Bearing Oil Transfer and Purification System
14.2.12.1.84	Reactor Cavity Cooling System
14.2.12.1.85	Containment Fan Coolers
14.2.12.1.86	CEDM Cooling AHU System
14.2.12.1.87	Laboratory HVAC System
14.2.12.1.88	ESF Switchgear Room HVAC System
14.2.12.1.89	Turbine Building HVAC System
14.2.12.1.90	Control Room HVAC System
14.2.12.1.91	Auxiliary Building HVAC System
14.2.12.1.92	Radwaste Building HVAC System
14.2.12.1.93	Station Heating System
14.2.12.1.94	Containment Purge System
14.2.12.1.95	Fuel Building HVAC System
14.2.12.1.96	Intake Structure Pumphouse Ventilation
14.2.12.1.97	Water Treatment and Chlorination Building HVAC System
14.2.12.1.98	Essential Chilled Water System
14.2.12.1.99	Plant Chilled Water System
14.2.12.1.100	Miscellaneous Control Room HVAC System
14.2.12.1.101	Machine Shop HVAC System
14.2.12.1.102	Diesel-Generator Room HVAC System
14.2.12.1.103	ECCS Equipment Room HVAC System

TABLE 14.2-1 (Sh. 5 of 7)

FSAR Subsection	Title
14.2.12.1.104	Miscellaneous Unoccupied Room HVAC System
14.2.12.1.105	Access Control Building HVAC System
14.2.12.1.106	Chemical Feed and Handling System
14.2.12.1.107	Chlorination System
14.2.12.1.108	Waste Water Transfer System
14.2.12.1.109	Fuel Oil System
14.2.12.1.110	Nitrogen System
14.2.12.1.111	Miscellaneous Building Drains
14.2.12.1.112	Polar Crane
14.2.12.1.113	Fire Protection System (Water)
14.2.12.1.114	Seismic Fire Protection System
14.2.12.1.115	CO_2 Suppression System
14.2.12.1.116	Breathing Air System
14.2.12.1.117	Fire Detection and Alarm System
14.2.12.1.118	Plant Protection System
14.2.12.1.119	Core Operating Limit Supervisory System
14.2.12.1.120	Control Element Drive Mechanism Control System
14.2.12.1.121	Feedwater Control System
14.2.12.1.122	Steam Bypass Control System
14.2.12.1.123	Reactor Regulating System
14.2.12.1.124	Area Radiation Monitoring System
14.2.12.1.125	Process Radiation Monitoring System
14.2.12.1.126	Seismic Instrumentation
14.2.12.1.127	Loose Parts Monitoring System
14.2.12.1.128	Containment Monitoring System
14.2.12.1.129	Excore Neutron Flux Monitoring System
14.2.12.1.130	Fixed Incore Nuclear Signal Channel Test

TABLE 14.2-1 (Sh. 6 of 7)

FSAR Subsection	Title
14.2.12.1.131	CEDM Motor Generator
14.2.12.1.132	AAC Diesel-Generator Load Sequencing
14.2.12.1.133	AAC Diesel-Generator Building HVAC System
14.2.12.1.134	Diverse Protection System
14.2.12.1.135	Internals Vibration Monitoring System
14.2.12.1.136	Inadequate Core Cooling Monitoring System
14.2.12.1.137	Acoustic Leak Monitoring System
14.2.12.1.138	Plant Annunciator System
14.2.12.1.139	Process Sampling System
14.2.12.1.140	Engineered Safety Features Auxiliary
14.2.12.1.141	Reactor Power Cutback System
14.2.12.1.142	Refueling Equipment
14.2.12.1.143	Plant Computer System
14.2.12.1.144	Main and Auxiliary Transformers
14.2.12.1.145	Generator Excitation and Voltage Regulation
14.2.12.1.146	Startup Transformer (03XN)
14.2.12.1.147	Startup Transformer (04XN)
14.2.12.1.148	Non-Class 1E 13.8-kV System
14.2.12.1.149	Class 1E 4.16-kV System
14.2.12.1.150	Non-Class 1E 4.16-kV System
14.2.12.1.151	480-Volt (Class 1E) System
14.2.12.1.152	480-Volt (Non-Class 1E) System
14.2.12.1.153	250-Vdc System
14.2.12.1.154	125-Vdc (Class 1E) System
14.2.12.1.155	125-Vdc (Non-Class 1E) System
14.2.12.1.156	Class 1E 120-Vac I&C Power
14.2.12.1.157	Non-Class 1E 120-Vac Computer Power
14.2.12.1.158	Non-Class 1E 120-Vac I&C Power

TABLE 14.2-1 (Sh. 7 of 7)

FSAR Subsection	Title	
14.2.12.1.159	Emergency Lighting System	
14.2.12.1.160	Heat Tracing (Freeze Protection) System	
14.2.12.1.161	Heat Tracing (Special Process) System	
14.2.12.1.162	Piping Steady-State and Transient Vibration	
14.2.12.1.163	CVAP Inspection and In-situ Measurements	1
14.2.12.1.164	Gas Stripper Process Radiation Monitor Subsystem	
		1

TABLE 14.2-2 (Sh. 1 of 2)

PRE-CORE HOT FUNCTIONAL TESTS

FSAR Subsection	Title
14.2.12.2.1	Pre-Core Hot Functional Test Controlling document
14.2.12.2.2	Pre-Core Test Data Record
14.2.12.2.3	Pre-Core Reactor Coolant System Expansion Measurements
14.2.12.2.4	Pre-Core Reactor Coolant and Secondary Water Chemistry Data
14.2.12.2.5	Pre-Core Pressurizer Performance
14.2.12.2.6	Pre-Core Control Element Drive Mechanism Performance
14.2.12.2.7	Pre-Core Instrument Correlation
14.2.12.2.8	Pre-Core Reactor Coolant System Flow Measurements
14.2.12.2.9	Pre-Core Reactor Coolant System Heat Loss
14.2.12.2.10	Pre-Core Reactor Cooling System Leak Rate Measurement
14.2.12.2.11	Pre-Core Chemical and Volume Control System Integrated Test
14.2.12.2.12	Pre-Core Safety Injection Check Valve
14.2.12.2.13	Pre-Core Boration/Dilution Measurements
14.2.12.2.14	Downcomer Feedwater System Waterhammer
14.2.12.2.15	Pressurizer Safety Valve
14.2.12.2.16	Steam-Generator Blowdown System
14.2.12.2.17	Turbine-Generator Statup Sequence and Initial Turbine Operation
14.2.12.2.18	Main Steam Safety Valves
14.2.12.2.19	Thermal Expansion (Balance of Plant)

TABLE 14.2-2 (Sh. 2 of 2)

FSAR Subsection	Title
14.2.12.2.20	Reactor coolant Loop and Pressurizer Steady State and Transient Vibration
14.2.12.2.21	Steam Bypass Valves
14.2.12.2.22	Pressurizer Surge Line Piping Differential Temperature and Displacement Measurements
14.2.12.2.23	Heated Junction Thermocouple
14.2.12.2.24	NSSS Integrity Monitoring System
14.2.12.2.25	Cooldown from Outside the Main Control Room

TABLE 14.2-3

POST-CORE HOT FUNCTIONAL TESTS

FSAR Subsection	Title
14.2.12.3.1	Post-Core Hot Functional Test Controlling Document
14.2.12.3.2	Post-Core Instrument Correlation
14.2.12.3.3	Post-Core Reactor Coolant System Flow Measurements
14.2.12.3.4	Post-Core Control Element Drive Mechanism Performance
14.2.12.3.5	Post-Core Reactor and Secondary Water Chemistry Data
14.2.12.3.6	Post-Core Pressurizer Spray Valve and Control Adjustments
14.2.12.3.7	Post-Core Reactor Coolant System Leak Rate Measurement
14.2.12.3.8	Post-Core Incore Instrumentation
14.2.12.3.9	NSSS Integrity Monitoring System
14.2.12.3.10	Heated Junction Thermocouple

TABLE 14.2-4

LOW-POWER PHYSICS TESTS

FSAR Subsection	Title
14.2.12.4.1	Low-Power Biological Shield Survey
14.2.12.4.2	CEA Symmetry
14.2.12.4.3	Isothermal Temperature Coefficient
14.2.12.4.4	Shutdown and Regulating CEA Group Worth
14.2.12.4.5	Differential Boron Worth
14.2.12.4.6	Critical Boron Concentration
14.2.12.4.7	Pseudo Dropped and Ejected CEA Worth

TABLE 14.2-5

POWER ASCENSION TESTS

FSAR Subsection	Title
14.2.12.5.1	Natural Circulation
14.2.12.5.2	Variable Tavg (Isothermal Temperature Coefficient and Power Coefficient)
14.2.12.5.3	Unit Load Transient
14.2.12.5.4	Control Systems Checkout
14.2.12.5.5	Reactor Coolant System and Secondary Chemistry and Radiochemistry
14.2.12.5.6	Turbine Trip
14.2.12.5.7	Unit Load Rejection
14.2.12.5.8	Shutdown from Outside the Main Control Room
14.2.12.5.9	Loss-of-Offsite Power
14.2.12.5.10	Biological Shield Survey
14.2.12.5.11	Xenon Oscillation Control (PLCEA)
14.2.12.5.12	"Ejected" CEA
14.2.12.5.13	Dropped CEA
14.2.12.5.14	Steady-State Core Performance
14.2.12.5.15	Intercomparison of PPS, CPCs and PMS Inputs
14.2.12.5.16	Verification of CPC Power Distribution-Related Constants
14.2.12.5.17	Main and Auxiliary Feedwater System
14.2.12.5.18	CPC Verification
14.2.12.5.19	Steam Bypass Valve Capacity
14.2.12.5.20	Incore Detector
14.2.12.5.21	COLSS Verification
14.2.12.5.22	NSSS Integrity Monitoring System (NIMS)

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TABLE 14.2-6
LOW POWER PHYSICS TEST PARAMETERS

Test Title	YGN 3*	YGN 4**
Low-Power Biological Shield Survey Test	320°F/565°F (160°C/296°C)	565°F (296°C)
CEA Symmetry Test	565°F (296°C)	565°F (296°C)
Isothermal Temperature Coefficient Test	320°F-565°F (160°C-296°C)	565°F (296°C)
Regulating CEA Group Worth Test	320°F & 565°F (160°C & 296°C)	565°F (296°C)
Shutdown CEA Group Worth Test	320°F (160°C)	565°F (296°C)
Differential Boron Worth Test	320°F & 565°F (160°C & 296°C)	565°F (296°C)
Critical Boron Concentration Test	320°F-565°F (160°C-296°C)	565°F (296°C)
Pseudo Dropped and Ejected CEA Worth Test	565°F (296°C)	NA

* An expanded test program is conducted for YGN 3 in order to validate the design, the design methods, and the safety analysis assumptions.

** Reduced testing is contingent upon the demonstration that YGN 4 behaves in an identical manner as YGN 3 through conformance with the Acceptance Criteria given in Table 14.2-8.

TABLE 14.2-7 (Sh. 1 of 2)

POWER ASCENSION TEST SEQUENCE

Test Title	YGN 3*	YGN 4**
Natural Circulation Test	*** ≥ 80%	NA
Variable Tavg (Isothermal Temperature+ Coefficient & Power Coefficient) Test	20, 50, 80, 100%	50 & 100%
Unit Load Transient Test	50, 100%	50, 100%
Control Systems Checkout Test	20, 50, 80, 100%	50, 80%
RCS and Secondary Chemistry and Radiochemistry Test	20, 50, 80, 100%	20, 50, 80, 100%
Turbine Trip Test	100%	100%
Unit Load Rejection Test	100%	100%
Shutdown from Outside the Control Room Test	≥ 10%	≥ 10%
Loss-of-Offsite Power Test	≥ 10%	≥ 10%
Biological Shield Survey Test	20, 50, 80, 100%	20, 50, 80, 100%
Xenon Oscillation Control Test	≥ 50%	N/A
Dropped CEA TEST	Post 80%	N/A
"Ejected" CEA TEST	Post 80%	N/A
Steady-State Core Performance Test	20, 50, 80, 100%	20, 50, 80, 100%
Intercomparison of PPS, CPCs, and Process Computer Input	20, 50, 80, 100%	20, 50, 80, 100%
Verification of CPC Power Distribution Related Constants	20, 50%	20, 50%

TABLE 14.2-7 (Sh. 2 of 2)

Test Title	YGN 3*	YGN 4**
Main and Auxiliary Feedwater	*** ≥ 10%	≥ 10%
CPC Verification	20, 50, 80, 100%	20, 50, 80, 100%
Steam Dump and Bypass Valve Capacity Test	≥ 15%	≥ 15%
Incore Detector Test	20, 50, 80, 100%	20, 50, 80, 100%
COLSS Verification	20, 50, 80, 100%	20, 50, 80, 100%
NSSS Integrity Monitoring System	20, 50, 80, 100%	20, 50, 80, 100%

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* An expanded test program is conducted for YGN 3 in order to validate the design, the design methods, and the safety analysis assumptions.

** Reduced testing is contingent upon the demonstration that YGN 4 behaves in an identical manner as YGN 3 through conformance with the acceptance with the criteria given in Table 14.2-8.

*** Initial Power Level

+ The temperature and power coefficient: measurements are done as close as possible to 100% power at a level where CEA motion is practical, accounting for margin considerations.

TABLE 14.2-8

PHYSICS (STEADY-STATE) TEST ACCEPTANCE CRITERIA TOLERANCES

Parameter	YGN 3	YGN 4
Low Power Physics Test		
Symmetry Test	± 1 1/2 ¢	± 1 1/2 ¢
CEA Group Worths***	± 15% or .1% $\Delta\rho$ whichever is greater	± 10% or .05% $\Delta\rho$ whichever is greater
Total Worth (Net Shutdown)	± 10%	± 10%
Temperature Coefficient	± .9 x 10^{-4} $\Delta\rho$/°C	± 0.55 x 10^{-4} $\Delta\rho$/°C
Critical Boron Concentration	± 100 ppm	± 50 ppm
Boron worth	± 15 ppm/% $\Delta\rho$	
Dropped and Ejected CEA Worths	± 31% or 0.1% $\Delta\rho$ whichever is greater	NA
Power Ascension Physics Test		
Power Distribution (Radial and Axial)	** RMS ≤ 5%	** RMS ≤ 3%*
Peaking Factors (Fxy, FR, Fzl, Fq)	± 10%	± 7.5%
Temperature Coefficient	± 0.9 x 10^{-4} $\Delta\rho$/°C	± 0.55 x 10^{-4} $\Delta\rho$/°C
Power Coefficient	± 0.2 x 10^{-4} $\Delta\rho$/% Power	± 0.2 x 10^{-4} $\Delta\rho$/% power
Pseudo Ejected CEA (2D Power Density Ratio Comparison)	± 20%	NA
Dropped CEA (2D Power Density Ratio Comparison)	± 0.2	NA

* at 50% power and above

** $RMS = \sqrt{\frac{\sum_{1}^{N} (RPD^{PRED} - RPD^{MEAS})^2}{N}}$, where N = 1, 2, 3 ... N (Total number of fuel assemblies in core or number of axial planes, as appropriate).

*** If CEA exchange methods are used, the acceptance criteria provided in CEN-319 (A) should be used.

TABLE 14.2-9 (Sh 1 of 18)

FSAR PARAGRAPH VERSUS TEST PROCEDURE

TABLE 14.2-9 (Sh 2 of 18)

FSAR PARAGRAPH VERSUS TEST PROCEDURE

TABLE 14.2-9 (Sh 3 of 18)

FSAR PARAGRAPH VERSUS TEST PROCEDURE

TABLE 14.2-9 (Sh 4 of 18)

TABLE 14.2-9 (Sh 5 of 18)

FSAR PARAGRAPH VERSUS TEST PROCEDURE

TABLE 14.2-9 (Sh 6 of 18)

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TABLE 14.2-9 (Sh 10 of 18)

TABLE 14.2-9 (Sh 11 of 18)

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TABLE 14.2-9 (Sh 13 of 18)

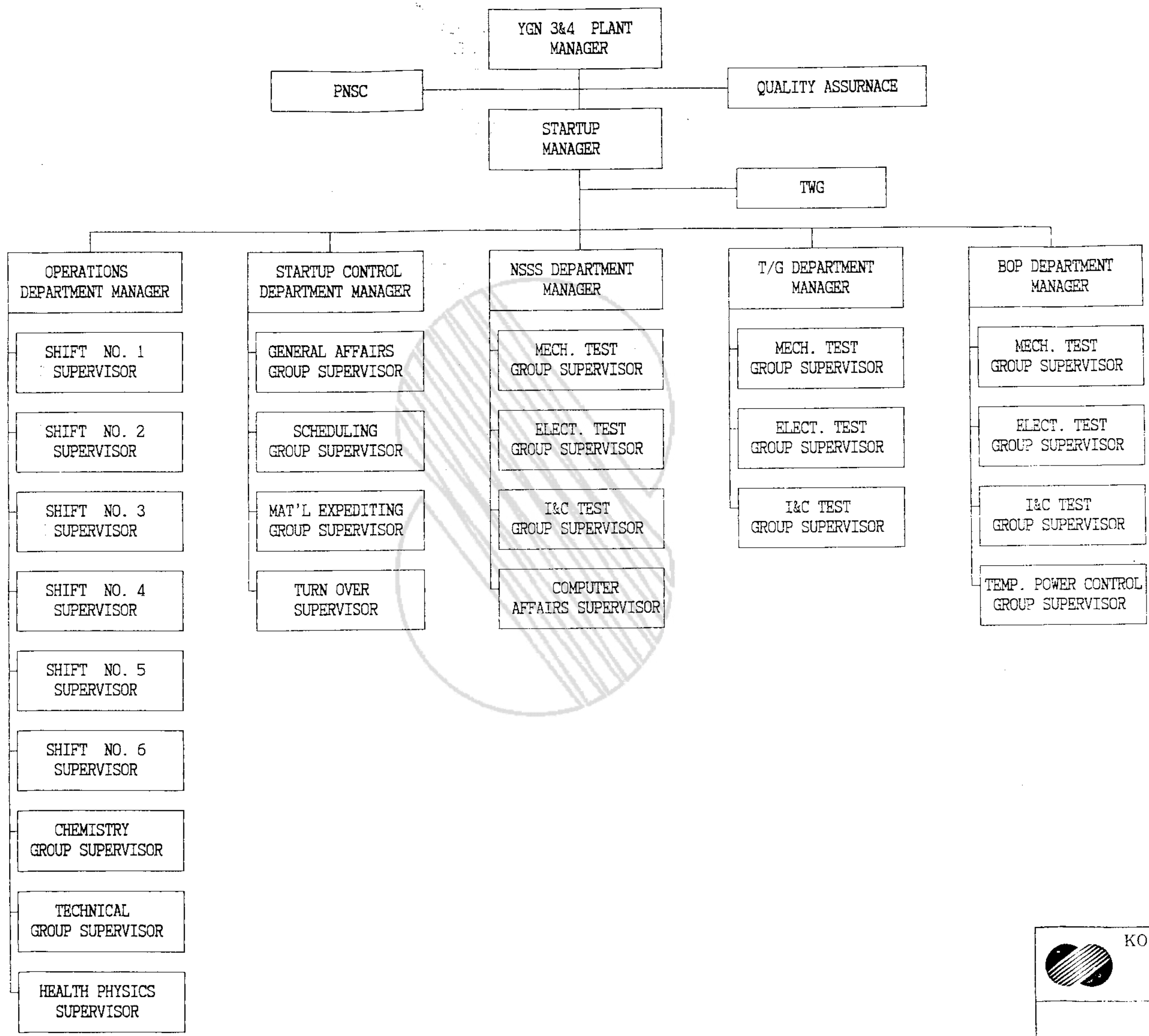
TABLE 14.2-9 (Sh 14 of 18)

TABLE 14.2-9 (Sh 15 of 18)

TABLE 14.2-9 (Sh 16 of 18)

TABLE 14.2-9 (Sh 17 of 18)

TABLE 14.2-9 (Sh 18 of 18)



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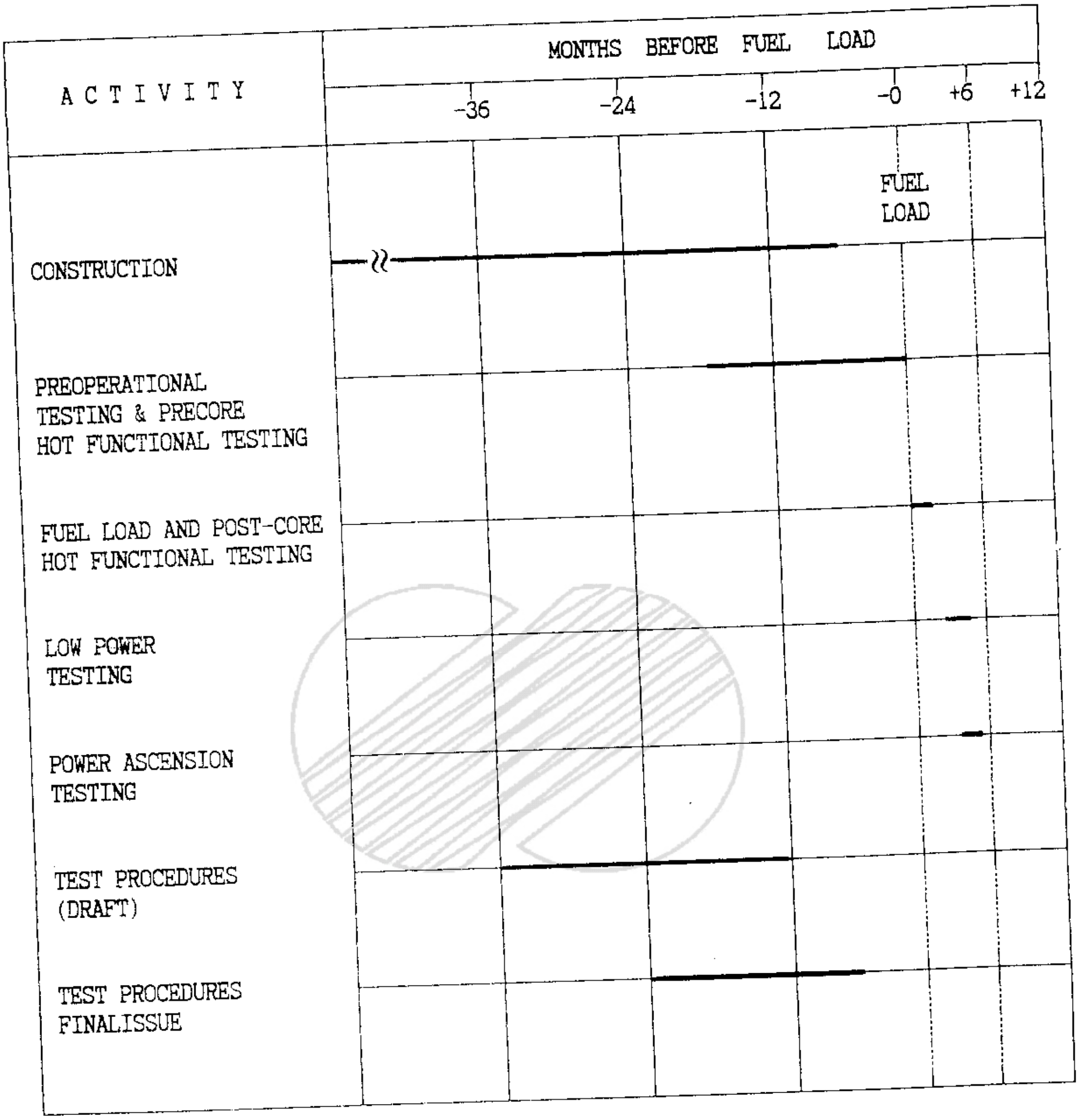
FSAR

STARTUP ORGANIZATION

Figure 14.2-1



KOREA ELECTRIC POWER CORPORATION
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INITIAL TEST PROGRAM SCHEDULE

Figure 14.2-2