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CHAPTER 14.0 INITIAL TEST PROGRAM

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14.1 SPECIFIC INFORMATION TO BE INCLUDED IN PRELIMINARY SAFETY ANALYSIS REPORTS

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

Chapter 14 context, in its entirety, is HISTORICAL INFORMATION

14.2 CONSTRUCTION, PREOPERATIONAL, AND INITIAL STARTUP TEST PROGRAM

14.2.1 Summary of Test Program and Objectives

14.2.1.1 Summary of the Startup Test Program

The Startup Test Program consists of a series of tests categorized into construction, preoperational, and startup test phases. The three test phases are summarized below:

a. Construction Test Phase - The construction test phase is that period during which construction tests, including hydrostatic tests, initial equipment energization, flushing and cleaning, calibration of instrumentation, valve testing, meggering, hi-pot testing, etc., are performed. Tests conducted are performed at the direction of the Bechtel Checkout and Turnover Organization (CTO) and Bechtel Construction (BC). Turnover from Bechtel Construction via the Checkout and Turnover Organization to Entergy Operations occurs at the end of this phase.

b. Preoperational Test Phase - Preoperational tests are performed prior to fuel loading and after the individual components in a system have been tested. Preoperational tests demonstrate the capability of safety-related structures, systems, and components, and any non-safety-related structures, systems, or components which meet any of the criteria below.

   Preoperational tests are conducted on those systems that:

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

   2. Will be relied upon for safe shutdown and cooldown of the reactor under faulted, upset, or emergency conditions.

   3. Will be relied upon for establishing conformance with safety limits or limiting conditions for operation that will be included in the facility's Technical Specifications.

4. Are classified as engineered safety features or will be relied upon to support or assure the operation of engineered safety features within design limits.

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

6. Will be utilized to process, store, control, or limit the release of radioactivity

Other plant structures, systems, or components have their performance capability proved in the acceptance test program.

Preoperational tests are performed to verify, to the extent feasible, under actual or simulated operating conditions the performance of the structures, systems, or components. The program includes tests, adjustments, calibration, and verification of system operating modes to ensure that initial fuel loading, approach to criticality, and subsequent power operations can be performed safely. The preoperational test program ends at the commencement of fuel loading; however, the possibility exists that preoperational tests may be conducted after fuel loading has occurred. Proper notification and justification will be provided prior to conducting any post-fuel load preoperational testing.

c. <u>Startup Test Phase</u> - Startup tests ensure that fuel loading is accomplished in a safe manner, confirm the design bases, demonstrate, where practical, that the plant is capable of withstanding the anticipated transients and postulated accidents, and ensure that the plant can be safely brought to rated capacity and sustained power operation. This phase is subdivided into four periods:

1. Fuel load and open vessel tests (includes preparations for fuel loading)

2. Initial ascension to rated temperature and pressure

3. Testing from rated temperature and pressure to 100 percent of rated output

4. Warranty demonstrations

14.2.1.2 Test Program Objectives

The objectives of the test program are:

a. To ensure that the construction is complete and acceptable

b. To demonstrate the capability of safety-related structures, components, and systems to meet performance requirements

c. To effect fuel loading in a safe manner

d. To demonstrate, where practical, that the plant is capable of withstanding anticipated transients and postulated accidents

e. To evaluate and demonstrate, to the extent possible, plant operating procedures to provide assurance that the plant staff is knowledgeable about the plant and procedures, and is fully prepared to operate the facility in a safe manner

f. To bring the plant to rated capacity and sustained power operation

14.2.2 Organization

14.2.2.1 Grand Gulf Startup Organization

The Startup Organization (Startup) has the responsibility and authority to conduct all startup testing for GGNS. The Startup Organization is directed by the Startup Supervisor who reports directly to the Manager, Plant Operations through the Technical Support Superintendent for matters relating to construction phase, preoperational phase, and startup phase testing. Startup is a composite of Entergy Operations, Bechtel, General Electric (GE) Startup Engineers, and Consultant Startup Engineers. The Bechtel Project Startup Engineer and the GE Site Operations Manager, as senior Startup representatives of their companies, serve on the Startup Supervisor's staff, providing advice, assistance, and consultation. Figures 13.1-1 and 14.2-2 illustrate the GGNS Plant Staff and GGNS Startup Organizations and their interrelationships.

14.2.2.2 Startup Supervisor

The Startup Supervisor has complete authority to control the conduct of the Startup program 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 Supervisor 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 procedures. He coordinates requests for Operations, Maintenance, Quality Programs, Technical, Construction, and Administrative staff support with the appropriate Plant Staff personnel as required.

14.2.2.3 Bechtel Project Startup Engineer

The Bechtel Project Startup Engineer is responsible for consulting and assisting in all Startup activities leading up to fuel loading. The Bechtel Project Startup Engineer has the following specific responsibilities:

a. Assist the Startup Supervisor in preparing schedules and managing all Startup activities.

b. Review selected component tests, preoperational/ acceptance tests, and special tests.

c. Advise the Startup Supervisor in matters relating to the Startup program.

d. Assist in data reduction, analysis, and interpretation of test results.

e. Coordinate with Bechtel Construction any required craft support.

f. Coordinate with Bechtel Construction the release of equipment to CTO for testing.

g. Coordinate with Bechtel Construction component repair/ rework required for testing.

h. Provide administrative support to the Bechtel personnel assigned for startup testing.

i. Act as liaison with appropriate groups within the Bechtel Project Organization, where required. Expedite the resolution of problems or design questions within Bechtel.

j. Act as manager of the Checkout and Turnover Organization (CTO).

k. Perform other duties as required by the Startup Supervisor.

14.2.2.4 General Electric Site Operations Manager

The General Electric Site Operations Manager is responsible to the Startup Supervisor for consulting and assisting in NSSS Startup testing. The General Electric Site Operations Manager has the following specific responsibilities:

a. Assist the Startup Supervisor in preparing schedules and managing all Startup activities.

b. Act as liaison with General Electric on testing matters involving General Electric-supplied equipment.

c. Review selected component tests, preoperational/ acceptance tests, special tests, and initial startup tests.

d. Advise the Startup Supervisor in all matters relating to the startup program.

e. Assist in data reduction, analysis, and interpretation of test results.

f. Provide administrative support to General Electric site personnel assigned to Startup.

g. Perform other duties as required by the Startup Manager.

14.2.2.5 Deleted

14.2.2.6 Deleted

14.2.2.7 Group Leaders

The Group Leaders under the supervision of the Startup Supervisor are responsible for directing and coordinating the activities of the teams of Test Supervisors assigned to them. The Group Leader has the following specific responsibilities:

a. Establish startup system test scope boundaries.

b. Assign systems to Test Supervisors. Make team assignments.

c. Schedule system procedure writing and revision. Review and submit procedures and results for approval.

d. Schedule system testing and monitor progress. Provide assistance as required to Test Supervisors.

e. Initiate with Checkout and Turnover Organization (CTO) turnover of system to Entergy Operations for testing.

f. Assist in data reduction, interpretation, and analysis of test results.

g. Provide input, track, and clear resolved items from the Master Punchlist for his group's systems.

h. Coordinate detailed system scheduling information and assist in developing system test logics and schedules.

i. Assist in resolving test problems and deficiencies as directed by the Startup Supervisor.

j. Coordinate resolution of deficiencies with Bechtel Project Startup Engineer, GE Site Operations Manager, or Plant Staff as appropriate.

k. Coordinate work requests with CTO and Plant Staff for turned-over systems.

l. Implement the Startup Manual for his group.

m. Coordinate the activities of his group with the other Group Leaders.

n. Review test results, test records, and test documentation for completeness, accuracy, and compliance with procedures, prior to submission for review/approval.

o. Coordinate with Plant Staff requests for test support required by his Test Supervisors.

14.2.2.8 Test Supervisors

The Test Supervisors under the supervision of the Group Leaders are responsible for conducting all test activities for the systems assigned to them. The Test Supervisors have the following specific responsibilities:

a. Define preoperational/acceptance 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 of the other Test Supervisors in his group.

c. Provide detailed system test scheduling information to the Group Leader for assigned systems. Assist in developing detailed test logics and schedules.

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

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

f. Supervise and direct the activities of GGNS Operations and Maintenance personnel assigned to them for testing.

g. Review operating, maintenance, and test procedures used in the course of testing. Suggest correction or improvements, 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 for testing and develop punchlist items.

j. Initiate, track, and resolve system deficiencies and discrepancies via Field Reports, Master Punchlist, etc.

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

l. Provide CTO with turnover requirements and dates for components of assigned systems based on integrated construction/startup schedule.

m. Provide on-the-job training of GGNS personnel on assigned systems.

n. Obtain concurrence to run all tests from the operations Shift Manager and keep the Shift Manager informed of status of tests and equipment.

14.2.2.8.1 Summary of Qualifications of Test Supervisors

There are 53 Startup Test Supervisors. All have at least a high school diploma; 36 (68 percent) have at least a bachelor's degree in engineering or a related physical science, and 3 (5.7 percent) have graduate degrees.

Three (5.7 percent) have less than one year related technical experience; two (3.8 percent) have between one to two years' related technical experience; 11 (20.8 percent) have two to five years' related technical experience, 19 (35.8 percent) have five to ten years' related technical experience and 18 (34.0 percent) have over ten years' related technical experience.

14.2.2.9 Startup Group Leader

During the initial Startup Test Phase, the GGNS Startup Group Leader, under the supervision of the Startup Supervisor, will be responsible for directing and coordinating the activities of the GGNS Shift Test Supervisors with GE Startup Test, Design, and Analysis (STD&A).

14.2.2.10 Startup Shift Test Supervisor

During the initial Startup Test Phase, under the supervision of the Startup Group Leader, the Startup Shift Test Supervisors will write and prepare test procedures, conduct and coordinate tests, and prepare and analyze test results. They and the STD&A Test Engineers will provide 24-hour shift coverage beginning with fuel loading as necessary for the testing evolutions.

14.2.2.11 Deleted

14.2.2.12 Deleted

14.2.2.13 Deleted

14.2.2.14 General Electric Startup Engineers

14.2.2.14.1 General Electric Operations Superintendent

The GE Operations Superintendent is responsible to the GE Site Operations Manager for supervising the activities of GE Shift Superintendents. During the startup test phase, he works directly with the Grand Gulf Operations Supervisor in providing GE technical direction to the Plant Operations Organization.

14.2.2.14.2 General Electric Shift Superintendents

The GE Shift Superintendents provide technical direction to Grand Gulf shift personnel in the testing and operation of GE-supplied systems. They provide 24-hour per day shift coverage as required, beginning with fuel loading. They report to the GE Operations Superintendent.

14.2.2.14.3 General Electric Lead Engineer - Startup Test, Design, and Analysis

The GE Lead Engineer - Startup Test, Design, and Analysis (STD&A) is responsible to the GE Site Operations Manager for supervising the GE Startup Test Engineers and for verifying core physics parameters and characteristics and documenting that performance of the NSSS and its components conform to test acceptance criteria. During the startup test phase, he works directly with the startup phase group leader providing GE technical direction to the power test effort.

14.2.2.14.4 General Electric Startup Test Engineers - Startup Test, Design, and Analysis

General Electric Startup Test Engineers will assist Startup in conducting the initial startup test phase. They will write and prepare test procedures, conduct and coordinate tests, and prepare and analyze test results. They will provide 24-hour shift coverage, beginning with fuel loading, working directly with the GGNS Shift Test Supervisors. They report to the STD&A lead engineer.

14.2.2.15 Interfacing Organizations

14.2.2.15.1 GGNS Nuclear Plant Engineering

During startup, GGNS's nuclear plant engineering staff may provide support to the GGNS startup program.

GGNS's nuclear plant engineering staff is headed by the Director, Design Engineering-GGNS. Nuclear plant engineering organization and responsibilities are described in subsection 13.1.1.

14.2.2.15.2 GGNS Project Construction

The GGNS construction supervisor represents GGNS 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.

14.2.2.15.3 GGNS Quality Programs

GGNS Quality Programs performs monitoring and audit functions during all testing phases. For the Component Test Phase, GGNS Quality Programs monitors, reviews, and audits Bechtel QA/QC. Bechtel QA/QC is responsible for developing and implementing the Bechtel quality aspects of the Component Test Program. The functions of GGNS Quality Programs concerning quality activities from the preoperational test phase through commercial operation are described in Section 17.2.

14.2.2.15.4 GGNS Plant Staff

The plant staff is responsible for the operations phase of the station and will assume responsibility for the operation and maintenance of plant systems upon turnover to GGNS. Chapter 13 details their duties and general responsibilities. In regard to testing, these managers will be responsible for:

a. Assigning and supervising plant personnel to support the testing program

b. Providing technical expertise to review test procedures and results

The operating shift managers are responsible for the safe operation of plant systems. Each test engineer will coordinate his efforts with the shift manager. All system operations in support of the test program will be performed by plant operating personnel using approved written procedures.

Plant maintenance personnel will be used to provide craft support for testing to the extent practical.

The plant staff chemistry and radiation control groups are responsible for all chemical, radiochemical, and radiation protection activities required to support testing.

Plant staff will provide specialized training required for site testing personnel in radiation protection, emergency plans, and security.

Quality Programs is responsible for reviewing preoperational test procedures and for monitoring of the testing program from preoperational/acceptance testing through commercial operation.

14.2.2.15.5 Plant Safety Review Committee (PSRC)

The Plant Safety Review Committee (PSRC) is a Plant Staff committee that is responsible for reviews and recommendations in accordance with the Quality Assurance Program during the operational phase of the plant. The scope of the PSRC is further described in Chapter 13.0.

The PSRC recommends approval of fuel load and all major step changes in the Startup Phase of the test program. During the Startup Phase, the Startup Supervisor shall submit test procedures, results, and reports to the PSRC for formal review and recommendation acceptance.

PSRC assumes the responsibility for review and approval recommendation functions on systems once they have been tested and accepted by the General Manager, Plant Operations for operation.

14.2.2.15.6 Bechtel Project Engineering

Project Engineering provides technical assistance in reviewing test procedures, designs services to satisfy special startup requirements, writes special test procedures to verify unique GGNS designs, 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.

14.2.2.15.7 Bechtel Field Construction

Bechtel Field Construction has primary responsibility for erecting structures, equipment and systems, and for conducting and documenting construction techniques and tests. These efforts are accomplished by Bechtel Field Construction (BC) personnel, Bechtel Field Quality Control, contractors, vendors, and subcontractors.

It is the responsibility of BC to complete plant structures, systems, and components in the proper order and in a timely manner consistent with the Integrated Startup/Construction Schedule.

After release of a system or subsystem, BC will provide craft labor and supervision to repair or modify equipment as requested to support Startup.

14.2.2.15.8 Bechtel Checkout and Turnover Organization

The Bechtel Checkout and Turnover Organization (CTO) is responsible for expediting and coordinating Bechtel Construction efforts to complete systems to support Startup. The CTO is managed by the Bechtel Project Startup Engineer. The CTO assists BC in scheduling system completion, coordinates walkdowns, dispositions punchlist items, administers and coordinates resolution of all Startup Field Reports, and turns over systems to Startup for test. Preparatory to the turnover CTO conducts required construction component testing, energization, and flushing.

14.2.2.15.9 GE Organization

GE Startup personnel are integrated into the Startup organization, supplementing GGNS Startup personnel. The GE Site Operations Manager is an advisor to the Startup Supervisor. He provides advice and assistance to the Startup Supervisor regarding the conduct of the Startup Program. He represents GE on Startup matters and serves as liaison with the GE Project Organization. He is administratively responsible for the GE Startup personnel.

14.2.2.15.10 Augmentation By Others

Qualified technical personnel from various consulting organizations, vendors, contractors, and Entergy Operations may be assigned to assist the Startup as required. The personnel will be assigned to work within the Startup organization.

14.2.2.16 Qualifications of Startup Participants

Minimum qualifications of individuals who prepare Preoperational Test Phase Procedures, or direct or supervise the conduct of individual tests are as follows:

a. The individual shall have a bachelor's degree in engineering or the physical sciences, or the equivalent and one year of applicable power plant experience or equivalent industrial experience. Included in the one year of experience should be the completion of an indoctrination and training course, or

b. A high school diploma or the equivalent and four years of power plant experience or equivalent industrial experience. Credit for up to two years of this four-year experience may be given for related technical training on a one-for-one time basis. Included in the four years of experience should be the completion of an indoctrination and training course.

Minimum qualifications of individuals who prepare Startup Test Phase Procedures, or direct or supervise the conduct of individual startup tests are as follows:

a. The individual shall have a bachelor's degree in engineering or the physical sciences, or the equivalent and two years of applicable power plant experience or equivalent industrial experience, of which at least one year shall be applicable nuclear power plant experience, or

b. A high school diploma or the equivalent and five years of applicable power plant experience, of which at least two years shall be applicable nuclear power plant experience. Credit for up to two years of non-nuclear experience may be given for related technical training on a one-for-one time basis.

Minimum qualifications of individuals responsible for review and approval of Preoperational and Startup Test Procedures and/or review and approval of test results are as follows:

The individual assigned to perform these activities shall have a minimum of eight years of applicable power plant or industrial experience with a minimum of two years of applicable nuclear power plant experience. A maximum of four years of non-nuclear experience may be fulfilled by satisfactory completion of academic training at the college level.

Test personnel performance shall be evaluated by the Startup Supervisor every two years to assure the continued capability of the individual. Retention as a test supervisor or additional training requirements will be determined by this evaluation.

In addition, members of GE Startup Operations staff who will advise and assist GGNS Operations personnel during fuel loading and power testing will meet the requirements of ANSI Std. N18.1-1971, as endorsed by Regulatory Guide 1.8.

A copy of each GGNS Test Supervisor's certification and resume will be maintained in the plant files. A certificate of qualification will be issued for the other Test Supervisors by their respective organizations. Documentation of the personnel qualifications and certification is retained in the respective participating organizations' files.

14.2.2.17 Participation of Plant Staff in Startup Testing

GGNS operating shift supervisors are responsible for safe operation of plant equipment and systems through all phases of testing covered by this chapter. All system operations will be performed by operations personnel.

GGNS maintenance personnel will perform routine maintenance on all components that have been released to Entergy Operations for preoperational and startup testing. GGNS I&C and electrical personnel will assist in the calibration program.

GGNS technical section engineers include results engineers, maintenance engineers, reactor engineers, and computer engineers. To ensure that the technical section engineers are involved in initial test programs, technical section engineers have, at various times, been assigned to startup activities. The technical section will support startup in the review of test data and review of initial test procedures. The plant reactor engineers will work with and support the startup group during initial startup and core physics testing. In addition, the plant engineering staff will assist in the resolution of problems once a plant system has been turned over to GGNS Startup.

The maintenance engineers are involved in startup support in the areas of establishment of a calibration program and plant documents for alignments, response time testing, instrument and protective device calibrations, and development of system maintenance instructions (preventive maintenance) for each system. Actual performance of these maintenance efforts and other support efforts by maintenance craft in support of startup will be monitored (on the job) by maintenance engineering.

14.2.3 Test Procedures

The Startup Manual establishes the methods for preparing, approving, revising, and controlling all acceptance, preoperational, startup, and special test procedures.

All testing will be performed in strict conformance with an approved test procedure and its authorized changes.

14.2.3.1 Test Procedure Preparation

The startup manual specifies test procedure format, style, and content guidelines.

In general, the following format will be used for preoperational, acceptance, and special test procedures:

INDEX

1.0	OBJECTIVES
2.0	REFERENCES
3.0	TEST EQUIPMENT
4.0	NOTES AND PRECAUTIONS
5.0	PREREQUISITES
6.0	INSTRUMENTATION
7.0	TEST PROCEDURE
8.0	TEST DATA SHEETS
9.0	RESTORATION
10.0	ACCEPTANCE CRITERIA

APPENDICES, FIGURES, AND TABLES

In general, the following format will be used for startup test procedures:

1.0	PURPOSE
2.0	REFERENCES
3.0	PREREQUISITES AND INITIAL CONDITIONS
4.0	TEST INSTRUCTIONS
5.0	ANALYSIS
6.0	CRITERIA

Draft test procedures are prepared by the test supervisors, plant staff, or consultants using the latest design performance information available in the FSAR, project drawings, vendor manuals, design criteria, and test specifications. These drawing manuals or other design information will be obtained from GGNS or Bechtel document control centers.

14.2.3.2 Test Procedure Review and Approval

The review and approval process for preoperational, acceptance, and special test procedures originates with the cognizant Test Supervisor who forwards the draft to his Group Leader for review. The Group Leader reviews the procedure and forwards copies of the procedure to the General Electric Site Operations Manager, the Bechtel Project Startup Engineer, Quality Programs, GGNS Operations staff and perhaps other departments if deemed necessary by the Startup Supervisor. These departments analyze the procedure and route it back to the cognizant Group Leader for comment resolution. The procedure cycles through this process until it is acceptable, then it is routed to the Startup Supervisor for final review and issue. Final review and approval will be by Startup Supervisor, GE Site Operations Manager and Bechtel Project Startup Engineer.

The review and approval process for startup test procedures originates with the cognizant Test Supervisor who forwards them to the Startup Group Leader. The Group Leader reviews the procedures and forwards them to the GE Site Operations Manager, GGNS Operations staff, Technical staff, and the Plant Safety

Review Committee (PSRC). The procedures cycle through this process until acceptable, at which time the PSRC recommends the procedures for approval to the General Manager, Plant Operations.

14.2.4 Conduct of Test Program

The GGNS Startup Test Program will be conducted using approved written test procedures. The administrative controls governing the conduct of the Startup Test Program are established in the Startup Manual. The Startup Manual and all test procedures are controlled documents.

14.2.4.1 Procedure Modifications

After a procedure has been approved for performance, all changes shall be documented using the Permanent Test Change (PTC) for startup test procedures, or the Test Change Notice (TCN) for preoperational, acceptance, and special test procedures.

If the functional or technical intent of a test procedure is not altered by minor and obvious changes, such as typographical errors, descriptive errors, etc., the Test Supervisor may make an on-the-spot change using a TCN or PTC and proceed with testing. Such modifications will be promptly reviewed and approved or rejected by the same authorities who originally reviewed and approved the procedure. In addition to these requirements, during the startup test phase the PTC will be signed by two members of the plant management staff, at least one of whom holds a senior reactor operator's license on the unit affected. The PTC will be reviewed and approved within 14 days of implementation.

If the functional or technical intent of a test procedure is altered by a PTC or TCN, test activities shall be halted pending PTC or TCN resolution. Upon resolution, testing may proceed after receipt of the approved PTC or TCN. Such PTCs or TCNs will be reviewed and approved by the responsible organizations which had reviewed and approved the original procedure. During the Startup Test Phase, this always includes a review by the PSRC.

Major changes (i.e., functional intent or acceptance criteria revisions) may be made when deemed necessary by the Startup Supervisor to ensure adequate testing. The revised test is reviewed, accepted, and approved as described in 14.2.3.2 above. Major changes to procedures required after the start of testing necessitate stopping the test until it is reviewed and approved by the responsible organizations which had reviewed and approved the original procedure.

Any changes or revisions to approved test procedures during the Startup Test Phase will be handled in accordance with Plant Administrative Procedures and Technical Specifications.

14.2.4.2 System Turnover To Entergy Operations

When a system's construction and construction testing are completed, it is formally turned over to Startup along with its required turnover documentation.

CTO prepares a turnover package detailing the scope of the turnover and containing the required turnover documentation and schedules a pre-turnover walkdown. At the walkdown a visual inspection of the system, subsystem, or components is made, the contents of the turnover package are reviewed, and any exceptions are noted and their disposition agreed upon.

With the acceptance of the turnover, the system is green tagged to indicate Entergy Operations custody and testing may commence. Prior to turnover, blue tags will be used to indicate CTO custody for construction testing.

Entergy Operations will perform all routine corrective and preventive maintenance after system turnover, i.e., cleaning of panels, lubricating, etc. This will include all routine cleaning to remove dirt, condensed moisture or other foreign objects in electrical components (e.g., relays, switches, breakers). Inspections by startup, maintenance, and operations personnel performing testing will identify required cleaning to the GGNS maintenance group.

Upon completion of preoperational testing, the systems will be green and white tagged to indicate completion of preoperational testing.

14.2.4.3 Test Performance

The test supervisors will be responsible for planning and conducting the test in accordance with written, approved procedures. Once a test procedure has been approved and issued for use, the Test Supervisor will be responsible for ensuring that all prerequisites are satisfactorily completed and all allowable exceptions noted. The test will be scheduled and published on the appropriate test plan of the day.

When the test procedure is approved for performance and when prerequisites to the test are completed as required, the test can be started. Required personnel are assembled by the Test Supervisor, and the test procedure is reviewed in detail and then performed. Operator personnel requirements necessary to conduct the tests will be coordinated through the Shift Manager. During the test, all precautions are observed, and data sheets are completed, reviewed, signed, and dated by the Test Supervisor. Witness points, as called for in the procedure, are also signed off appropriately. Temporary changes to the systems as required for testing are documented, and following completion of the tests, systems are restored to a predetermined status. The Test Supervisor is responsible for documenting test exceptions and for testing or retesting these when it becomes possible to do so.

During the performance of all tests, the Operations Shift Manager is responsible for the safe and proper operation of the plant. He shall have the authority to take whatever action he deems necessary to assure the safe operation of GGNS.

14.2.4.4 Deficiency Reporting and Correction

In the process of construction, preoperational, and startup phase testing, design problems, deficiencies, or the need for design changes and improvements may be encountered. Such matters will be formally documented and reported to the proper design organization for resolution.

During plant startup, there are four mechanisms to identify and correct discrepancies. These are: Field Report (FR), Trouble Tickets (TT), Quality Deficiency Report (QDR), and Material Nonconformance Report (MNCR).

a. <u>Field Reports</u>

   Field Reports (FRs) are initiated by Startup to identify and correct deficiencies which Bechtel Construction, Bechtel Project Engineering, General Electric, Allis-Chalmers or the GGNS technical section must resolve.

   Typical Field Reports might address:

1. Errors or discrepancies in approved design documents

2. Systems, subsystems, or components failing to meet design specifications, test acceptance criteria, or licensing commitments

3. Potential hazards to personnel or equipment safety

4. Component malfunction, damage, or failure

5. Proposed design modifications and enhancements

Typically, a Field Report will be originated by the cognizant test supervisor, then forwarded to his group leader for review. The group leader enters the FR into the master punchlist for tracking to ensure that the required repairs or modifications will be performed.

The FR is then routed to the Bechtel Project Startup Engineer, the General Electric Site Operations Manager, Allis-Chalmers Site Engineer, or GGNS Technical Support Superintendent, depending on the responsibility of deficiency resolution. This action ensures that any proposed facility modifications will be reviewed by the original design organization. The responsible organization will keep Startup informed of action and progress in resolving the problem.

Upon resolution of the deficiency, the test supervisor and group leader will evaluate the disposition and determine at that time what, if any, retesting is required.

By signing the FR, the test supervisor and group leader document their review and recommend acceptance of the FR disposition. With his signature, the Startup Supervisor accepts the disposition and closes out the FR; at this time, the group leader will close out the FR on the master punchlist.

b. Trouble Tickets

Trouble tickets are initiated by Startup to identify problems or deficiencies which must be corrected or resolved by GGNS Maintenance. Plant Operating Manual Administrative Procedures provide a method for reporting equipment abnormalities and failures, for reporting all material deficiencies, and for requesting work from the Maintenance Section. Trouble tickets also provide notification of all plant deficiencies to the shift manager. This procedure establishes controls to ensure that quality-related problems identified on trouble tickets, whether specifically identified as quality-related by the originator, or not, are identified and that proper quality actions are initiated. The trouble ticket system will, in coordination with the maintenance work authorization and other administrative systems, provide for tracking and reporting the disposition of all trouble tickets.

c. Quality Deficiency Report

The QDR is GGNS's mechanism by which significant quality deficiencies may be reported, investigated, tracked, reviewed, and corrective action taken, determination of cause, follow-up, and close-out documented. This program provides for resolution of quality deficiencies, except material nonconformances, with organizations external to the plant as well as those internal to the plant. QDRs are used for resolution of deficiencies discovered in services and non-material items which do not meet contract specifications or plant administrative requirements. QDRs do not normally require engineering resolution. Deficiency items which are within the scope of the QDR's applicability are resolved in accordance with Nuclear Production Department and Implementing Procedures.

Any member of the Nuclear Production Department may at any time initiate a QDR if he determines that significant quality deficiencies exist in services or non-material items. The QDR will be submitted to Quality Programs for disposition and closeout.

d. Material Nonconformance Report

The MNCR is GGNS's mechanism by which safety-related deficiencies are reported and corrected. Material nonconformances include physical defects, acceptability test failures, incorrect or inadequate material documentation, or failure to comply with prescribed manufacturing processing, inspection, and test procedures. Material nonconformances are used for material items which do not meet design/procurement specifications or contract requirements and provide for the resolution of deficiencies by an engineering review and evaluation process. QDRs or other reporting documents would normally be initiated and used to resolve quality program deficiencies identified as a result of MNCR actions. Deficiency items which are within the scope of the MNCR's applicability are resolved in accordance with Plant Operating Manual Administrative Procedures.

The Startup Supervisor has the option of directing GGNS Maintenance or Bechtel Construction to perform the work involved in making any plant modifications, repairs, or corrections during the preoperational test phase. GGNS Maintenance will perform work under its maintenance work authorization procedures, and Bechtel Construction, directed by Bechtel CTO, will perform work under their construction work permit procedures. Either procedure requires consideration of inspection and retesting upon work completion. During the startup test phase, corrective work, repairs, and modifications are the responsibility of GGNS Maintenance.

14.2.4.5 Startup Test Phase Prerequisites

With the completion of the required preoperational testing and acceptance of the test results, the PSRC will recommend to the General Manager, Plant Operations that fuel loading and the initial startup test phase commence. The PSRC must review the test results on each power plateau during the startup test phase prior to authorizing further power testing. Power plateaus consist of each of the following related test conditions (see Figure 14.2-4):

a. Open vessel

b. Heat up to rated temperature and pressure

c. Test condition 1

d. Test conditions 2 and 3

e. Test conditions 4, 5, and 6

f. Warranty demonstration

14.2.5 Review, Evaluation, and Approval of Test Results

Upon test completion, the responsible Test Supervisor will review the test data for completeness and evaluate the results to ensure that they meet all acceptance criteria or note any allowable exceptions. The evaluated test results will be submitted to the Group Leader who will review the results for completeness, technical accuracy, and conformance to procedures prior to submitting them to the Startup Supervisor.

The test results will be submitted for review and comment to all those who originally reviewed and approved the procedure. In addition, the results of all preoperational tests, all startup tests, and selected special and acceptance tests will be transmitted to Bechtel Project Engineering, GE Project Engineering, and GGNS Technical Section for an independent technical review.

When the results review is complete, preoperational, acceptance, and special test results, exceptions, and review comments will be reviewed by the Startup Supervisor, Bechtel Project Startup Engineer, and GE Site Operations Manager. They will agree to a final resolution of review comments and test exceptions, approve or disapprove the test results, and recommend acceptance or rejection to the General Manager, Plant Operations who has the final sign-off.

Startup test results will be initially reviewed by the Startup Supervisor and GE Site Operations Manager who will transmit the results of their review to the PSRC. The PSRC will review the results and comments and recommend acceptance, rejection, or retesting to the General Manager, Plant Operations who has final sign-off.

Should the results of the test program reveal system, component, design, construction, or manufacturing deficiencies, the Startup Supervisor, during the preoperational test phase, and the PSRC, during the startup test phase, will direct that the deficiencies be reported, investigated, and corrected as described in subsection 14.2.4.4. Any retesting required to further define the nature of the deficiency or to prove satisfactory deficiency correction will be done as directed by the Startup Supervisor or PSRC and General Manager, Plant Operations.

14.2.6 Test Records

A single copy of each test procedure will be designated the official copy for testing. The official copy of the procedure and all information called for by the procedure, such as completed data forms, instrument calibration data, chart recordings, photographs, etc., will be included with the procedure. This information will be retained in the GGNS plant records for the life of the facility.

14.2.7 Conformance of Test Programs with Regulatory Guides

All project regulatory guide positions are contained in Appendix 3A.

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

GGNS regularly receives and maintains reactor operating experience reports which describe operating and testing problems in other nuclear plants. The General Electric Company, through its evolutionary BWR product line design and from the information it gathers from 25 or more operating plants, has always factored industry experience into its design and testing program. The GGNS Startup Supervisor will ensure that operational and testing experiences of other similar plants will be considered in the development of the test program.

14.2.9 Trial Use of Plant Operating and Emergency Procedures

As much as possible throughout the Preoperational and Initial Startup Test Program, test procedures utilize operating, emergency, and off-normal event procedures where applicable in the performance of tests. The use of these procedures is intended to do the following:

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

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

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

Test procedures may use these operating, emergency, and abnormal procedures in several ways: the test procedure may reference the procedure directly; the test procedure may extract a series of steps from the procedure; the test procedure may use a combination of the first two methods. The schedule for the development of plant procedures is discussed in Section 13.5.

14.2.10 Initial Fuel Loading and Initial Criticality

14.2.10.1 Fuel Loading and Shutdown Power Level Tests

Fuel loading and initial criticality are conducted in accordance with written procedures after all prerequisite tests are satisfactorily completed and an operating license has been issued. Prior to approving fuel loading, the plant will be verified ready to load fuel. This verification is accomplished by the following steps, which are performed near the completion of preoperational testing:

14.2.10.1.1 Loss of Power Demonstration - Standby Core Cooling Required

This test demonstrates the capability of each emergency diesel generator to start automatically and assume all of its emergency core cooling load during a loss of normal auxiliary power.

14.2.10.1.2 Cold Functional Testing

Cold functional testing is defined as an integrated operation of various plant systems prior to fuel loading. The intent is to observe any unexpected operational problems from either equipment or a procedure and to provide an opportunity for operator familiarization with the system-operating procedures under operating conditions.

14.2.10.1.3 Routine Surveillance Testing

Because the interval between completion of a preoperational test on a system and the requirement for that system to be operated may be of considerable duration, a number of routine surveillance tests will be performed prior to fuel loading and will be repeated on a routine basis. The Technical Specifications detail the test frequency. In general, this Surveillance Test Program (specified in the Technical Specifications) is instituted by the plant operating staff.

Those surveillance tests required to support fuel load will be performed in accordance with Technical Specifications prior to issuance of the Operating License.

14.2.10.1.4 Master Startup Checklist

A detailed list of items that must be complete, including the preoperational tests, work requests, design changes, and proper disposition of all exceptions noted during preoperational testing, is checked to verify completion just prior to the final approvals for fuel loading and rechecked at each significant new step, such as heatup, opening MSIVs, and power operation.

14.2.10.1.5 Initial Fuel Loading

Fuel loading requires the movement of the full core complement of assemblies from the fuel pool to the core, with each assembly identified by number before being placed in the correct coordinate position. The procedure controlling this movement is written so that shutdown margin checks are made at predetermined intervals throughout the loading, thus ensuring safe loading increments. A complete check is made of the fully loaded core to ascertain that all assemblies are properly installed, correctly oriented, and are occupying their designated positions.

14.2.10.1.6 Zero Power Level Tests

At this point in the program, a number of tests are conducted which are best described as initial zero power level tests. Chemical and radiochemical tests are made to check the quality of the reactor water before fuel is loaded, and to establish base and background levels which will be required to facilitate later analysis and instrument calibrations. Plant and site radiation surveys are made at specific locations for later comparison with the values obtained at the subsequent operating power levels. Shutdown margin checks are repeated for the fully loaded core, and criticality is achieved with each of the two prescribed rod sequences in turn, the data being recorded for each rod withdrawn. Each rod drive is subjected to scram and performance testing. The initial setting of the intermediate range monitors (IRMS) is at maximum gain.

14.2.10.2 Power Testing From 25 Percent to 100 Percent of Rated Output

The power test phase consists of the following tests, many of which are repeated several times at the different test levels; consequently, reference should be made to Table 14.2-3 for the probable order of execution for the full series. The power-flow map shown in Figure 14.2-4 describes the startup test conditions. While a certain basic order of testing is maintained relative to power ascension, there is, nevertheless, considerable flexibility in the test sequence at a particular power level which may be used whenever it becomes operationally expedient. In no instance, however, is nuclear safety compromised.

a. Coolant chemistry tests and radiation surveys are made at each principal test level to preserve a safe and efficient power increase.

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

c. The effect of control rod movement on other parameters (e.g., electrical output, steam flow, and neutron flux level) is examined for different power conditions.

d. Following the first reasonable accurate heat balance (25 percent power), the IRMs are reset.

e. At each power plateau (refer to subsection 14.2.4.5), the Local Power Range Monitors (LPRMs) are calibrated.

f. The average power range monitors (APRMs) are calibrated initially at each new power level and following LPRM calibration.

g. Completion of the process computer checkout is made for all variables, and the various options are compared with hand or off-line computer calculations as soon as significant power levels are available.

h. Further tests of the reactor core isolation cooling system (RCIC) are made with and without injection into the reactor pressure vessel (RPV).

i. Collection of data from the system expansion tests is completed for those piping systems which had not previously reached full operating temperatures.

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

k. Core performance evaluations are made at all test points above the 10 percent power level and for selected transient flow conditions; the evaluations involve the determination of core thermal power, maximum fuel rod surface heat flux, the minimum critical power ratio (MCPR), and other thermal parameters.

l. Overall plant stability in relation to minor perturbations is verified by the following group of tests which are performed at all test points:

   1. Core power-void mode response

   2. Initial pressure controller set point change

   3. Water level set point change

   4. Bypass valve opening

   5. Recirculation flow set point change

   For the first of these tests, a centrally located control rod is moved, and the flux response is noted on a selected LPRM chamber. The next two tests require that the changes made should approximate as closely as possible a step change in demand, while for the next test the bypass valve is opened quickly. The remaining test is performed to properly adjust the control loop of the recirculation system. For all of these tests the plant performance is monitored by recording the transient behavior of numerous process variables, the one of principal interest being neutron flux. Other imposed transients are produced by step changes in demand core flow, simulating loss of a feedwater heater, and simulating failure of the operating pressure regulator. Table 14.2-3 indicates the power and flow levels at which all these stability tests are performed.

m. The category of major plant transients includes full closure of all the main steam isolation valves, fast closure of turbine-generator stop valves, loss of the main generator and offsite power, tripping a feedwater pump, and several trips of the recirculation pumps. The plant transient behavior is recorded for each test, and the results are compared with the acceptance criteria and the predicted design performance. Table 14.2-3 shows the operating test conditions for the major plant transients.

n. A test is made of the relief valves in which leak-tightness and general operability are demonstrated.

o. At all major power levels the jet pump flow instrumentation is calibrated.

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

q. The local control loop performance, based on the drive pump, jet pumps, and control equipment, is checked.

14.2.11 Test Program Schedule

Figure 14.2-3 presents the current integrated startup testing schedule for GGNS.

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Within the scope of preoperational and startup piping vibration, thermal monitoring and dynamic effects testing of piping systems, selected snubbers are monitored for performance by visual inspection or instrumentation.

Specifically:

a. The tests are performed by monitoring and recording piping movements at selected points as systems are brought to operating temperature and loaded in operating modes. Snubber movements will be monitored and recorded. Periodically during the system heatup, the area under test shall be walked down for visual observation.

b. Criteria used to identify systems, modes of operation of these systems, and the piping to be subjected to these tests are as follows:

    1. Selected systems (or piping) having a design temperature of 400 F or greater will be subjected to a thermal test.

    2. Selected systems (or piping) subjected to fast valve operation will be subjected to a dynamic test. Fast valve closure is defined as a valve that opens or closes in less than 0.1 second.

    3. Selected systems (or piping) that are ASME Code Section III, Class 1, 2, or 3 and are subjected to pump start and stop transients and/or have a safety function will be subjected to a vibration test, except in cases where the system fluid velocity is less than 10 feet per second. However, all ECCS systems having ASME Code class piping will be included in the test program.

    4. For systems with more than one operating mode of operation, only the most critical mode will be selected.

    5. Where similar piping loops exist in the same system, only one of the loops will be selected.

Copies of test procedures will be available for examination by NRC personnel approximately 60 days prior to the scheduled performance of preoperational tests and not less than 60 days prior to scheduled fuel loading date for startup tests.

14.2.12 Individual Test Descriptions

14.2.12.1 Preoperational Test Procedures

The following general descriptions are the specific objectives of each preoperational test. During the final construction phase, it may be necessary to modify the preoperational test methods as operating and preoperational test procedures are developed. Consequently, methods described in the following descriptions are general, not specific. An index of these tests is provided at the front of this chapter.

Since on the Grand Gulf Nuclear Station no onsite source (diesel generators or dc batteries) is shared between the two units in accordance with Regulatory Guide 1.81, the status of Unit 2 dc breakers will not have any effect on preoperational testing of Unit 1.

General acceptance criteria for each preoperational test are in accordance with the detailed system and equipment specifications for equipment in those systems. The tests demonstrate that the installed equipment and systems perform within the limits of these specifications.

14.2.12.1.1 Feedwater Control System Preoperational Test

a. Test Objectives

   To verify proper operation and response of the feedwater control system

b. Prerequisites

   1. All component tests are completed and approved.

   2. Verify that instruments within the feedwater control system boundary have been calibrated; instrument loop checks complete.

   3. AC and dc electrical power are available.

   4. Instrument air is available.

c. Test Procedure

The feedwater control system preoperational test will verify operational capability of the system using simulated signals. System operability will be verifiedby performing the following:

1. Checking system operation in various modes

2. Verifying system response to abnormal signal inputs and checking all alarms, interlocks, and signal outputs for proper response

3. Verifying proper response of the reactor feed pump speed regulation motor and control unit to varying steam, feed, and level signals

4. Verifying optional methods of feedwater control system operation

d. Acceptance Criteria

1. All controls, alarms, and interlocks function as specified in design specifications.

2. System responds properly to simulated inputs.

3. All modes of feedwater control have been satisfactorily demonstrated.

14.2.12.1.2 Reactor Water Cleanup (RWCU) System Preoperational Test

a. Test Objectives

1. To verify the flow path and operational capability of the system

2. To operationally check the following:

(a) Reactor water cleanup pumps

(b) Flow control stations

(c) Filter/demineralizers and associated equipment

(d) Valve and pump interlocks

(e) Alarm and trip interlocks

(f) Ability of filter/demineralizer to produce and maintain acceptable water quality

3. To verify that leak detection system functions associated with RWCU operate properly

b. <u>Prerequisites</u>

1. Component tests are completed and approved.

2. Reactor water available to supply cleanup recirculation pump suction

3. Component cooling water (CCW) system available

4. AC electrical power available

5. AC and dc electrical control power available

6. Cation/anion resin and filter aid available

7. Instrument air available

8. Instrument calibration and instrument loop checks completed

c. <u>Test Procedure</u>

1. Check operation of RWCU pumps by pumping reactor water to the hotwell and radwaste. The filter/ demineralizers are bypassed during this portion of the test.

2. Check operation of condenser and radwaste flow control station

3. Check operation of filters, demineralizers, and all associated equipment in the following flow modes:

(a) Precoating

(b) Normal operation

(c) Standby recirculation

(d) Backwashing

4. Simulate pumping of sludge to the radwaste system (pump non-radioactive sludge water generated during preoperational test program)

5. Check operation of the reactor water cleanup system by pumping to the reactor, to the condenser hotwell, and to radwaste

6. Check operation of all valve and pump interlocks by simulated signals to appropriate instrumentation

7. Check calibration and alarm of trip (interlock) set points of all instrumentation and verify proper operation of annunciators

8. Using simulated inputs, verify the leak detection system's ability to detect and respond to a leak

d. Acceptance Criteria

1. The system is proven to be operational in all modes of operation which are possible to demonstrate without pressure or temperature in the reactor.

2. The filter/demineralizers provide output consistent with water chemistry specifications.

3. All valve and pump interlocks function in accordance with design specifications.

4. Alarm and trip set points of all instrumentation are in accordance with design specifications.

5. All leak detection trips, interlocks, and logic sequences associated with RWCU operate in accordance with design specifications.

14.2.12.1.3 Standby Liquid Control System (SLCS) Preoperational Test

a. Test Objectives

1. To verify the flow path and operational capability of the system

2. To verify operation of the system in the test modes

3. To verify that the pump produces rated flow at rated pressure

4. To verify that the pump does not cavitate when taking suction from the test tank or storage tank

b. Prerequisites

1. Component tests are completed and approved

2. Demineralized water available

3. AC electrical power available

4. AC and dc electrical control power available

5. Reactor vessel available to receive injection of demineralized water

6. Boric acid and borax available for item 5 under Test Procedure

7. Service air available

8. Instrument calibration and instrument loop checks completed

c. Test Procedure

1. The standby liquid control tank will be filled with demineralized water and the following operations checked:

(a) The standby liquid control pumps will be operated to verify rated flow at rated head and absence of cavitation at low tank level.

(b) Operation of the standby liquid control solution temperature controls and air sparger will be verified.

(c) Set points of the standby liquid control pumps discharge relief valves will be checked.

2. The test tank will be filled with demineralized water and the standby liquid control pumps will be operated in the test mode to verify rated flow at rated head and absence of cavitation at low tank level.

3. Each loop will be manually initiated using the keylock switch to fire the explosive valve and start the injection pump. Flow rates into the reactor will be measured.

4. The interlock associated with the reactor water cleanup system will be verified to isolate the reactor water cleanup system upon actuation of the standby liquid control system.

5. Upon completion of all tests above, the standby liquid control tank will be filled with the required boron solution, mixed, and sampled. This should be accomplished just prior to fuel loading.

d. Acceptance Criteria

1. The standby liquid control storage tank functions properly to air sparge the solution and maintain required liquid temperature.

2. Standby liquid control pumps' discharge pressure relief valves relieve within the tolerances set forth in technical specifications.

3. The standby liquid control system functions properly in the test mode.

4. Keylock switch and interlocks function in accordance with design specifications.

5. Flow rates into the reactor are in accordance with design specifications.

6. Pumps do not evidence cavitation at low storage or test tank levels.

7. Liquid mixing results in a uniform solution and samples are representative of storage tank liquid.

14.2.12.1.4 Nuclear Boiler System Preoperational Test

a. Test Objectives

1. To verify operation of all controls, interlocks, alarms, and valves associated with the nuclear boiler system, both in the control room and at the remote shutdown panel

2. To verify automatic isolation capability of group isolations and other isolations in the containment and reactor vessel isolation control system (CRVICS) in response to their initiation signals

3. To verify proper operation of the main steam isolation valves (MSIV) and accumulators

4. To verify proper operation of the post-accident monitoring system instrumentation associated with the nuclear boiler

5. To verify proper response of all nuclear boiler process instruments

6. To verify that leak detection system functions associated with the nuclear boiler operate properly

7. To verify proper operation of ADS logic and safety/relief valves in the relief and ADS modes

8. To verify proper operation and response of all drywell and containment pressure and temperature monitoring devices, and suppression pool temperature monitoring devices

b. Prerequisites

1. All component tests are completed and approved.

2. AC electrical power is available; ac and dc control power available.

3. Instrument calibration and integrated loop checks are completed.

4. Instrument air and booster compressor subsystems are available.

c. Test Procedure

1. All controls, alarms, computer points, and interlocks will be checked for proper operation.

2. All remotely operated valves will be checked for proper operation and indication.

3. Proper operation of the MSIVs will be checked and closure times will be adjusted. An individual MSIV will be operated to demonstrate adequate accumulator capacity.

4. All isolation logic will be checked for proper operation as well as redundancy in logic circuits.

5. The reactor vessel water level will be varied to check operation of level instrumentation.

6. Safety/relief valve actuator accumulators will be checked for capacity.

7. Safety/relief valve air piston operation will be checked.

8. Reactor head seal, main steam line leak detection, and safety valve leak detection systems will be checked.

9. Automatic depressurization system (ADS) logic functions will be checked.

10. Proper operation of containment and drywell pressure and temperature instrumentation will be verified.

d. Acceptance Criteria

1. Operation of isolation logic shall be in accordance with the design specifications.

2. The closure times of the main steam isolation valves are within limits of the design specifications.

3. Nuclear boiler process instrumentation set points and operations are within limits of the design specifications.

4. Isolation valve operating times are within limits of design specifications. Logic time delays will be included in acceptance criteria which are currently being developed.

5. Capacity of the MSIV accumulators is sufficient to operate the MSIVs the required number of times.

6. Capacity of safety/relief valve actuator accumulators and their actuation meet design specifications.

7. Leakage detection system functions correctly.

8. Automatic depressurization system logic functions correctly.

9. Drywell and containment pressure and temperature instrumentation and alarm, and suppression pool temperature alarm function correctly.

10. Isolation system response times have been measured and are acceptable per TRM Table TR3.6.1.3-1.

11. Remote shutdown system controls and instruments operate in all required modes from the remote shutdown panel.

12. Control from the remote shutdown panel takes precedence over main control room control.

14.2.12.1.5 Residual Heat Removal (RHR) System Preoperational Test

a. Test Objectives

1. To verify that the RHR system provides the following safeguards and operational functions:

   (a) Low-pressure coolant injection (LPCI)

   (b) Suppression pool cooling

   (c) Containment spray cooling

   (d) Reactor steam condensing for isolation cooling (The steam condensing mode of RHR is not licensed by NRC for GGNS.)

(e) Shutdown cooling

(f) Testing

(g) Fuel pool cooling assist

2. To demonstrate that the operating vibrations in the RHR suction piping are within acceptable limits

3. To verify automatic start of the RHR room coolers in response to RHR pump start signals

4. To verify that leak detection system functions associated with RHR operate properly

5. To verify that the feedwater leakage control system operates properly

b. Prerequisites

1. Component tests completed and approved

2. Demineralized water available in the suppression pool, spent fuel pool, and reactor vessel when required for RHR pump suction supply.

3. AC power available

4. AC and dc control power available

5. Instrument air available

6. Instrument calibration and instrument loop checks completed and approved

7. Reactor vessel available to receive water during the LPCI tests

8. Standby service water (SSW) operable and available

9. The RHR system piping is supported and restrained in conformance with the design drawings

c. Test Procedure

1. Operate all applicable valves in the RHR system from the control room, remote shutdown panels, and the local control panels. Verify proper operation and indication.

2. Conduct a logic and interlock test as follows:

   (a) LPCI - verify initiation logic and response time, automatic isolation, and valve and pressure interlocks and response time. Signals will be simulated to cause an automatic initiation signal to the LPCI system. The start signal will be introduced into the systems under conditions of both normal auxiliary power and standby diesel-generator power to verify required sequencing of the valve and pump.

   (b) Containment spray cooling - verify reactor pressure level interlock.

   (c) Shutdown cooling - verify the automatic isolation of the shutdown cooling system on high drywell pressure or low reactor water level and the automatic initiation of the LPCI system.

   (d) Steam condensing mode - verify proper operation of all valves, controls, etc., by varying test signals from the sensing elements. Demonstrate proper isolation when LPCI initiation is simulated.

   (e) Suppression pool cooling - verify proper operation of the initiation signal path.

3. Conduct the following system tests:

   (a) LPCI - with the suction valves from the suppression chamber to the RHR pumps locked open and the LPCI system lined up to take suction from the suppression pool, start the LPCI system using a simulated automatic initiation signal. After flow has been established through the system by manual operation of the pumps and valves, establish the system operating characteristics with one, two, and three pumps operating. In the LPCI lineup, verify pump head flow characteristics and available NPSH.

(b) Containment spray cooling - introduce compressed air or nitrogen into the containment cooling sparger via the air test connection. The remainder of the system is isolated. Verify flow through each nozzle by using a smoke bomb, flags, etc., or any other method which will verify flow through the nozzles. Verify the flow path between the containment spray isolation valve and the air test connection by either pressurizing the line with water from the condensate/refueling water transfer system and obtaining flow at the test connection or by pressurizing the line with air and obtaining air flow at a vent or test connection upstream of the containment spray isolation valves.

(c) Shutdown cooling - line up the RHR system to take suction on the RPV and place the system in its normal shutdown cooling lineup. Start the shutdown cooling system and verify system flowpaths. Verify pump head flow characteristics and available NPSH. Simultaneous operation of the SSW system will verify compatible integrated operation. If, during steady-state operation, visual observation indicates significant piping vibration, measurements will be taken using a hand-held instrument.

(d) Steam condensing mode - verify control functions of RHR steam condensing mode. Actual steam condensing will be verified in the startup test phase.

(e) Suppression pool cooling - line up the RHR system to take a suction on the suppression pool, pump it though the heat exchangers, and return the water to the suppression pool. Obtain pump head flow characteristics and available NPSH.

(f) Fuel pool cooling intertie - line up to prove low capability and NPSH adequacy. May be done with fuel pool cooling and cleanup preoperational test.

(g) Test mode - demonstrate that acceptable flow and head conditions can be produced in recirculation flow paths from the suppression pool and that available NPSH is adequate. Demonstrate that acceptable flow and head conditions can be produced for simulated automatic actuation of LPCI pumps A and B from the recirculation lines to the vessel; and for LPCI pump C, from the spent fuel storage pool to the vessel.

4. Verify proper operation of all alarms and proper annunciations at both the control room and local panels

5. Verify system standby operation with jockey pumps operating

6. Verify the RHR fuel pool assist mode for proper operation

7. Verify that the RHR room coolers start in response to RHR pump start signals

8. With RHR pump “C” running, perform a heat balance on RHR “C” pump room cooler

   Note: RHR “A” and “B” coolers tested during power ascension testing

9. Using simulated inputs, verify the ability of the leak detection system to detect and respond to an RHR system leak

10. Using the RHR jockey pump, verify that the feedwater leakage control system functions properly

d. Acceptance Criteria

1. All valves in the RHR system operate properly with acceptable closing times and indications are correct.

2. Initiation logic, automatic isolations, and valve and pressure interlocks function in accordance with design specifications.

3. Pumphead flow characteristics and NPSH are consistent with design specifications for the various modes of operation.

4. Annunciator indications are consistent with system operation and alarms.

5. Standby lineup and jockey pump operation is correctly demonstrated.

6. Piping vibration levels are within predicted limits.

7. Remote shutdown system controls and instruments operate in all required modes from the remote shutdown panel.

8. Control from the remote shutdown panel takes precedence over main control room control.

9. The RHR room coolers start automatically in response to RHR pump start signals.

10. All leak detection system trip, interlocks, and logic sequences associated with RHR operate in accordance with design specifications.

11. The feedwater leakage control system performs in accordance with design specifications.

12. RHR “C” Pump room cooler is capable of handling post-accident design heat loads.

14.2.12.1.6 Reactor Core Isolation Cooling (RCIC) System Preoperational Test

a. Test Objectives

1. To verify operation of the controls, alarms, interlocks, and valves associated with the RCIC system, including standby operation

2. To verify that the system can be initiated automatically and manually and that automatic isolation occurs when any of the required isolation signals are present

3. RCIC turbine operation, flow parameters, pump available NPSH, speed/flow controls, and auxiliary equipment shall be demonstrated with auxiliary steam available to the RCIC turbine. Due to the limited, anticipated steam supply from the Auxiliary Steam System, the preoperational testing of the RCIC turbine will not include response time and rated flow verification.

4. Flow and minimum start time criteria will be demonstrated during the startup test phase.

5. To verify that the RCIC room cooler starts in response to an RCIC pump start signal

6. To verify that the leak detection system functions associated with RCIC operate properly

b. Prerequisites

1. All component tests are completed and approved.

2. AC electrical power is available.

3. AC and dc control power are available.

4. Instrument air is available.

5. Instrument calibration and instrument loop checks are completed.

6. Demineralized water is available in the condensate storage tank and suppression pool when required for RCIC pump suction supply.

7. The reactor vessel is able to receive water during RCIC testing of vessel injection in section c.4 below.

c. Test Procedure

1. All alarms, controls, and interlocks will be checked for proper operation.

2. All automatic valves will be cycled in manual and remote modes. Closing times will be in accordance with design specifications.

3. A manual initiation of the system will be performed to verify proper operation of system valves.

4. A simulated initiation signal will be introduced to verify automatic initiation of the RCIC system valves. Auto-isolate signals will also be evaluated. The system will be operated in the vessel injection and test recirculation modes.

5. Verify system standby lineup

6. Verify system control capability from remote shutdown panel

7. Verify that the RCIC room cooler starts in response to the RCIC start signal

8. Using simulated inputs, verify the leak detection system's ability to detect and respond to a leak

d. Acceptance Criteria

1. All alarms, controls, and interlocks function in accordance with design specifications.

2. Automatic valves can be operated from remote and local positions, and valve cycle times are within limits of design specifications.

3. System responds properly to manual and automatic initiation signals and automatic isolation signals.

4. Standby lineup is correctly demonstrated.

5. Using auxiliary steam, flow can be obtained through the normal vessel injection and test recirculation flow paths. Pump available NPSH is adequate.

6. The RCIC room cooler starts automatically in response to an RCIC start signal.

7. All leak detection system trips, interlocks, and logic sequences operate in accordance with system design specifications.

8. Remote shutdown system controls and instruments operate in all required modes from the remote shutdown panel.

9. Control from the remote shutdown panel takes precedence over main control room control.

14.2.12.1.7 Low-Pressure Core Spray (LPCS) System Preoperational Test

a. Test Objectives

1. To verify operation of the low-pressure core spray system, including spray pump, spray nozzles, control valves, etc., during both recirculation and simulated accident conditions

2. To verify operation of all controls, interlocks, alarms, and valves associated with the LPCS system, including standby operation

3. To verify that automatic initiation and response times of the LPCS system fall within the limits established for the accident analysis criteria

4. To verify automatic start of the LPCS room cooler in response to the LPCS pump start signal and the heat removal capability of the room cooler

5. To verify that leak detection system functions associated with LPCS operate properly

b. Prerequisites

1. All component tests are completed and approved.

2. AC electrical power is available.

3. AC and dc control power is available.

4. Instrument air is available.

5. Demineralized water is available in the suppression pool or spent fuel pool when required for LPCS pump suction supply.

6. The reactor vessel is capable of receiving water during LPCS testing of vessel injection.

7. Instrument calibration and instrument loop checks are completed.

c. Test Procedure

1. All controls, alarms, and interlocks will be checked for proper operation, and remote-operated valves will be operated in all modes.

2. The system will be operated in the recirculation mode to demonstrate the test mode of operation. Pump and system parameters, head flow characteristics, and NPSH will be verified to be within design specifications.

3. Operation of the system will be demonstrated under normal initiation lineup. With the system spraying into the reactor vessel, proper flow rates and spray pattern will be verified.

4. Accident conditions will be simulated to verify all modes of emergency operation and initiation. Loss of normal ac power under accident conditions will be demonstrated to verify proper sequential operation of system pumps and valves. (This portion of the test can be completed during the loss of offsite power testing.)

5. Verify system standby operation and jockey pump operability.

6. Verify LPCS pump room fan automatic start on LPCS pump start. (Automatic initiation of the Standby Service Water supply to the room cooler will be checked in that system's test procedure.)

7. With the LPCS pump running, perform a heat balance on the LPCS pump room cooler.

8. Using simulated inputs, the Leak Detection System for the LPCS system will be tested to verify the system's ability to detect a leak and to respond properly to the actuation of the leak detection circuits.

d. Acceptance Criteria

1. System flow paths are correct and flows, pump head flow characteristics, and NPSH are within limits of design specifications for all modes of operations. Core spray pattern is acceptable.

2. All automatic valves can be operated from all operating points and valve cycle times are within design limits.

3. System functions, as designed under accident initiation and loss of normal ac power, result in proper pump and valve sequencing.

4. All leak detection trips, interlocks, and logic sequences associated with LPCS operate in accordance with system design specifications.

5. LPCS pump room fan starts on LPCS pump start and the LPCS room cooler is capable of handling post-accident design heat loads.

6. Standby lineup and jockey pump operability is correctly demonstrated.

14.2.12.1.8 High-Pressure Core Spray (HPCS) System Preoperational Test

a. Test Objectives

1. To verify operation of the high-pressure core spray system, including operation with HPCS diesel generator power and related auxiliary equipment, while pumping from both the suppression pool and condensate storage tanks to the reactor pressure vessel, including standby pump operation

2. To verify operation in the recirculating test mode and system initiation from the test mode

3. To verify operation of all controls interlocks alarms, and valves associated with the HPCS system

4. To verify automatic initiation capability of the HPCS system

5. To verify automatic start of the HPCS room cooler in response to the HPCS pump start signal

6. To verify the heat removal capability of the HPCS room cooler

7. To verify that pump operation is in accordance with the pump head flow curves, and pump NPSH requirements are met

8. To verify that leak detection system functions associated with HPCS operate properly

b. Prerequisites

1. All component tests completed and approved

2. AC electrical power available

3. AC and dc control power available

4. HPCS diesel generator is available as needed to perform the test.

5. Instrument air available

6. Demineralized water available to the suppression pool and condensate storage tank when required for HPCS pump suction supply

7. The reactor vessel is capable of receiving water during HPCS testing of vessel injection

8. Instrument calibration and instrument loop checks completed

9. Standby service water is available.

c. Test Procedure

1. All controls, alarms, and interlocks will be checked for proper operation and remote-operated valves will be operated in all modes.

2. The system will be operated in the recirculation mode from the suppression pool to demonstrate the test mode of operation. Pump and system parameters will be verified to be within design specifications.

3. The system will be operated using the condensate storage tank as a suction source. The system will spray into the reactor vessel. Proper flow rates and spray pattern will be verified. HPCS pump suction pressure will be measured as the CST is pumped down to the transfer point and the available pump NPSH will be determined. While pumping down, observations will be made for vortexing.

4. Item 3 will be repeated using the suppression pool as a suction source. Autotransfer between suppression pool and condensate storage tank will be demonstrated.

5. Accident conditions will be simulated to verify all modes of emergency operation and initiation. An HPCS initiation signal using full-flow conditions for normal power and also for emergency HPCS diesel generator power will be given. Pump flow and time to rated flow will be measured.

6. Verify standby lineup and jockey pump operability

7. Verify that the HPCS room cooler starts in response to the HPCS pump start signal

8. With the HPCS pump running, perform a heat balance on the HPCS pump room cooler.

9. Using simulated inputs, the leak detection system will be tested to verify the system's ability to detect and respond to a leak.

d. Acceptance Criteria

1. System flow paths are correct, pump head flow characteristics and NPSH requirements are within limits of design specifications for all modes of operation. Core spray pattern is acceptable.

2. All automatic valves can be operated from all operating points, and valve cycle times are within design limits.

3. System functions, as designed under accident initiation and loss of normal ac power, result in proper pump and valve sequencing.

4. Standby lineup and jockey pump operability is correctly demonstrated.

5. HPCS room cooler starts automatically in response to an HPCS pump start signal and is capable of removing the post-accident design heat load.

6. All Leak Detection System trips, interlocks, and logic sequences associated with HPCS operate in accordance with system design specifications.

14.2.12.1.9 Main Steam Isolation Valve Leakage Control System (MSIV-LCS) Preoperational Test

a. Test Objectives

1. To verify operation of all controls, interlocks, alarms, and valves associated with the MSIV leakage control system

2. To verify system flow paths in accordance with the design specifications

b. Prerequisites

1. All component tests are completed and approved.

2. Instrument calibration and integrated loop checks are completed.

3. Electrical power is available.

c. Test Procedure

1. All controls, alarms, and interlocks will be checked for proper operation.

2. All remotely operated valves will be checked for operation and indication.

3. All heaters and blowers will be checked for proper operation.

4. Proper operation of depressurization and bleedoff modes will be checked.

d. Acceptance Criteria

1. All controls, alarms, and interlocks function in accordance with design specifications.

2. Valve operating times are within limits of design specifications.

3. Heater and blower parameters are within limits of design specifications.

14.2.12.1.10 Reactor Recirculation and Flow Control System Preoperational Test

a. Test Objectives

1. Determine recirculation loop characteristics under operating conditions with no fuel in the reactor

2. Determine jet pump characteristics under both normal and abnormal conditions

3. Demonstrate the proper operation of the reactor recirculation flow control system, including controls, safety devices, alarms, and annunciators

4. Demonstrate the proper operation of the low-frequency motor generator set and the ability to transfer to and from flow control

5. Demonstrate that flow control valve stroke times are in accordance with accident analysis assumptions

6. Demonstrate that valve stem leak detection is operable

7. Demonstrate that the operating vibrations in the recirculation piping are within acceptable limits

8. Any design features to prevent or mitigate anticipated transients without scram that are incorporated into the plant's design prior to fuel load will be tested as part of the preoperational and startup test program.

9. Preoperational tests confirm proper installation and performance values for flow rate and pressure of the hydraulic subsystems. These tests also validate the control system functions related to both automatic and manual valving of the hydraulic lines. A separate startup test ST-30 (recirculation system test), as discussed in subsection 14.2.12.3.27, confirms the transient responses of the recirculation system/ feedwater system.

   Actual plant instrumentation is first calibrated and then used in preoperational tests for flow measurements, pressure measurements, and as sensor inputs for control circuitry. Final performance is validated during the above cited startup tests.

b. Prerequisites

1. Component tests completed and approved

2. Demineralized water available for recirculation pumps suction

3. AC electrical power available

4. AC and dc electrical control power available

5. Instrument air available

6. Instrument calibration and instrument loop checks completed

7. Component cooling water (CCW) system available

8. Flow control valves hydraulic control unit operational

9. Low-frequency motor generator (LFMG) set and switchgear operational

10. Remote piping vibration measurement devices are installed and calibrated

c. Test Procedure

1. Operate all recirculation loop valves and check interlocks and verify control and indication capability for all local and remote control stations. Verify that valve stem leak detection is operable for recirculation valves.

2. Operate recirculation pumps at low and high speed, up to rated flow conditions, and perform the following:

   (a) Check loop instrumentation, controls, and interlocks

   (b) Check pump operation, controls using low-frequency motor generator and transfers to the high-speed power supply

   (c) Check flow control transient operation and optimize controller settings for system linearity and response time requirements

   (d) Using installed instrumentation, determine jet pump characteristics under both normal and abnormal conditions

3. If, during steady-state operation, visual observation indicates any visible piping vibration, measurements will be taken using a hand-held instrument. In addition, selected locations on the piping will be monitored using remote vibration measurement devices.

d. Acceptance Criteria

1. System flow characteristics are consistent with design specifications.

2. All interlocks, controls, and instrumentation function in accordance with design specifications.

3. Flow transient disturbances are within design limitations.

4. System controller settings are optimized.

5. Jet pump characteristics are within tolerance of manufacturer's specifications.

6. Operation using the low-frequency motor generators and high-speed operation are within the limits of the design specifications.

7. Piping vibration levels are within predicted levels.

14.2.12.1.11 Control Rod Drive (CRD) Hydraulic System Preoperational Test

a. Test Objectives

1. To verify flow path and flow logic of hydraulic system

2. To verify pump performance data for the control rod drive water pumps

3. To adjust individual flow control valves for proper drive speeds

4. To verify operating parameters of the installed system

b. Prerequisites

1. Component tests completed and approved

2. Demineralized water available

3. Instrument air available

4. Nitrogen supply available for CRD scram accumulators

5. AC and dc power available

6. Power available through the reactor protection system (RPS) circuit to energize scram valves

7. Instrument calibration and instrument loop checks, including rod control and information system (RCIS) completed to the extent necessary to support rod movement

8. Reactor vessel available to receive water when required to support control rod movements

c. Test Procedure

1. Operate the control rod drive water pumps to verify pump and motor performance data

2. Verify CRD notch control including latching and position indication

3. Observe the operation of each individual control rod and verify that there is no binding or restriction to rod motion and listen for any scraping or binding noises which may signify rod misalignment.

4. Measure the function of each CRD drive line as indicated by the differential pressure developed across the CRD piston during notch withdrawal.

5. Compare the differential pressure traces to reference traces to assure proper operation and the absence of abnormal friction.

6. Perform scram testing of control rods at atmospheric pressure

7. Verify scram discharge level switches and CRD position indication, alarms, and interlocks

8. The operation of valves from appropriate selector switches, interlocks, or trip signals will be checked, including:

   (a) Scram valves and scram solenoid pilot valves

   (b) Backup scram pilot valves

   (c) Scram volume dump and vent valves

   (d) Drive selection valves; withdraw and insert controls

6. Flow control valves will be adjusted for proper drive speed.

7. Total system performance data will be compiled with all drives installed, including:

    (a) Cooling water flow

    (b) Total system flow

    (c) System pressures

    (d) Transient response of system during insert and withdraw operations and following scrams

8. Verify CRD pump operation from the remote shutdown panel

9. Charge CRD scram accumulators

d. <u>Acceptance Criteria</u>

1. Flows and pressures for all normal flow paths and operational transients are within the limits of design specifications.

2. Control rod drive pump and motor characteristics are within tolerance of those specified by the manufacturer.

3. Control rod drive speeds are adjustable in accordance with design specifications. Scram times are within allowable limits.

4. Operating parameters of the system are within limits of design specifications.

5. Scram discharge volume capacity and instrument discharge volume trips are within allowable limits.

6. Control rod drive pumps can be operated from the remote shutdown panel.

7. Remote shutdown system controls and instruments operate in all required modes from the remote shutdown panel.

8. Control from the remote shutdown panel takes precedence over main control room controls.

14.2.12.1.12 Fuel Handling and Vessel Servicing Equipment Preoperational Test

a. Test Objective

To verify the operation of the fuel handling, refueling, and vessel servicing equipment, including tools for servicing control rods, fuel assemblies, local power range monitors (LPRMs) and dry tubes; to verify the operation of the horizontal fuel transfer system, including the transfer of a dummy fuel assembly

b. Prerequisites

1. Component tests are complete.

2. The following systems are operational:

   (a) Service air system

   (b) Reactor cavity and core structure available

   (c) AC electrical power available

   (d) AC and dc electrical control power available

3. All slings and lifting devices are certified at their design load by vendor.

4. The refueling platform, fuel preparation equipment, and fuel racks are installed and operational.

5. Fuel storage pool is available.

c. Test Procedure

1. Verify proper operation of indicating and position instruments simultaneously with steps below

2. Verify proper operation of refueling system interlocks and logic associated with the refueling platform in conjunction with the rod control and information system preoperational test

3. Verify the operability of the following equipment by operating them dry:

   (a) Cell disassembly tools

   (b) Channel replacement tools

   (c) Instrument handling tools

   (d) Vacuum cleaning equipment

   (e) Refueling, fuel handling, auxiliary, and service platforms

   (f) Refueling, service platform, and crane interlocks

4. Verify the operability of the horizontal fuel transfer system by:

   (a) Mechanical and electrical subsystem checkouts

   (b) Containment isolation capability test

   (c) Leak testing of penetration assembly

   (d) Dummy fuel assembly transfer

   (e) Fuel transfer interlocks and logic checks associated with the refueling platform according to design specification

d. Acceptance Criteria

1. Fuel handling, refueling and vessel servicing equipment function in accordance with design and operating specifications.

2. All areas in the fuel pool, containment pools, and the reactor cavity are accessible from the fuel handling platform or refueling platform.

3. Refueling platform and fuel handling platform position indicators function correctly and within design limits.

4. Refueling interlock and logic systems function as specified in design specifications.

14.2.12.1.13 Rod Control and Information System (RCIS) Preoperational Test

a. Test Objectives

To verify correct operation of the rod control and information system, including the rod pattern controllers, control circuitry, control valves, indicators, and operational modes

b. Prerequisites

1. The component tests have been completed.

2. AC and dc electrical power is available.

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

c. Test Procedure

Verification of rod control and information system capability is demonstrated by the proper integrated operation of the system as follows:

1. The position of each control rod must be accurately displayed and available from each channel.

2. Rod position associated status information, to include drift and overtravel, must be available and required signals annunciated.

3. LPRM status and level information must be available and properly displayed.

4. All rod assignments to gangs, groups, and sequence must be correct for each channel.

5. All system rod blocks, including rod pattern constraints, function correctly for all system modes, power levels, and all positions of the reactor mode switch.

6. All operator requests for data display, system mode commands, rod selection, and rod drive commands are properly responded to.

7. Rod directional control valve timing sequences are correct.

8. Hydraulic control unit status information is accurately displayed, and required signals are annunciated.

9. Control rod bypass provisions function as designed.

10. System self test and data quality checks are functioning correctly.

d. Acceptance Criteria

1. All rod blocks and alarms function properly.

2. All rod movement and rod pattern restraints and alarms are applied and removed under specified conditions, including power level.

3. The rod position information system functions properly.

4. The LPRM display system functions properly.

5. Rod assignments are as specified.

6. Rod bypass provisions are verified.

7. Rod selection and motion timers function correctly.

14.2.12.1.14 Deleted

14.2.12.1.15 Deleted

14.2.12.1.16 Reactor Protection System (RPS) Preoperational Test

a. Test Objectives

The objectives of the reactor protection system (RPS) preoperational test are as follows:

1. To demonstrate the capability of the RPS to initiate a scram signal in conformance with system design
2. To demonstrate RPS response to motor-generator (MG) set coastdown
3. To demonstrate that the RPS channel response times assumed in the Accident Analysis (Chapter 15) are conservative.
4. To demonstrate and evaluate the RPS operating procedure

b. Prerequisites

1. All component tests are completed and approved.
2. Instruments within the RPS boundary have been calibrated and all trip points set.
3. AC and dc electrical power is available.
4. RPS MG sets are in service.
5. Instrument air is available.

c. Test Procedure

1. Verify proper performance and operation of the RPS MG sets
2. Verify all RPS sensor logic systems and scram relay operation
3. Verify all reactor mode switch interlocks and bypasses
4. Demonstrate all scram reset time delay operations
5. Measure the response time for each trip function in each RPS channel as required by the Technical Specifications by injection of a pressure ramp, approximating design casualty conditions, to the sensor input or by manipulation of the valve position detection device, as applicable. In all cases, except neutron flux and radiation sensors, the primary sensor response time is included in the measurement

of overall channel response time. To the results of this measurement is added the calculated delay for the process to sensor hardware as appropriate for each application.

6. Verify proper operation of the annunciators, alarms, and computer points

7. Verify proper system operation from normal and alternate power supplies and during switching transients

d. Acceptance Criteria

1. RPS MG sets operate as specified in the design specifications.

2. All system logic functions, interlocks, and time delay functions are within tolerance of design specifications.

3. RPS responds correctly to simulated scram condition input signals, and annunciator and indicating systems function properly.

4. Response times for the RPS channels are less than or equal to the values stated in the Technical Specifications.

5. Power supply switching and interlocks function properly.

14.2.12.1.17 Neutron Monitoring System (NMS) Preoperational Test

a. Test Objectives

1. To demonstrate that the neutron monitoring system (NMS) will function in accordance with design specifications

2. The test includes the following neutron monitoring subsystems:

(a) Source range monitor (SRM)

(b) Intermediate range monitor (IRM)

(c) Local power range monitor (LPRM)

(d) Average power range monitor (APRM)

b. Prerequisites

1. All component tests are completed and approved.

2. All instrument calibrations and trip point settings within the neutron monitoring system boundaries have been completed.

3. AC and dc power supplies are operational

4. Rod control and information system (RCIS) is operational as required to support testing

c. Test Procedure

Demonstrate proper integrated operation of the following:

1. SRM detectors and their respective insert and retract mechanisms and cables

2. SRM channels, including pulse preamp, remote meter and recorder, trip logic, logic bypass and related lamps and annunciators, control system interlocks, refueling instrument trips, and power supply

3. IRM detectors and their respective insert and retract mechanisms and cables

4. IRM channels, including voltage preamps, remote recorders, RCIS interlocks, RPS trips, annunciators and lamps, and power supplies

5. All LPRM detectors and their respective cables and power supplies

6. All APRM channels, including trips, trip bypasses, annunciators and lamps, remote recorders, RCIS interlocks, RPS interlocks, and power supplies

7. Recirculation flow bias signal, including flow unit, flow transmitters, and related annunciators, interlocks, and power supplies

d. Acceptance Criteria

Proper integrated operation (in accordance with design specifications) of the following NMS subsystems has been demonstrated:

1. All SRM detectors, and their respective insert and retract mechanisms, and cables

2. SRM channel, including pulse preamp, remote meter and recorder, trip logic, logic bypass and related lamps and annunciators, control system interlocks, refueling instrument trips, and power supply

3. All IRM detectors and their respective insert and retract mechanisms and cables

4. IRM channels, including voltage preamps, remote recorders, RCIS interlocks, RPS trips, annunciators, and lamps, and power supplies

5. All LPRM detectors and their respective cables, and power supplies

6. All APRM channels, including trips, trip bypasses, annunciators and lamps, remote recorders, RCIS interlocks, RPS trips, and power supplies

7. Recirculation flow bias signal, including flow unit, flow transmitters and related annunciators, interlocks, and power supplies

14.2.12.1.18 Traversing Incore Probe (TIP) System Preoperational Test

a. Test Objectives

To verify operational capability of the traversing incore probe system (TIP) and to demonstrate that the system will function in accordance with design specifications

b. Prerequisites

1. All component tests are completed and approved.

2. AC and dc power supplies are operational.

3. All mechanical portions of the system have been lubricated and certified for operation.

4. Instrument air is available.

5. Instruments within the TIP system boundary have been calibrated.

c. Test Procedure

1. Demonstrate the proper integrated operation of the following:

   (a) Indexer cross calibration interlock

   (b) Drive manual control and override, automatic control and stop, and low speed control

d. Acceptance Criteria

1. Indexer cross calibration interlock functions in accordance with design specifications.

2. All modes of operation of the TIP system have been demonstrated in accordance with design specifications.

3. All recorders and drives have been demonstrated to operate in accordance with design specifications.

4. All alarms, annunciators, etc., have been demonstrated to operate in accordance with design specifications.

14.2.12.1.19 Process Radiation Monitoring (RPM) System Preoperational Test

a. Test Objectives

1. To demonstrate that the process radiation monitoring system will function in accordance with the design specifications

2. The test includes the following process radiation monitoring subsystems:

   (a) Offgas vent pipe subsystem

(b) Offgas pretreatment radiation monitoring subsystem

(c) Offgas post-treatment radiation monitoring subsystem

(d) Main steamline radiation monitoring subsystem

(e) Liquid process radiation monitoring subsystem

(1) Component cooling water

(2) Standby service water

(3) Liquid radwaste effluent

(f) Fuel handling area ventilation exhaust radiation monitoring subsystem

(g) Fuel pool area ventilation exhaust radiation monitoring subsystem

(h) Radwaste building ventilation exhaust subsystem

(i) Turbine building ventilation exhaust subsystem

(j) Containment and drywell vent exhaust radiation monitoring subsystem

(k) Control room vent exhaust radiation monitoring subsystem

(l) Charcoal adsorber vault radiation monitoring subsystem

(m) Fuel handling area vent radiation monitoring subsystem

b. <u>Prerequisites</u>

1. All component tests are completed and approved.

2. Instrument calibration is complete.

3. Electrical power is available.

4. All trip points are as set by site radchem personnel.

5. All system low- and high-voltage power supplies and signal cables have been tested and meet specifications.

6. Check sources are in place where required. All radiation monitors will be tested using a check source.

c. Test Procedure

Demonstrate proper operation of the following:

1. The offgas vent pipe, radwaste building vent pipe, fuel handling area vent, and turbine building vent radiation monitors including pulse preamp, trip check, annunciation, recorder, sample rack equipment, log count rate meter (LCRM), and detector calibration

2. The offgas pretreatment radiation monitors, including recorders, radiation detectors, and sample rack equipment

3. Main steam line radiation monitoring system, including log radiation monitors (LRM), annunciation, recorders, and trip check

4. Liquid process radiation monitors, including pulse amplifier LCRM, recorders, discriminator, and annunciator and control functions where applicable

5. Containment/drywell vent, fuel area/fuel pool vent, control room vent exhaust subsystems and charcoal adsorber vault radiation monitors, including trip check, annunciators, and isolation signal output

6. Offgas post-treatment radiation monitors, including annunciation, recorders, trip check, and sample rack equipment

d. Acceptance Criteria

1. All process radiation monitoring systems are demonstrated to operate within the tolerance of design specifications.

2. All systems logic functions, interlocks, trip signals, etc., are within tolerances of the design specifications.

3. RPS interface is in accordance with the design specifications.

4. All sample racks function properly.

14.2.12.1.20 Area Radiation Monitoring (ARM) System Preoperational Test

a. Test Objectives

To verify the operation of the area radiation monitoring system including sensors, power supplies, alarms, trip units, and recorder

b. Prerequisites

1. All component tests are completed and approved.

2. Instrument calibration is complete.

3. Electrical power is available.

4. Trip points are as set by radchem personnel.

5. All power supplies and signal cables are installed, tested, and meet specifications.

c. Test Procedure

1. Verify all ARM channel connection, recording, indication, and alarm functions

2. Check, with a radioactive source, all ARM channels

d. Acceptance Criteria

1. Indicator and trip unit set points are at the specified trip points.

2. Multipoint recorder inputs are as specified in the elementary diagram.

3. Accuracy of each channel shall be within design tolerances when exposed to known radiation levels.

14.2.12.1.21 NSSS Process Computer Preoperational Test

a. Test Objective

To verify the input/output list for the NSSS process computer

b. Prerequisites

1. All component tests are completed and approved.

2. AC electrical power is available.

3. The computer diagnostic test has been completed.

4. The scan, log, and alarm (SLA) programs have been entered into the process computer.

c. Test Procedure

1. Verify that each analog and digital input point has the correct printout range, alarm, and units in accordance with the I/0 List

2. Verify that each analog and digital sensor input has the correct polarity, signal conditioning, and printout

d. Acceptance Criteria

1. All analog and digital inputs are terminated at the correct process computer input point.

2. Each variable can be printed out in the correct units.

3. Digital input alarm signals are printed out correctly on the alarm typer.

14.2.12.1.22 Fuel Pool Cooling and Cleanup System Preoperational Test

a. Test Objective

To demonstrate the capability of the fuel pool cooling and cleanup system to provide the water flow to system components and maintain the required water level in the spent fuel pool; to demonstrate the capability of containment isolation valves to close within the required time in response to a containment isolation signal; to demonstrate the operability of remotely controlled valves under full flow conditions; to demonstrate the ability of the fuel pool filter/ demineralizers to produce and maintain acceptable water quality. To demonstrate that inputs from the fuel pool cooling and cleanup system to the leak detection system function properly and that all trips, interlocks, and logic sequences are functional. To verify leak-tightness of the upper containment pool gates and the refueling bellows.

b. Prerequisites

1. Component tests are completed and approved.

2. The following support systems are available:

   (a) AC electrical power to motors, control circuits, instrumentation, etc.

   (b) AC and dc control power

   (c) Condensate and refueling water storage and transfer system

   (d) Instrument air system

   (e) Radwaste sludge handling system

   (f) Component closed cooling water (CCW) system

3. Valve flow rate settings are as recommended in the manufacturer's technical manual.

4. All instrument calibrations and instrument loop checks complete

5. Spent fuel storage pool and upper containment pools filled with demineralized water when required to support c.2(c) and c.5 below

6. Cation/anion resin and filter aid available

c. Test Procedure

1. Check all controls, alarms, and interlocks for proper operation, and check remote-operated valves to ensure performance in accordance with specifications.

2. Verify the fuel pool filter/demineralizer system for proper operation by checking the following modes:

   (a) Precoating

   (b) Backwashing

   (c) Standby recirculation

   (d) Normal Operation

3. Simulate pumping sludge to radwaste

4. Using simulated inputs, the leak detection system will be verified to operate all controls and alarms, and interlocks will be checked for proper operation.

5. The leak-tightness of the two upper containment pool gates will be tested by installing the gates, inflating the double seals, and monitoring for leakage via the leak detection system when the upper pools are filled. The leak-tightness of the refueling bellows will be tested by flooding the upper pool, entering the drywell, and visually inspecting for leakage.

d. Acceptance Criteria

1. Fuel pool cooling pump interlocks meet the design specifications.

2. The fuel pool cooling pumps meet rated flow and discharge pressure.

3. The filter/demineralizer can be backwashed, precoated, placed in service, and put in standby recirculation.

4. The filter/demineralizers are being evenly precoated and produce effluent water quality in accordance with specifications.

5. The filter/demineralizer valve interlocks operate in accordance with specifications.

6. Alarm and trip set points of all instrumentation are in accordance with design specifications.

7. All leak detection interlocks and logic sequences operate in accordance with design specifications.

8. The upper containment pool gates and refueling bellows are acceptably leaktight.

14.2.12.1.23 Suppression Pool Makeup (SPMU) System Preoperational Test

a. Test Objective

To verify the operation of the suppression pool makeup system, including valve interlocks and an actual transfer of water from the upper containment pool to the suppression pool

b. Prerequisites

1. Component tests are completed and approved.

2. AC electrical power is available.

3. AC and DC electrical control power is available.

4. RHR system is available.

5. Fuel pool cooling and cleanup system is available.

6. Condensate and refueling water storage and transfer system is available.

7. Upper containment pools are filled with demineralized water as necessary to support timed dumps of c.2 below.

8. Suppression pool has adequate freeboard to receive water as necessary to support timed dumps of c.2 below.

9. Instrument calibration is complete.

c. Test Procedure

1. Initiation logic is checked for proper operation, including all alarms, computer points, controls and interlocks.

2. Flow capability is verified by doing a timed dump from the upper containment to the suppression pool.

d. Acceptance Criteria

Initiation logic and flow capability are within design specifications.

14.2.12.1.24 Combustible Gas Control System (CGCS) Preoperational Test

a. Test Objectives

1. To demonstrate the capability of the combustible gas control system to operate in response to post-LOCA requirements.

2. To demonstrate that post-LOCA hydrogen monitors function properly.

3. To test the drywell/containment vacuum breakers.

b. Prerequisites

1. Component tests required completed and approved

2. All permanently installed instrumentation properly calibrated and operable

3. All test instrumentation available and properly calibrated

4. Instrument air system available

5. Domestic water system available

6. Containment ventilation system available

7. Appropriate ac and dc power sources available

c. Test Procedure

1. Demonstrate that system components and valves respond to manual, test, and post-LOCA initiation signals; check initiation logic for proper operation, including all alarms, computer points, controls, and interlocks

2. Measure and verify operability and performance of the drywell and containment purge compressor

3. Measure recombiner heater performance

4. Measure recombiner air flow

5. Measure valve interlocks, opening and closing times

6. Demonstrate that the post-LOCA hydrogen monitors function correctly

7. For the hydrogen ignition system:

   (a) Energize one of the two divisions of igniters from the control room. Verify that all igniters powered from the associated panel are functional. The identical procedure will be followed for the remaining igniters powered off the other division.

   (b) Measure and record:

      (1) Surface temperature of each igniter to verify that it is operating at or above 1700 F at 120 V ac.

      (2) Total current being drawn through one breaker when all igniters powered by that breaker are operating. Repeat the procedure for the remaining breaker of the division being tested.

d. Acceptance Criteria

1. All trips, permissives, interlocks, etc., operate per design specifications in response to manual, test, or automatic initiation signals.

2. Drywell and containment purge compressor performance and operability are within design specifications.

3. Recombiner performance is within design specifications.

4. Valve interlocks and operating times are within design specifications.

5. Post-LOCA hydrogen monitors function correctly.

6. All the igniters of the hydrogen ignition system are functional and maintain a surface temperature of at least 1700 F at 120 V ac.

14.2.12.1.25 Component Cooling Water System (CCW) Preoperational Test

a. Test Objectives

To demonstrate the capability of the component cooling water system (CCW) to provide cooling flow to supplied components in the normal and cooldown modes and the loss of offsite power and recirculation modes; to demonstrate the ability of system air-operated and motor-operated valves to operate during design system flow

b. Prerequisites

1. Component tests complete and approved

2. All permanently installed instrumentation properly calibrated and operable

3. All test instrumentation available and properly calibrated

4. Instrument air system available

5. Appropriate ac and dc power sources available

6. Annunciator system available

7. Makeup water treatment system available

c. Test Procedure

1. Measure CCW pump performance

2. Check all trips, permissives, interlocks, controls, and alarms for proper operation

3. System air- and motor-operated valve interlocks are verified for the normal, loss of offsite power, and recirculation modes.

4. Close isolation valves against flow to verify acceptable closing times

d. Acceptance Criteria

1. CCW pump performance is within design specifications.

2. Trips, permissives, interlocks, controls all function within design specifications.

3. Valve interlocks for normal, loss of offsite power, and recirculation modes function within design specifications.

4. Isolation valve operating times are within design specifications.

14.2.12.1.26 Standby Service Water (SSW) System Preoperational Test

a. Test Objectives

1. To demonstrate the capability of the SSW system to provide required or design flow to supplied components

2. To demonstrate the ability of the system to function correctly with adequate net positive suction head over the range of basin levels required by system design; verify the absence of any degrading vortex effects

3. To demonstrate the ability of the system containment isolation valves to close within the required time

4. To demonstrate that system valves automatically line up in the LOCA and LOSP modes and that the pumps and cooling tower fans start automatically in the LOCA mode.

5. To demonstrate the capability of the SSW pumphouse ventilation system to maintain the SSW pumphouse within design temperature limits and to verify automatic system control functions

b. <u>Prerequisites</u>

1. Component tests completed and approved

2. All permanently installed instrumentation properly calibrated and operable

3. All test instrumentation available and properly calibrated

4. The following systems available as necessary to support the test:

(a) Plant service water system

(b) Turbine building cooling water system

(c) Instrument air system

(d) Standby service water pumphouse ventilation system

(e) Appropriate ac and dc power sources

(f) Control room air-conditioning system

(g) Annunciator system

(h) Component cooling water system

(i) Computer system

(j) LPCS system

(k) RCIC system

(l) RHR system

(m) Standby and HPCS diesel generators

5. An operational hydrodynamic test has been performed on the SSW system to demonstrate the leak-tightness of the valves which separate the SSW system from the PSW system and the CCW system.

c. Test Procedure

1. Demonstrate that loops operate in response to a LOCA signal, manual, and various automatic initiation signals
2. Demonstrate that valves operate in response to LOSP or LOCA signals
3. Demonstrate that containment isolation valves operate within the required time
4. Check trips, permissives, interlocks, controls, including alarms and computer points
5. Measure SSW pump performance (head flow characteristics, available NPSH)
6. Verify all SSW pump house ventilation system trips, permissives, and interlocks, including automatic start upon receipt of SSW pump start signals
7. Demonstrate that the SSW system can be operated from the remote shutdown panel
8. Verify that the SSW pump house ventilation system maintains the SSW pump house within design limits during SSW system operation
9. Demonstrate that the basin overflow lines are unobstructed.

d. Acceptance Criteria

1. SSW loops are aligned and flow is delivered in response to manual, LOCA, and various other automatic signals.
2. SSW system valves assume correct positions in response to LOCA or LOSP signals.

3. Isolation valve operating times are within design specifications.

4. Trips, permissives, interlocks, controls, and alarms function within design specifications.

5. SSW pump performance (head flow characteristics, available NPSH) is within design specifications.

6. The SSW pumphouse vent system starts automatically in response to SSW demands and is capable of maintaining the room within design temperature limits.

7. SSW system can be operated from remote shutdown panel.

8. Remote shutdown system controls, and instruments, operate in all required modes from the remote shutdown panel.

9. Control from the remote shutdown panel takes precedence over main control room control.

14.2.12.1.27 Deleted

14.2.12.1.28 Safeguard Switchgear and Battery Rooms Ventilation System Preoperational Test

a. Test Objectives

To demonstrate the capability of the safeguard switchgear and battery rooms ventilation system to provide the flows to/from specified areas in the summer and winter modes of operation; to verify that battery rooms are maintained at a negative pressure; to verify system automatic functions; to verify that the room coolers are capable of removing post-accident design heat loads

b. Prerequisites

1. Component tests completed and approved

2. All permanently installed instrumentation properly calibrated and operable

3. All test instrumentation available and properly calibrated

4. Instrument air system available

5. Appropriate ac and dc power sources available

6. Annunciator system available

c. Test Procedure

1. Check heaters and fans response to temperature

2. Check trips, permissives, interlocks, and system automatic functions

3. Check ability to maintain battery rooms at a negative pressure

4. With the associated ESF switchgear under load, perform a heat balance on the ESF switchgear room coolers

d. Acceptance Criteria

1. Heaters and fans respond to temperature signals within design specifications.

2. Trips, permissives, interlocks, and other automatic functions are within design specifications.

3. Battery rooms are maintained at negative pressure.

4. The ESF switchgear room coolers are capable of removing the post-accident design heat load.

5. Tested flow capacities are within ten percent of the design flow values.

14.2.12.1.29 Control Room HVAC System Preoperational Test

a. Test Objectives

To demonstrate the capability of the control room HVAC system to provide the flows to/from specified areas in the isolation, winter, normal, and post-isolation fresh air makeup modes of operation; to demonstrate the ability of system isolation valves to close within the required times; to demonstrate system automatic functions; to demonstrate the control room is maintained at a positive pressure with respect to surrounding areas during normal conditions; to demonstrate that inleakage is within design limits while operating in the recirculation mode.

b. Prerequisites

1. Component tests completed and approved
2. All permanently installed instrumentation properly calibrated and operable
3. All test instrumentation available and properly calibrated
4. Instrument air system available
5. Appropriate ac and dc power sources available
6. Annunciator system available
7. Domestic water system available
8. Plant service water system available
9. Control building ventilation system available

c. Test Procedure

1. Verify that all fan, heater, damper and air conditioner interlocks, trips, permissives and controls function correctly
2. Verify that operating times for isolation dampers is acceptable
3. Verify purge operation upon detection of freon
4. Verify correct system response to manual isolation and automatic isolation signals
5. Verify that control room is maintained at a positive pressure with respect to the surrounding areas during normal conditions
6. Verify that control room inleakage is within design limits while operating in the recirculation mode

d. Acceptance Criteria

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

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

3. System purge mode response is within design specifications for freon detection signal.

4. System isolation response is within design specifications for manual and various automatic isolation signals.

5. Control room is maintained at a positive pressure with respect to surrounding areas during normal conditions.

6. Control room inleakage is maintained within design limits.

7. Tested flow capacities are within ten percent of the design flow values.

14.2.12.1.30 Deleted

14.2.12.1.31 Diesel Generator Room Ventilation System Preoperational Test

a. Test Objective

To verify system automatic functions and the ability of the outside air fan to maintain diesel generator room within design temperature limits during diesel generator operation.

b. Prerequisites

1. Component tests completed and available

2. AC electrical power available

3. AC/DC electrical control power available

4. Instrument calibrations and loop checks complete

c. Test Procedure

1. Verify that all heaters, fan coil units, and dampers respond correctly to automatic trips, permissives, interlocks, and controls.

2. Verify that diesel generator room air supply fans automatically start in response to their associated diesel generator starting. Additionally, verify that fan speed automatically changes from low to fast speed on high duct temperature.

3. With the diesel generator at rated full load observe that the outside air fan maintains the diesel generator room at ≤120 F.

d. Acceptance Criteria

1. All heaters, fan coil units, and dampers function within design specifications.

2. Diesel generator room air supply fans start in response to their associated diesel generator starting.

3. Diesel generator room fan speed changes from low to high speed on receipt of high air duct temperature.

4. The outside air fan is capable of maintaining the diesel generator room at ≤120 F with the diesel generator at rated full load.

5. Tested flow capacities are within ten percent of the design flow values.

14.2.12.1.32 Drywell Cooling System Preoperational Test

a. Test Objective

1. To verify automatic system control actions; to verify additional cooling is provided to the CRD cavity upon receipt of high area temperature signals

2. To verify that leak detection system functions associated with drywell cooling operate properly

b. Prerequisites

1. Component testing completed and approved

2. All permanently installed instrumentation properly calibrated and loop checks complete

3. AC electrical power available

4. Instrument air available

5. Drywell chilled water available

c. Test Procedure

1. Verify that fan coil units and dampers respond correctly for all trips, permissives, interlocks, and controls

2. Verify damper realignment to provide additional cooling to CRD cavity in the event of high area temperature

3. Using simulated inputs, verify the leak detection system's ability to detect and respond to a steam or coolant leak into the drywell

d. Acceptance Criteria

1. Fan coil units and dampers respond within design specifications for all trips, permissives, interlocks, and controls.

2. Additional cooling is provided to the CRD cavity by realigning dampers on high area temperature.

3. All leak detection system trips, interlocks, and logic sequences associated with drywell cooling operate in accordance with design specifications.

4. Tested flow capacities are within ten percent of the design flow values.

14.2.12.1.33 Containment Cooling System Preoperational Test

a. Test Objective

To demonstrate the capability of the containment cooling system to provide flows to/from specified areas in the normal, drywell purge, containment cleanup, and containment purge modes of operation. To demonstrate that a high-radiation signal will close the containment and auxiliary building isolation valves within the required time.

b. Prerequisites

1. Component testing completed and approved
2. All permanently installed instrumentation properly calibrated and operable
3. All test instrumentation available and properly calibrated
4. Appropriate ac and dc power sources available
5. Drywell cooling system available as necessary to support the test
6. Combustible gas control system available as necessary to support the test
7. Instrument air system available

c. Test Procedure

1. 1.Demonstrate that containment and auxiliary building isolation valves close in the required time during design flow in response to a high-radiation signal
2. Demonstrate that fans, dampers, isolation valve trips, permissives, interlocks, and controls function correctly
3. Demonstrate that trips, interlocks, alarms, and controls associated with the exhaust filter train function correctly
4. Tested flow capacities are within ten percent of the design flow values

d. Acceptance Criteria

1. System dampers isolate within allowed operating times.

2. Fan, damper, isolation valves trips, permissives, interlocks, and controls function within design specifications.

3. Filter train trips, permissives, interlocks, and controls function within design specifications.

14.2.12.1.34 Standby Gas Treatment System (SGTS) Preoperational Test

a. Test Objective

To demonstrate the automatic system functions and the capability of SGTS to evacuate its boundary region and maintain its boundary region at a specified negative pressure in addition to maintaining the specified mixing ratio in the enclosure building following a LOCA or radiation release to the secondary containment

b. Prerequisites

1. Component tests completed and approved

2. Permanent instrumentation calibrated and instrument loop checks completed

3. Test instrumentation calibrated and installed

4. AC electrical power available

5. AC/DC electrical control power available

6. The following systems available as necessary to support the test:

(a) Fuel handling area ventilation system

(b) Fire protection system

(c) Auxiliary building ventilation system

(d) Containment cooling system

7. Auxiliary building and enclosure building complete and intact

8. All auxiliary building roof covers, doors, blowout shafts, etc., in place

9. Secondary containment established

c. Test Procedure

1. Demonstrate that all alarms, controls, trips, permissives, and interlocks operate correctly

2. Manually initiate each SGTS train and verify:

   (a) Filter train and enclosure building recirculation fans start

   (b) Auxiliary building dampers open and align in proper flow paths

   (c) Primary and secondary containment isolation valves and dampers close

3. Automatically initiate SGTS by simulating LOCA signals and fuel handling ventilation high-radiation signals and verify:

   (a) Filter train and enclosure building recirculation fans start

   (b) Auxiliary building dampers open and align in proper flow paths

   (c) Primary and secondary containment isolation valves and dampers close

4. Verify that filter train trips, permissives, interlocks, alarms, and controls function correctly

5. Verify that each SGTS train is capable of drawing down the SGTS boundary to 1/4 in. w.g. vacuum within 120 seconds after actuation

6. Verify that the mixing ratio of enclosure building area to auxiliary building area is acceptable

d. Acceptance Criteria

1. All SGTS system trips, permissives, interlocks, operate within design specifications.

2. Upon manual or automatic initiation:

   (a) Filter train fans start

   (b) Enclosure building fans start

   (c) Auxiliary building dampers open to set correct flow paths

   (d) Primary and secondary valves and dampers isolate

3. Filter train trips, permissives, interlocks, alarms, and controls function within design specifications.

4. Each SGTS filter train will attain and maintain 1/4 in. w.g. within an acceptable time.

5. The mixing ratio of enclosure building air to auxiliary building air is within design specifications.

14.2.12.1.35 Deleted

14.2.12.1.36 Standby Diesel Generator Preoperational Test

a. Test Objectives

1. To demonstrate the standby diesel generator starting reliability, sustained load-carrying capability, and independence from off-site power sources.

2. To provide assurance that the system is capable of providing emergency electrical power during normal and simulated accident conditions and that voltage and frequency are maintained within specified limits during steady-state and transient loading conditions

3. To demonstrate automatic starting, connection to the respective ESF bus, and load sequencing in response to simulated emergency conditions

4. To demonstrate the operability of the diesel-generator auxiliary systems, i.e., diesel fuel oil transfer and diesel-generator starting air supply system

5. To demonstrate capability of the diesel generator system:

    (a) To synchronize with offsite power source while loaded

    (b) To undergo periodic surveillance testing

    (c) To respond properly to signals requiring emergency power while undergoing surveillance testing

    (d) To be restored to standby status from operation

b. Prerequisites

1. All component tests are completed and approved.

2. All instrument calibration sheets are completed and approved.

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

    (a) Fire protection system in DG room

    (b) Standby service water (SSW)

    (c) Service air

    (d) Electrical power to motors, fans, etc.

    (e) Diesel generator room HVAC

4. Sufficient diesel fuel is on site to perform tests.

c. Test Procedure

1. Test all diesel starting and trip sequences to assure proper operation

2. Test all auxiliary systems to demonstrate that they operate within design specifications

3. Verify that all interlocks, controls, and alarms operate in accordance with design specifications

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

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

6. Demonstrate proper operation of the diesel generator during load shedding, load sequencing, and load rejection. Include a test of the loss of the largest single load while maintaining voltage and frequency within design limits, and a test of the complete loss of load in which overspeed limits are not exceeded.

7. Demonstrate full-load carrying capability of the diesel generators for a period of not less than 24 hours, of which 22 hours are at a load equivalent to the continuous rating of the diesel generator and 2 hours are at the DEMA STANDARD 2-hour load rating (110 percent of nameplate rating). Verify that voltage and frequency are maintained within design limits and that the diesel cooling systems function within design limits.

8. Demonstrate functional capability at operating temperature conditions by reperforming "the automatic response" tests per 4. and 5. above, immediately (within 5 minutes) after completion of the 24-hour load test per 7. above

9. Demonstrate the ability to:

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

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

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

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

11. Demonstrate that the capability of the diesel generators to supply emergency power within the required time is not impaired during periodic surveillance testing

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

d. Acceptance Criteria

1. System construction and operation meet design criteria.

2. The automatic test sequence starts and loads the diesel generators in the proper sequence. Voltage and frequency are maintained within specified limits in response to LOCA and LOSP signals.

3. All auxiliary systems function in accordance with design specifications.

4. Rated load and frequency can be attained and maintained for a specified time period.

5. The diesel generators can maintain a load equivalent to the continuous rating of the diesel generator for a continuous period not less than 24 hours, while maintaining voltage, frequency, and auxiliary system's performance within design limits.

6. The diesel generators can maintain 110 percent of nameplate rated load (DEMA standard) for a period of 2 hours, while maintaining voltage, frequency, and auxiliary system's performance within design limits.

7. The diesel generators can be synchronized to an offsite power source while maintaining the ESF loads.

8. The standby diesel generator system is capable of transferring the ESF load from the generator to the offsite power source, and of isolating the diesel generator from the bus and returning it to standby status.

9. The rate of fuel consumption at design-basis load for each respective diesel generator is such that the requirements for 7-day storage inventory are met.

10. During surveillance testing, the capability of the diesel generators to respond to an emergency signal and supply power to the ESF bus within the required time is not impaired.

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

14.2.12.1.37 Vessel Internals Vibration Preoperational Test

a. Test Objective

1. Vibration tests are conducted to verify the structural integrity of core support structure and reactor internals in accordance with Regulatory Guide 1.20. The jet pumps are part of this program.

b. Prerequisites

1. Reactor recirculation and flow control system preoperational test has been completed or is in progress.

2. Sensors have been installed and verified operable.

3. Instrumentation is calibrated.

c. Test Procedure

1. Vibration measurements are made during preoperational testing and during operation of the recirculation system. The following table summarizes the vibration test conditions:

PREOPERATIONAL VESSEL INTERNALS TESTING
(hot, pressurized, without fuel)

Test Series	A-loop Flow	B-loop Flow
Low pump speed	Max. (LFMG set)	Max. (FLMG set)
Balanced flow	Increase min. to max.	Increase min. to max.
B-pump trip	Max.	Trip pump from max.
A-pump only	Increase min. to max.	Pump off
Unbalanced	Max.	Increase min. to max.
A-pump trip	Trip pump from max.	Max.
B-pump only	Pump off	Increase min. to max.
Unbalanced	Increased min. to max.	Max.
2-pump trip	Trip pump from max.	Trip pump from max.

2. Inspections of reactor internals are conducted before and after preoperational functional testing of the reactor system in significant flow modes. The post-flow inspection is conducted prior to fuel loading and reactor criticality.

d. Acceptance Criteria

1. Vibration levels during the various test conditions are within predicted limits.

2. Visual inspection indicates no significant wear, cracking, loosening of bolts, or the presence of debris and loose parts.

14.2.12.1.38 Offgas System Preoperational Test

a. Test Objective

To verify the operation of the offgas system including valves, filters, hydrogen analyzers, pumps, and refrigeration machines

b. Prerequisites

1. Component tests are completed and approved.

2. Electrical power is available.

3. Instrument air and service air are available.

4. Turbine building closed cooling water is available.

c. Test Procedure

Demonstrate the following:

1. Valve operation including fail-safe and isolation features

2. Pump operation

3. Level and temperature control and indication

4. Gas dryer and cooler tests

5. Filter efficiency

6. Hydrogen analyzer performance test

7. Offgas vault refrigeration subsystem operation

d. Acceptance Criteria

1. All alarms, controls, trips, permissives, interlocks function within design specifications.

2. All remote-operated valves function within design specifications.

3. Mechanical equipment, cooling systems, and sampling systems perform within design specifications.

4. HEPA and charcoal filters perform within design specifications.

14.2.12.1.39 ESF 125-Volt DC System Preoperational Test

a. Test Objective

To demonstrate the capability of each battery to supply its safety load demand without support of the chargers for a specified time without exceeding minimum battery cell voltage. To demonstrate the capability of each battery charger to restore the battery from design minimum charge to its fully charged state in 8 hours while supplying normal steady-state loads.

b. Prerequisites

1. The energization procedures as required for this test are completed and the data have been reviewed.

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

3. All test instrumentation is available and properly calibrated.

4. Appropriate ac and dc power sources are available.

5. Safeguard switchgear and battery room ventilation is available.

c. Test Procedure

1. Load each battery at 125 percent of design load without support of the battery charger, verify that the battery will support the load for 8 hours without dropping below minimum battery cell voltage of 105V dc.

2. With the battery at design minimum charge, verify that each battery charger will fully charge the battery within 8 hours while supplying normal steady-state load.

d. Acceptance Criteria

1. Each battery will support 125 percent design load demand without support of its charger for the 8 hours without dropping below minimum cell voltage of 105V dc.

2. Each battery charger will fully charge the battery from design minimum charge while supporting normal steady-state load.

14.2.12.1.40 Liquid Radwaste System Preoperational Test

a. Test Objective

To demonstrate the reliable operation of the liquid radwaste equipment drains subsystem, floor drains subsystem, chemical waste subsystem, and reactor water cleanup waste subsystem

b. Prerequisites

1. Component tests completed and approved

2. All instrumentation calibrated and loop checks complete

3. AC and dc electrical power available

4. The following systems available as required to support the test:

   (a) Instrument air

   (b) Service air

   (c) Auxiliary steam

   (d) Condensate and refueling water storage and transfer

   (e) Makeup water treatment

   (f) Floor and equipment drains

   (g) Radwaste building ventilation

c. Test Procedure

1. Demonstrate flow capabilities, control and interlock operations and overall system operation using demineralized water

2. Demonstrate the ability of the filters to be precoated, backwashed, recirculated, and placed in normal operation

3. Demonstrate the ability of the demineralizers to be backwashed, recharged, and placed in normal operation

4. Demonstrate that the filters, demineralizers, and evaporators produce acceptable water quality from simulated process sources.

5. Demonstrate the ability of the RWCU waste phase separators to be decanted and transfer solids to the solid radwaste system.

d. Acceptance Criteria

1. Flow capabilities, controls, and interlocks perform within design specifications.

2. Precoat filters perform within design specifications in the following modes:

(a) Precoat

(b) Backwash

(c) Recirculation

(d) Normal

3. Demineralizers perform within design specifications in the following modes:

(a) Backwash

(b) Recharge

(c) Recirculation

(d) Normal

4. Filters, demineralizers, evaporators produce water of a quality within design specifications.

5. Subsystem and integrated system dynamic operations have been completed within design specifications.

14.2.12.1.41 Solid Radwaste System Preoperational Test

a. Test Objective

1. To demonstrate the capability of the solid radwaste system mixer units, cement handling equipment, drum handling equipment, and remotely operable valves to operate under dynamic conditions

2. To demonstrate that the solidification equipment and process equipment operate properly by processing a batch sample

3. To demonstrate that the waste compactor operates properly by compacting a batch of compressible waste

b. Prerequisites

1. Component tests completed and approved

2. Instrumentation calibrations and loop checks complete

3. AC/DC electrical power available

4. The following systems are available as required to support this test:

(a) Instrument air

(b) Service air

(c) Radwaste building ventilation

(d) Condensate and refueling water storage and transfer

(e) Liquid radwaste

c. Test Procedure

1. Demonstrate that the solid radwaste system cement handling equipment operates under dynamic conditions

2. Demonstrate that the solid radwaste system mixer units operate under dynamic conditions

3. Demonstrate that the solid radwaste system remotely operable valves operate under dynamic conditions

4. Demonstrate a water-free, solid radwaste end product by processing sample batches

5. Demonstrate that the waste compactor satisfactorily compacts compressible waste

d. Acceptance Criteria

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

2. All system components and operations have been performed within design specifications.

3. Solidification samples are free of liquid.

4. Waste compactor performs satisfactorily within design specifications.

14.2.12.1.42 Drywell Monitoring System Preoperational Test

a. Test Objective

To demonstrate that the drywell monitoring system performs satisfactorily

b. Prerequisites

1. Component tests are completed and approved.

2. Electrical power is available.

3. Drywell cooling system is available.

4. Instrument calibrations and loop checks are completed.

c. Test Procedure

1. Verify that all trips, permissives, interlocks, and controls function correctly

2. Verify that the system samples satisfactorily

d. Acceptance Criteria

1. Interlocks, controls, trips, and permissives function within design specifications.

2. Monitors can be calibrated and system samples within design specifications.

14.2.12.1.43 Deleted

14.2.12.1.44 ECCS Integrated Initiation During Loss of Offsite Power Preoperational Test

a. Test Objective

1. To demonstrate the capability of load shedding and sequencing to provide alternate power sources to the engineered safety features buses during a partial or complete loss of offsite power

2. To demonstrate the ability of RHR/LPCI, LPCS, and HPCS systems to realign and provide rated flow within the prescribed period of time on integrated response to a simulated LOCA signal

3. To demonstrate the ability of the diesel generators to maintain ECCS loads while they provide rated flow within the prescribed period of time on integrated response to a simulated LOCA signal in conjunction with LOSP signals

4. To demonstrate independence of emergency buses and correct assignments of loads by performing the loss of offsite power coincident with LOCA signal three times, each time having only its associated dc system energized with the diesel generator and dc system for one load group/division completely disconnected

5. To demonstrate, under worst-case conditions of a (simulated) design-basis accident event concurrent with loss of offsite power and inoperable battery chargers, that:

   (a) The dc system loads and battery voltage levels as measured remain within values consistent with battery sizing criteria, and

   (b) The dc system loads remain operable at the resulting minimum voltage level conditions.

6. Verify design adequacy of the voltage optimization at the safety-related buses and load centers during a simulated LOCA (full load condition).

b. Prerequisites

1. Systems actuated by load shedding and sequencing are available. The LSS functions of these systems have been preoperationally tested.

2. Valves actuated by the containment, drywell, and auxiliary building isolation system are available. The actuation functions have been preoperationally tested.

3. The preoperational tests described in subsections 14.2.12.1.45, 14.2.12.1.46, 14.2.12.1.36, and 14.2.12.1.50 are complete.

4. Post-LOCA ESF systems are available for operation to support ESF 4160-volt bus voltage data.

5. RPS system is available.

6. Preoperational test flow data for RHR, HPCS, and LPCS have been reviewed and systems available.

7. All permanently installed instrumentation properly calibrated and operable

8. All test instrumentation available and properly calibrated

9. Appropriate ac and dc power sources available

10. ESF electrical switchgear rooms cooling system available

11. Plant engineered safety features buses are energized from their preferred ESF transformers.

12. Safeguard switchgear and battery room ventilation system available

13. Plant engineered safety features buses are loaded with their normal plant demands.

14. Standby diesel generator system available

15. Diesel generator rooms ventilation system available

16. Emergency pump rooms ventilation system available

17. Standby service water system available

18. HPCS diesel generator available

19. The taps of all intervening transformers between the 500 kV and 115 kV offsite power and the 480-volt safety-related buses and load centers have been properly set.

c. Test Procedure

1. Initiate ESF transformer undervoltage signals and verify starting of the diesel generators associated with the buses fed from this source, stripping all ESF loads on the bus and tripping incoming feeder breakers to the bus, automatic selection of an alternate source of power, and finally the timed sequential restarting of normal loads. Repeat the above procedure (restoring ESF transformers as required) for other two ESF transformers.

2. Initiate a total loss of offsite power and verify starting of the diesel generators associated with the buses fed from this source, stripping all ESF loads on the bus and tripping incoming feeder breakers to the bus, connecting the diesel generators to the bus after reaching rated voltage at frequency, and finally the timed sequential restarting of normal loads

3. Simulate a loss-of-coolant accident signal with normal power available and test ECCS integrated response beginning from normal system lineup

4. Simulate a loss-of-coolant accident signal simultaneously with a loss of offsite power. Verify diesel generators' load shedding, and sequencing and ECCS response

The battery chargers for each Class 1E dc bus are to remain disconnected for the duration of this test. The test will be continued for a period greater than or equal to 4 hours. Measure battery voltage and current to verify that:

(a) The dc system loads remain within the design load profile values for each respective dc bus, and

(b) The dc voltage remains greater than or equal to the minimum design value under conditions of steady-state and transient loading, and

(c) The dc system loads respond and operate properly throughout the test period.

5. Simulate LOCA signal with combinations of buses and dc supplies deenergized to verify independence and correct load assignments

6. Simulate LOCA signal and post-LOCA restoration event and measure voltages at the 500 kV, 115 kV, 34.5 kV, 4160-volt ESF, and 480-volt safety-related buses and load centers with the ESF buses being fed from one ESF transformer. Record load current values for correlation purposes. Repeat the above procedure (restoring ESF transformers as required) for the other two ESF transformers.

d. <u>Acceptance Criteria</u>

1. On loss of ESF power, diesel generators start and load shedding and sequencing occur within design specifications.

2. On total loss of offsite power, diesel generators start, load shedding takes place, diesel generators accept the sequenced loads.

3. Integrated ECCS response must show the ability of RHR/LPCI, LPCS, and HPCS to provide rated flow within the prescribed period of time following LOCA signal.

4. Integrated ECCS response in conjunction with simulated LOCA/LOSP signals demonstrates the ability of the diesel generators to maintain ECCS loads while they provide rated flow within the prescribed time.

5. DC system loads, supplied by the battery only during response to a (simulated) LOCA event concurrent with LOSP and inoperable battery charger conditions, are demonstrated within the design load profile values, and therefore are consistent with the battery sizing criteria.

6. DC system loads are demonstrated operable at minimum voltage levels occurring during integrated ECCS response to a (simulated) LOCA event in conjunction with LOSP and inoperable battery chargers.

7. Correlation of measured safety-related bus and load center voltages with the design analysis and anticipated offsite voltage variations results in values which are within acceptable design limits.

14.2.12.1.45 4160-Volt and 6900-Volt Distribution System Pre-operational Test Procedure

a. Test Objectives

1. To demonstrate the functional capability of the medium-voltage plant protective relaying, breaker interlocks, and trip and close logic associated with the 4160-volt and 6900-volt switchgear and transformers

2. To demonstrate the functional capability to monitor and alarm the status of the medium-voltage switchgear and transformers via the computer and annunciator logic system

3. To ascertain proper voltage, phase sequence, and phase angles of each source feed to each bus in the plant

4. Verify design adequacy of the voltage optimization at the safety-related buses and load centers under minimum load condition.

b. Prerequisites

1. Fire protection is available to all equipment to be energized.

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

3. All test instrumentation is available and properly calibrated.

4. Appropriate ac and dc power sources are available.

5. Electrical switchgear room cooling is available.

6. The 34.5 kV buses are energized.

7. Switchgear and battery room ventilation is available.

8. The taps of all intervening transformers between the 500 kV and 115 kV offsite power and the 480-volt safety-related buses and load centers have been properly set.

c. Test Procedure

1. Test the operability of the trips, permissives, interlocks, controls, and alarms of the 4160-volt buses and feeder breakers

2. Test the operability of the trips, permissives, interlocks, controls, and alarms of the 6900-volt buses and feeder breakers

3. Test the operability of the trips, permissives, interlocks, controls, and alarms of the 34.5 kV/ 4160-volt transformers

4. Test the operability of the trips, permissives, interlocks, controls, and alarms of the 34.5 kV/ 6900-volt transformers

5. Verify proper voltage, phase sequence, and phase angles on the 4160-volt and 6900-volt buses

6. Measure voltage at the 500 kV, 115 kV, 34.5 kV, 4160-volt ESF, and 480-volt safety related buses and load centers at minimum load conditions, and record tap setting of all intervening transformers. Record load current values for correlation purposes.

d. Acceptance Criteria

1. Voltage on the 4160-volt buses is 4160±208 volts.

2. Voltage on the 6900-volt buses is 6900±365 volts.

3. Phase sequence on all medium-voltage buses is A-B-C.

4. Phase angles on all buses are in accordance with their proper reference source as tabulated in the procedure.

5. Correlation of measured safety-related bus and load center voltages with the design analysis and anticipated offsite voltage variations results in values which are within acceptable design limits.

14.2.12.1.46 Load Shed and Sequence System (LSSS) Preoperational Test

a. Test Objectives

1. To demonstrate the operational capability of the load shed and sequence panels to recognize test and emergency signal inputs and respond to each input in the proper manner, independent of the other two ESF divisions

2. To demonstrate that the proper shedding and sequence takes place under varied input signals in the required time period

b. Prerequisites

1. Testing of systems as required for this test is complete.

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

3. All test instrumentation is available and properly calibrated

4. Appropriate ac and dc power sources are available.

5. ESF 4160-volt buses are available.

c. Test Procedure

1. Verify that the load shed and sequence panel will properly respond in each of its manual test modes

2. Simulate a 90 percent bus undervoltage (BUV) condition and verify that the proper shedding and sequence takes place in the required time interval

3. Simulate a 70 percent BUV condition and verify that the proper shedding and sequencing takes place in the required time interval

4. Simulate a LOCA condition to the LSS panels and verify that the proper shedding and sequencing takes place in the required time interval

5. Simulate a LOCA with 80 percent BUV condition to the LSS panels and verify that the proper shedding and sequencing takes place in the required time interval

d. Acceptance Criteria

1. Shedding and sequencing occurs within the design specifications of the panels.

2. Each panel operates independently of the other and the other two ESF divisions.

14.2.12.1.47 480-Volt Distribution System Preoperational Test

a. Test Objectives

To demonstrate and document the operational and functional integrity of load center feeder breakers, 480V incoming breaker and buses, including their associated annunciation, computer alarms, and protection devices

b. Prerequisites

1. Component tests are completed and approved.

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

3. All test instrumentation is available and properly calibrated.

4. Appropriate ac and dc sources are available as well as annunciators and the computer system.

c. Test Procedure

1. Demonstrate trips, permissives, interlocks, controls, and alarms for 6900V and 4160V load center feeder breakers

2. Demonstrate trips, permissives, interlocks, controls, and alarms for 480V load center bus feeders

3. Demonstrate trips, controls and alarms for MCC feeder breakers

4. Observe load center and MCC voltages, both remote and local. Voltages should be within ± 5% of 480V ac.

5. Demonstrate trip function for MCC's associated with LOCA-LSS actuation

d. Acceptance Criteria

1. All load centers' bus voltage is 480 ± 5% V ac.

2. All MCC's bus voltage is 480 ± 5% V ac, ABC rotation.

3. MCCs associated with LOCA-LSS trip, function as designed.

14.2.12.1.48 Emergency dc and Control Room Lighting Preoperational Test

a. Test Objectives

1. To demonstrate that two inverters, each fed from a separate dc bus, supply designated emergency lighting in the control room.

2. To demonstrate that, with the loss of normal power, emergency dc lighting will remain illuminated for a minimum of 30 minutes near stairs, exit doors, halls, etc., and for a minimum of 8 hours on essential areas used during emergency or shutdown condition to include access and exit routes.

3. To demonstrate that the essential lighting system is powered from two redundant ESF dc buses (Division l and Division 2) and provides illumination in the control room, Class IE switchgear rooms, shutdown panel area, and access routes between those areas where critical tasks are carried out during emergencies.

b. Prerequisites

1. Component tests are completed and approved.

2. All automatic emergency lights to be tested have been energized for at least 24 hours.

3. DC buses 11A and B are energized.

c. Test Procedure

1. Observe and record that designated control room lamps, normally fed from two inverters, are energized

2. Observe and record that, upon loss of normal lighting, lamps are illuminated in the control room, Class 1E switchgear room, shutdown panel area, and access routes between those areas where critical tasks are carried out during emergencies.

3. Observe and record that designated lighting fixtures in the control building are powered from Division 1 and Division 2 ESF buses.

4. Observe that, upon loss of normal lighting, automatic emergency lights energize and can remain illuminated for a minimum of 30 minutes. This should be tested in all areas and elevations of the control, auxiliary, containment, radwaste, water treatment, firewater pump house, circulating water, and SSW buildings.

d. Acceptance Criteria

1. Control room emergency lights are always energized from two separate inverters.

2. Automatic emergency lights energize upon loss of normal lighting and supply light for at least 30 minutes to hallways, exit doors, and stairs.

3. Type E3 X35 battery pack (18 each), upon loss of normal power, provides light for at least 8 hours to essential areas required for the safe shutdown of the plant.

4. Control building lighting 105 fixtures are connected and divided into two redundant ESF buses, Division 1 and Division 2.

14.2.12.1.49 Seismic Monitoring System Preoperational Test

a. Test Objectives

1. To verify operational capability of the system

2. To verify operation of the system in the test modes

b. Prerequisites

1. AC electrical power available

2. DC electrical power available

3. Instrument calibration and instrument loop checks completed

c. Test Procedure

1. The Strong Motion Accelerograph system will be checked as follows:

(a) The battery and power supply will be checked by system operation.

(b) The accelerometer test loop will be tested by placing the system in the test mode and recording the results on the system cassette recorders.

(c) The playback system will be checked by printing the results of the test loop check ((b) above).

(d) The seismic switches and triggers will be tested by displacing the sensors and verifying proper system and annunciator response.

d. Acceptance Criteria

1. The seismic monitoring system functions properly in the test, record and playback modes.

2. Proper annunciation is received when the seismic switches and triggers are displaced.

14.2.12.1.50 HPCS Diesel Generator Preoperational Test

a. Test Objectives

1. To provide assurance that the high-pressure core spray system diesel generator is capable of supplying emergency electrical power during normal and accident conditions, and that voltage and frequency are maintained within specified limits during steady-state and transient loading conditions

2. To demonstrate the starting and operating reliability, sustained load-carrying capability, and independence of the HPCS diesel generator power source from offsite power sources

3. To demonstrate the system's ability to respond to manual and automatic initiation signals, to automatically start and connect to the emergency bus within a specified time limit, and to successfully start and operate the HPCS system load during simulated accident conditions

4. To demonstrate the operability of the diesel generator auxiliary systems, i.e., the diesel fuel oil transfer and the diesel generator starting air systems

5. To demonstrate capability of the diesel generator system to:

(a) Synchronize with offsite power source while loaded

(b) Undergo periodic surveillance testing

(c) Respond properly to signals requiring emergency power while in surveillance testing mode

(d) Be restored to standby status

b. Prerequisites

1. All component tests completed and approved

2. All instrument calibration sheets completed and approved

3. Appropriate ac and dc power sources available

4. Suitable communications established between the control room and the equipment to be tested

5. The following support systems/components are available:

(a) Fire protection system in diesel generator room

(b) Ventilation system for diesel generator room

(c) Fuel storage and transfer system for diesel generator

6. The diesel generator and the auxiliary support systems are serviced and available for operation with sufficient diesel fuel, lubricating oil, and cooling water to sustain operation to rated load for extended periods.

c. Test Procedure

1. Test the diesel auxiliary systems to demonstrate operation within design specifications

2. Verify that all controls, interlocks, protective devices, and alarms operate in accordance with design criteria

3. Test all diesel generator starting and tripping sequences to assure proper operation

4. Demonstrate proper manual and automatic operation of the diesel generator, and that it will start automatically upon simulated loss of ac voltage and attain the required frequency and voltage within specified limits

5. Demonstrate proper automatic starting and operation in response to a simulated design-basis accident event, and verify that voltage and frequency are maintained within specified limits

6. Demonstrate capability of each redundant starting air train to start the diesel generator five times with the air compressors secured out-of-service

7. Demonstrate proper operation of the diesel generator during load rejection, in which overspeed limits are not exceeded upon complete loss of load

8. Demonstrate full-load carrying capability of the diesel generators for a period of not less than 24 hours, of which 22 hours are at a load equivalent to the continuous rating of the diesel generator and 2 hours are at the DEMA STANDARD 2-hour load rating (110 percent of nameplate rating). Verify that voltage and frequency are maintained within design limits, and that the diesel cooling systems function within design limits.

9. Demonstrate functional capability at operating temperature conditions by performing an automatic response test with concurrent loss of offsite power and, LOCA signals immediately (within 5 minutes) after completion of the 24-hour load test per (8) above

10. Demonstrate the ability to:

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

    (b) Transfer the load from the diesel generator to the offsite power source

(c) Disconnect the diesel generator and restore it to standby status

11. Demonstrate that the rate of fuel consumption while operating at not less than the design-basis accident load value is such that the requirements for 7-day storage inventory are met

12. Demonstrate proper operation of the diesel generator for surveillance testing purposes, loading in parallel with the offsite power source, and that the capability of the diesel generator to supply emergency power within the required time is not impaired during periodic surveillance testing

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

d. <u>Acceptance Criteria</u>

1. The system operating controls, interlocking functions, protective devices, and alarms function to meet the design criteria.

2. Each starting air train is capable of starting the diesel generator five times in succession without recharging of the associated air receivers.

3. The diesel generator auxiliary systems (Diesel Fuel Storage and Transfer System and Starting Air System) operate in accordance with design criteria.

4. The HPCS diesel generator is capable of supplying power to the HPCS motor, in the event offsite power is unavailable, within the specified time limit, and is capable of maintaining voltage and frequency within specified limits.

5. The diesel generators can maintain a load equivalent to the continuous rating of the diesel generator for a continuous period not less than 24 hours, while maintaining voltage, frequency, and auxiliary systems' performance within design limits.

6. The diesel generator can operate at 110 percent of nameplate-rated load for a period of 2 hours while maintaining voltage, frequency, and auxiliary systems' performance within design limits.

7. The diesel generator can be synchronized to an offsite power source while maintaining the HPCS load.

8. The diesel generator is capable of transferring the HPCS motor load from the generators to an offsite power source, and is also capable of being disconnected from the bus and returning to standby status.

9. The rate of fuel consumption at the design-basis load value is such that the requirement for 7-day storage inventory is met.

10. During surveillance testing, the diesel generator system's capability of responding to an emergency signal and supplying power to the bus within the required time is not impaired.

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

14.2.12.1.51 Security System Preoperational Test

a. Test Objective

To demonstrate the operation of the plant security system

b. Prerequisites

1. Component tests are completed and approved.

2. AC electrical power is available.

3. Instrument calibrations are complete.

c. Test Procedure

1. Demonstrate proper operation of the access control system

2. Demonstrate proper operation of the intrusion control system

3. Demonstrate proper operation of the patrol tour supervision system

4. Demonstrate proper operation of the closed circuit television (CCTV) surveillance system

5. Demonstrate proper operation of the fire detection and alarm system

6. Demonstrate proper operation of the security communications system

7. Demonstrate proper operation of the personnel exit radiation detection system and all special purpose detection systems

8. Demonstrate the hardware and software capabilities of the security and fire protection (SFPS) computer

d. <u>Acceptance Criteria</u>

1. All trips, permissives, controls, interlocks, alarms, and other features operate in accordance with design specifications for the following systems:

   (a) Access control system

   (b) Intrusion control system

   (c) Patrol tour supervision system

   (d) Closed circuit television surveillance system

   (e) Fire detection and alarm system

   (f) Security communications system

   (g) Personnel exit radiation detection and special purpose detection systems

2. SFPS computer hardware and software perform as required with sufficient system accuracy and real time response.

14.2.12.1.52 Deleted

14.2.12.1.53 Deleted

14.2.12.1.54 Auxiliary Building Fuel Handling Cranes' and Polar Crane Preoperational Test

a. Test Objectives

To demonstrate the operational capabilities of the new fuel bridge crane, the spent fuel cask crane, and the containment polar crane

b. Prerequisites

1. CTO no-load checkout complete and documentation available

2. Mechanical and electrical load tests complete

3. Rated load test complete

4. AC electrical power available

5. Cranes have been inspected and refurbished as necessary after construction use

c. Test Procedure

1. Verify operational capabilities of the new fuel bridge crane, the spent fuel cask crane, and the containment polar crane by operating the cranes through all motions with the hooks unloaded

2. Check all interlocks and controls for proper operation

d. Acceptance Criteria

1. The new fuel bridge crane, the spent fuel cask crane, and the containment polar crane operational capabilities are within design specification.

2. All interlocks and controls function within design specification.

14.2.12.1.55 Radwaste Building Ventilation System Pre-operational Test

a. Test Objectives

The purposes of this test are to demonstrate the capability of the radwaste building ventilation system:

1. To maintain the building at a slight negative pressure with respect to the outside atmosphere

2. To maintain air-flow patterns such that air flows from relatively clean areas to areas of progressively greater contamination potential

Two more objectives of this are:

1. To demonstrate the automatic functions of controls and system trip functions

2. To demonstrate filter train capabilities

b. Prerequisites

1. Component tests completed and approved

2. All permanently installed instrumentation properly calibrated and operable

3. All test instrumentation available and properly calibrated

4. Instrument air system available

5. Appropriate ac and dc power sources available

6. Annunciator system available

7. Hot lab vacuum system available

8. Primary chilled water system available

9. Radwaste building ventilation radiation monitoring system available

c. Test Procedure

1. Verify that all fan, heater, damper and cooling interlocks, trips, permissives, and controls function correctly

2. Verify that radwaste building is maintained at a slightly negative pressure with respect to the outside atmosphere

3. Visually verify that air flow patterns are from clean to progressively greater contamination areas.

4. Demonstrate filter performance and tightness

5. Demonstrate fan air capacities are within specification

d. Acceptance Criteria

1. All heater, fan coils and damper interlocks, trips, and permissives function within design specification.

2. HEPA and charcoal filters perform within design specifications.

3. Radwaste building is maintained at a slightly negative pressure with respect to outside atmosphere.

4. Air flow patterns are from clean areas to progressively greater contaminated areas.

5. Fan capacities are within ten percent of the design specifications.

14.2.12.1.56 Fuel Handling Area Ventilation System Pre-operational Test

a. Test Objective

To demonstrate the capability of the fuel handling area ventilation system to provide the flows to/from specified areas in post-isolation operations, pool sweep operation, and normal operation; to demonstrate that the fuel handling area is ventilated and maintained at a slightly negative pressure with regard to surrounding areas; to demonstrate all alarms, controls, trips, permissives, and interlocks operate correctly; to demonstrate the ability of isolation valve to close within required times

b. Prerequisites

1. Component tests completed and approved
2. All permanently installed instrumentation properly calibrated and operable
3. All test instrumentation available and properly calibrated
4. Instrument air system available
5. Appropriate ac and dc power sources available
6. Annunciator system available
7. Auxiliary building ventilation system available
8. Plant chilled water system available
9. Standby gas treatment system available

c. Test Procedure

1. Verify that all fan, heater, cooler and damper interlocks, trips, permissives, and controls function correctly
2. Verify that operating times for isolation valves are acceptable
3. Verify correct system response to manual isolation and automatic isolation signals
4. Verify that fuel handling area is maintained at a slight negative pressure with regard to the surrounding areas
5. Verify that fan capacities are within design limits
6. Visually verify that air flow patterns are from areas of lower contamination to areas of higher contamination
7. Verify air flow distribution across the fuel pool, cask storage pool and transfer canal

d. Acceptance Criteria

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

2. Operating times for isolation valves/dampers are within design specifications.

3. System isolation response is within design specifications for manual and various automatic isolation signals.

4. Fuel handling area is maintained at a slight negative pressure with regard to the surrounding areas during normal conditions.

5. Fan capacities are within ten percent of the design limits.

6. Air flow patterns are from areas of lower contamination to areas of higher contamination.

7. Air flow distribution across the fuel pool, cask storage pool, and transfer canal are within design limits.

14.2.12.1.57 Communications System Preoperational Test

a. Test Objective

1. To verify that the public address and evacuation alarm systems are audible above area noise levels with normal and emergency equipment running

2. To verify communications between the control room or remote shutdown panel and working stations required following transients and/or accidents (including fires)

3. To verify that communication links are available throughout the site to support normal operations and routine maintenance

4. To verify the operability of communication systems under normal conditions

b. Prerequisites

1. All component tests completed and approved

2. AC electrical power available

3. Area equipment available for running

c. Test Procedure

1. With area equipment running, verify that public address and evacuation alarm systems are audible

2. With area equipment running, verify that two-way radio system can transmit and receive

3. Establish post-transient and accident work locations and communicate with the control room and remote shutdown panel

d. Acceptance Criteria

1. Public address and evacuation alarm systems are audible above normal and emergency noise levels.

2. The control room and remote shutdown panel area can communicate with work stations required following transients and/or accidents.

14.2.12.1.58 Fire Protection System Preoperational Test

a. Test Objectives

1. To verify operation of the controls, detectors, alarms, interlocks and valves associated with the fire protection system, including automatic and manual initiation

2. To verify that the fire water pumps operate to design specifications

3. To verify that the Halon 1301 system will provide required concentrations

4. To verify that the carbon dioxide fire protection system will provide the required concentrations

b. Prerequisites

1. Component tests complete and approved
2. All permanently installed instrumentation properly calibrated and operable
3. All test instrumentation available and properly calibrated
4. Instrument air system or equipment available
5. Appropriate ac power sources available
6. Annunciator system available
7. Plant service water system or temporary water available
8. Condensate and refueling water transfer and storage system available

c. Test Procedure

1. Check all controls, detectors, alarms and interlocks for proper operation
2. Measure firewater pumps'/pump performance
3. Perform Halon 1301 system concentration test
4. Close isolation valves against flow to verify acceptable closing times. Perform carbon dioxide system concentration test.

d. Acceptance Criteria

1. Controls, detectors, alarms and interlocks function within design specifications.
2. Firewater pumps performance is within design specifications.
3. Halon 1301 system provides concentrations within design specifications.

4. Isolation valve operating times are within design specifications.

5. The carbon dioxide fire protection system provides concentrations within design specifications.

14.2.12.1.59 Instrument Air System Preoperational Test

a. Test Objectives

1. The testing of the instrument air system will be conducted in two parts to satisfy NRC Regulatory Guide 1.80. Part one of the testing will demonstrate the operability, performance, and capacity of the instrument air compressor and air dryer; the operability, performance, and capacity of the instrument air booster compressors; the operation of isolation valves, interlocks, and alarms.

2. Part two of the testing will be the loss-of-air test to demonstrate that the designated air-operated valves will fail to the fail-safe position upon loss of air.

b. Prerequisites

1. Part one - Instrument air system except loss-of-air test

   (a) Component tests are complete.

   (b) The following systems are operational:

      (1) Annunciator system

      (2) Turbine building cooling water system

      (3) Vibration monitoring system

   (c) AC and dc power is available.

2. Part two - Loss-of-air test

   (a) Instrument air test part one is complete.

   (b) All designated valves have been tested and are operational.

c. Test Procedure

1. Part one - The following tests will be performed:

(a) Air compressor motor protection and operability test

(b) Air compressor capacity test

(c) Air dryer capacity and moisture content tests

(d) Valve operability, to include timing and interlocks checks

(e) Booster compressor capacity and operability tests

2. Part two - the following test will be performed:

(a) Line up valves to other than fail position using branch header concept

(b) Establish loss of air to branch headers

(c) Record the fail position of the designated valves for concurrence to FSAR Tables 6.2-44, 9.3-1, and 9.3-2.

d. Acceptance Criteria

1. Part one - Instrument air system except loss-of-air test

(a) Instrument air compressor discharge air flow capacity meets design specifications.

(b) Instrument air dryer discharge air flow capacity meets design specifications.

(c) Moisture content of air dryer discharge air meets design specifications.

(d) Booster compressors' air flow capacity meets design specification.

(e) Isolation valves closure times meet design specifications.

2. Part two - Loss-of-air test

   All air-operated valves fail to the fail-safe position upon loss-of-air.

14.2.12.1.60 Integrated Leak Rate Preoperational Test

a. Test Objective

   To verify that the actual containment leakage rate does not exceed the design limits, and that no paths for gross leakage from the drywell to the containment air space bypassing the suppression feature exist

b. Prerequisites

   1. Local leakage tests are completed with any exceptions noted.

   2. All ILRT instrumentation have been calibrated and functionally checked.

   3. Pressurization System is installed and functional.

   4. Drywell and containment boundaries, penetrations, valves, personnel locks, equipment hatches, and ventilation/cooling systems are complete.

c. Test Procedure

   1. Pressurize drywell and containment to peak test pressure and stabilize the atmosphere measure leakage rate L_{am} using the absolute method

   2. Verify integrated leakage rate instrumentation by imposing a known leak on the containment through a calibrated flow measurement device

   3. Depressurize containment to 0 psig and drywell to drywell reduced pressure, and stabilize drywell atmosphere. Measure drywell to containment leakage bypassing the suppression feature.

d. Acceptance Criteria

   The measure leakages do not exceed the designed leakage rates.

14.2.12.2 Acceptance Tests

With minor differences in quality assurance coverage and engineering review of test results, the administrative controls for the acceptance test program are the same as the preoperational test program. These controls govern test procedure format, contents, preparation, review, and approval; conduct of test procedures; and review and approval of test results (see subsections 14.2.3, 14.2.4, and 14.2.5).

Acceptance test controls differ from preoperational test controls in the following respects:

> Quality Programs review is not required for acceptance test procedures or acceptance test results. However, Quality Programs review is mandatory for preoperational test procedures and results. Further, for safety-related preoperational test procedures, witness and hold points are required in the procedure where the conduct of the test or outcome of the results are critical to quality or safety. At all times, Quality Programs has the authority to enforce the administrative controls contained in the Startup Manual, regardless of whether a preoperational or acceptance test is involved.
>
> The results of all preoperational tests are submitted to the originating engineering organization (Bechtel or GE) and to the GGNS Technical Section for review. The results of selected major acceptance tests will be submitted for engineering review.

14.2.12.2.1 Main and Reheat Steam System Acceptance Test

The Main and Reheat Steam System Acceptance Test will demonstrate:

a. Correct function of all trips, permissives, interlocks and indications associated with main and reheat steam piping drains

b. Correct function of all main and reheat steam instrumentation, alarms, indications, and computer points

c. Correct function of all motor-operated and air-operated valves including position indication

d. Correct function of moisture separator/reheater (MSR) second-stage reheat temperature controls

e. Correct function of all trips, permissives, and interlocks deriving from the MSR, MSR vents and drains, and extraction steam systems

f. Correct function of all trips, permissives, interlocks, and indications associated with reactor feed pump turbine steam supply lines, drain lines, and exhaust lines

14.2.12.2.2 Condensate System Acceptance Test

The Condensate System Acceptance Test will demonstrate:

a. Operability of the condensate and condensate booster pumps, including head and flow characteristics and suction head

b. Trips, permissives, interlocks, and indications associated with condensate and condensate booster pump starting, shutdown, automatic start and trip controls

c. Operability of all motor-operated and air-operated valves, including indication

d. Operability of condensate and condensate booster flow control and recirculation flow control loops and valves

e. Operability of hotwell level indication, alarms, and hotwell level control

f. Operability in all operating modes and flow paths

g. Operability of all instrumentation, controls, indications, alarms, and computer points

14.2.12.2.3 Feedwater System Acceptance Test

Note: The Feedwater Control System Preoperational Test is described in subsection 14.2.12.1.1.

The Feedwater System Acceptance Test will demonstrate:

a. Operability of the feed pumps, including head and flow characteristics and suction head. Flow attained will be less than rated due to the limited capacity of the auxiliary boilers.

b. Operability of the feed pump turbines, including:

   1. Correct function of ac and dc oil pumps and lube oil system

   2. Correct function of high- and low-pressure stop and control valves

   3. Correct functions of interlocks, trips, and permissives, including overspeed trips

   4. Correct function of the turning gear

   5. Correct function of instrumentation, controls, alarms, indications, and computer points

c. Operability of all motor-operated and air-operated valves, including indication

d. Operability and correct control function of feedwater recirculation, bypass, and main flow control valves

e. Operability of all instrumentation, controls, indications, alarms, and computer points

f. Operability of all trips, permissives, and interlocks associated with manual and automatic starts, stops, and trips

14.2.12.2.4 Heater Vents and Drains System Acceptance Test

(Including Feedwater Heater Vents and Drains, Moisture Separator Vents and Drains, and Extraction Steam Systems)

The Heater Vents and Drains Acceptance Test will demonstrate:

a. High- and low-pressure feedwater heater level control instrumentation, indications, alarms, control function, and trip function

b. Operability of air-operated and motor-operated feedwater heater, and moisture separator/reheater (MSR) shell and drain tank vent and drain shutoff valves

c. Operability of feedwater heater and MSR level control and high-level bypass dump valves

d. Operability of temperature, pressure, flow, and level instrumentation, controls, indications, alarms, and computer points

e. Operability of feedwater heater, MSR, and extraction steam high-level trips and interlocks

f. Operability of heater drain pumps, including heads and flow characteristics, manual and automatic start and stop features, trip features

g. Operability of heater drain pump instrumentation and controls, including recirculation and flow control valves

h. Operability of extraction steam line air-operated drain valves, including position indication

i. Operability of extraction steam line temperature and pressure computer points

j. Operability of motor-operated shutoff valves and air operated bleeder trip valves, including timed response to turbine trip signals and position indication

14.2.12.2.5 Makeup Water System Acceptance Test

The Makeup Water System Acceptance Test will demonstrate:

a. Operability of the clearwell transfer pumps, including trips and permissives and minimum flow recirculation control

b. Operability of clearwell tank level controls and low-level alarms and trips

c. Operability of the demineralized water transfer pumps, including trips, permissives, and flow control

d. Operability of demineralized water storage tank level controls and alarms

e. Operability of the instrumentation, controls, trips, permissives, alarms, and indications associated with the acid and caustic storage tanks and acid and caustic transfer pumps

f. Operability of the acid and caustic transfer pumps, and regeneration waste sample pumps

g. Operability of the activated carbon filter system

h. Operability of the makeup water demineralizer system, including cation and anion exchanger regeneration and performance, and auxiliary equipment operability

i. The ability of the makeup demineralizer to produce sufficient quantities of demineralized water with acceptable chemical and conductivity characteristics

14.2.12.2.6 Condenser Air Removal System Acceptance Test

The Condenser Air Removal System Acceptance Test will demonstrate:

a. Operability of all motor-operated and air-operated valves, including indication

b. Operability of the supply steam pressure control loop and pressure control valves

c. Operability of all instrumentation, controls, indication, alarms, and computer points, and all trips, permissives, and interlocks associated with system operation

d. Performance of the mechanical vacuum pumps, including the manual start, stop, and trip logic sequences, and demonstrate the ability to draw and maintain a vacuum on the condenser

e. Performance, using auxiliary steam, of the steam jet air ejectors, including the ability to complete drawdown and maintain condenser vacuum

f. Leaktight integrity of the main condenser

14.2.12.2.7 Circulating Water System Acceptance Test

The Circulating Water System Acceptance Test will demonstrate:

a. Operability of all motor-operated and air-operated valves, including indication

b. Operability of all trips, permissives, and interlocks associated with system operation

c. Operability of the circulating water pumps, including head and flow characteristics, suction head, and start, stop, and trip logic

d. Operability of the lube water pumps

e. Operability of the circulating water recirculation and drain pumps

f. Operability of the circulating water chemical control system, including pH control, hypochlorite control, and cycles of concentration blowdown control

g. Operability of the cooling tower level control loop

h. Operability of the cooling tower in normal and cold weather modes of operation

i. Operability of all instrumentation, controls, indications, alarms, and computer points associated with system operation

14.2.12.2.8 Turbine Control System Acceptance Test

The Turbine Control System Acceptance Test will demonstrate:

a. Correct control function, trip function, opening and closing times for the combined main stop and control valves, combined low-pressure stop and control valves, and combined bypass stop and control valves

b. Operability of the turbine electrohydraulic (EHC) and mechanical hydraulic control systems (MHC), using actual and simulated signals

c. Operability of turbine supervisory instrumentation and equipment, such as the turbine stress evaluator (TSE), the speed measuring unit (SMU), the vibration and expansion monitor (VEM)

d. Operability of the automatic turbine tester (ATT)

e. Operability of the turbine trip system (TTS)

f. Operability of the exhaust hood water spray and seal steam controller (SSC).

g. Control function, trips, permissives, and interlocks associated with the initial pressure controller/bypass pressure controller (IPC/BPC)

h. Control function and control interface with the recirculation system flow controller and generator load controls

14.2.12.2.9 Process Sampling System Acceptance Test

The Process Sampling System Acceptance Test will demonstrate:

a. The ability to draw representative samples at the radwaste building sampling panel

b. The ability to draw representative samples at the reactor sample station and that the sample coolers, conductivity recorders, and conductivity alarms and computer points function correctly

c. The operability of the Feedwater Corrosion Product Monitor, including its associated sample coolers and conductivity alarms, recorders, and computer points

d. The ability to draw representative samples at the turbine building sampling station and that the sample coolers, conductivity instrumentation, dissolved oxygen instrumentation, turbidity instrumentation, sodium analyzers, and condenser sampling systems function correctly

14.2.12.2.10 Plant Service Water (PSW) System Acceptance Test

The Plant Service Water System Acceptance Test will demonstrate:

a. Operability of the plant service water pumps, including head and flow characteristics, suction head, manual and automatic start, stop, and trip features

b. Operability of the individual and master radial well flow control system

c. Operability of instrumentation, controls, indicators, alarms, computer points associated with the plant service water pumps, radial wells, and plant service water system

d. Operability of all trips, permissives, and interlocks associated with the plant service water pumps, radial wells, plant service water system, and the circulating water, standby service water, and hypochlorite systems

e. Operability of all motor-operated and air-operated valves, including temperature and flow control valve function, and isolation valve closing times

f. Operability of plant service water to standby service water isolation and crosstie valves

g. Adequate cooling water flow is available to the components served by the plant service water system.

14.2.12.2.11 Turbine Building Cooling Water (TBCW) System Acceptance Test

The Turbine Building Cooling Water System Acceptance Test will demonstrate:

a. Operability of the TBCW makeup control loop and control valve

b. Operability of all air-operated and motor-operated valves

c. Operability of the TBCW pumps, including head and flow characteristics; suction head; manual and automatic start, stop, and trip functions; single and dual pump operation

d. Operability of the TBCW pump minimum recirculation flow control loop and control valve

e. Operability of TBCW trips, permissives, interlocks, instrumentation, controls, indicators, alarms, and computer points

f. Adequate cooling water flow is available to the components served by TBCW.

14.2.12.2.12 Service Air System Acceptance Test

Note: The Instrument Air System Preoperational Test is described in subsection 14.2.12.1.59.

The Service Air System Acceptance Test will demonstrate:

a. Operability and capacity of service air compressors

b. Operability of the service air pressure control loop and pressure control valve

c. Operability of all instrumentation, indications, controls, alarms, and computer points associated with the service air compressors and service air system

d. Operability of all trips, permissives, and interlocks associated with the service air compressors and service air system

e. Operability of all air-operated and motor-operated valves, including indication and closing times, and interlocks on isolation valves

14.2.12.2.13 Auxiliary Building Ventilation System Acceptance Test

The Auxiliary Building Ventilation System Acceptance Test will demonstrate:

a. Operability of the auxiliary building fan coil units, including manual start, stop, trips, and inlet damper interlocks

b. Operability of the auxiliary building heating coils, including their associated temperature control loops

c. Operability of all air-operated dampers, including indication and interlocks, and closing times on isolation dampers

d. Operability of all instrumentation, controls, indications, alarms, and computer points

e. Operability of the main steam tunnel cooler outside containment, including fans, coolers, valves, dampers, instrumentation, controls, computer points, trips, permissives, and interlocks

14.2.12.2.14 Turbine Building Ventilation System Acceptance Test

The Turbine Building Ventilation System Acceptance Test will demonstrate:

a. Operability of the makeup air fan coil unit, general area fan coil units, battery room fan coil unit, lube oil room fan coil unit, pump area fan coil units, and elevator machine room fans and heaters. Testing includes manual fan start, stop, trips, damper operation and interlocks, temperature control, and instrumentation.

b. Operability of the turbine building exhaust fans, inlet and outlet damper interlocks and operations

c. Control function of the exhaust fan flow control loop and turbine building differential pressure control loop

d. Operability of the controls, instrumentation, and interlocks associated with the turbine building filter train

e. Operability of the turbine building smoke exhaust subsystem

14.2.12.3 Startup Tests

All those tests comprising the startup test phase (Table 14.2-3) are discussed in this section. For each test a description is provided for test objective, test prerequisites, test procedure and statement of test acceptance criteria, where applicable. Additions, deletions, and changes to these discussions are expected to occur as the test program progresses. Such modification to these discussions will be reflected in amendments to the FSAR.

In describing the purpose of a test, an attempt is made to identify those operating and safety-oriented characteristics of the plant which are being explored.

The criteria section of each test has one or two sections. The following paragraphs describe the degree of each kind of test criterion, and the actions to be taken after an individual criterion is not satisfied.

Level 1

If a Level 1 test criterion is not satisfied, the plant must be placed in a hold condition that is judged to be satisfactory and safe, based upon prior testing. Plant operating or test procedures, or the Technical Specifications, may guide the decision on the direction to be taken. Startup tests consistent with this hold condition may be continued. Resolution of the problem must immediately be pursued by appropriate equipment adjustments or through engineering support by offsite personnel, if needed. Following resolution, the applicable test portion must be repeated to verify that the Level 1 requirement is satisfied. A description of the problem resolution must be included in the report documenting the successful test.

Level 2

If a Level 2 test criterion is not satisfied, plant operating or startup test plans would not necessarily be altered. The limits stated in this category are usually associated with expectations of system transient performance, and whose characteristics can be improved by equipment adjustments. An investigation of the related adjustments, as well as the measurement and analysis methods, would be initiated.

If all Level 2 requirements in a test are ultimately met, there is no need to document a temporary failure in the test report unless there is an educational benefit involved. Following resolution, the applicable test portion must be repeated to verify that the Level 2 requirement is satisfied.

If a certain controller-related Level 2 criterion is not satisfied after a reasonable effort, then the control engineers may choose to document that result with a full explanation of their recommendations. This report must discuss alternatives of action, as well as the concluding recommendation, so that it can be evaluated by all related parties.

During the conduct of the Startup Test Program, Technical Specifications will override any test in progress if plant conditions dictate.

14.2.12.3.1 Test Number 1 - Chemical and Radiochemical

a. Test Objective

The principal objectives of this test are a) to secure information on the chemistry and radiochemistry of the reactor coolant, and b) to determine that the sampling equipment, procedures and analytic techniques are adequate to supply the data required to demonstrate that the chemistry of all parts of the entire reactor system meet specifications and process requirements.

Specific objectives of the test program include evaluation of fuel performance, evaluations of demineralizer operations by direct and indirect methods, measurements of filter performance, confirmation of condenser integrity, demonstration of proper steam separator-dryer operation, measurement and calibration of the offgas system, and calibration of certain process instrumentation. Data for these purposes is secured from a variety of sources: plant operating records, regular routine coolant analysis, radiochemical measurements of specific nuclides, and special chemical tests.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

Prior to fuel loading, a complete set of chemical and radio-chemical samples will be taken to ensure that all sample stations are functioning properly and to determine initial concentrations. Subsequent to fuel loading, during reactor heatup and at each major power level change, samples will be taken and measurements will be made to determine the chemical and radiochemical quality of reactor water and reactor feedwater, amount of radiolytic gas in the steam, gaseous activities leaving the air ejectors, decay times in the offgas lines, and performance of filters and demineralizers. Calibrations will be made of monitors in the stack, liquid waste system and liquid process lines.

d. Acceptance Criteria

Level 1

Chemical factors defined in the Technical Specifications and Fuel Warranty must be maintained within the limits specified.

The activity of gaseous and liquid effluents must conform to license limitations.

Water quality must be known at all times and must remain within the guidelines of the Water Quality Specifications.

14.2.12.3.2 Test Number 2 - Radiation Monitoring

a. Test Objective

The purposes of this test are a) to determine the background radiation levels in the plant environs prior to operation for base data on activity buildup and b) to monitor radiation at selected power levels to assure the protection of personnel during plant operation.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

A survey of natural background radiation throughout the plant site will be made prior to fuel loading. Subsequent to fuel loading, during reactor heatup and at power plateaus (refer to subsection 14.2.4.5), gamma radiation level measurements, and where appropriate, thermal and fast neutron dose rate measurements will be made at significant locations throughout the plant. All potentially high-radiation areas will be surveyed. This should specifically include:

1. Drywell to containment building penetrations

2. RWCU system backwash receiver tank resin transfer piping in the area where it exits the containment building and enters the auxiliary building. This should be monitored before, during, and after the transfer of discharged resins from RWCU backwash receiver tank.

3. A complete survey of all accessible floor areas within the containment building prior to fuel loading, at intermediate powers, and at full power.

Containment building environment should be monitored prior to entry after SRV action. This will specifically include measurements of airborne contamination prior and subsequent to those tests which could add radioactivity to the containment building atmosphere.

d. Acceptance Criteria

Level 1

The radiation dose of plant origin and the occupancy times of personnel in radiation zones shall be controlled consistent with the guidelines of the Standards for Protection Against Radiation outlined in 10 CFR 20.

14.2.12.3.3 Test Number 3 - Fuel Loading

a. Test Objective

The purpose of this test is to load fuel safely and efficiently to the full core size.

b. Prerequisites

Prerequisites to fuel loading are established in subsection 14.2.10 and the tests required thereby are implied in those prerequisites. The PSRC has approved fuel loading.

c. Test Procedure

Prior to fuel loading, control rods, neutron sources, and neutron detectors will be installed and tested. Fuel loading will begin by placing the first four bundles adjacent to an off-center neutron source and proceeding radially outward. This loading pattern shall continue until a 10-by-10 array of bundles has been loaded, at which time the outside face of the loading block will have reached the core periphery.

Subsequent loading increments will be performed as a series of crescents proceeding radially outwards. The neutron count rates shall be monitored as the core loading progresses to ensure continuous subcriticality, and a shutdown margin demonstration will be performed.

d. Acceptance Criteria

Level 1

The partially loaded core must be subcritical by at least 0.38 percent Δk/k with the analytically determined strongest rod fully withdrawn.

14.2.12.3.4 Test Number 4 - Full Core Shutdown Margin

a. Test Objective

The purpose of this test is to demonstrate that the reactor will be subcritical throughout the first fuel cycle with any single control rod fully withdrawn.

b. Prerequisites

Fuel loading is complete; the PSRC has reviewed and approved the test procedures and initiation of testing.

c. Test Procedure

This test will be performed in the fully loaded core in the xenon-free condition. The shutdown margin test will be performed by withdrawing the control rods from the all-rods-in configuration until criticality is reached. If the highest worth rod will not be withdrawn in sequence, other rods may be withdrawn providing that the reactivity worth is equivalent. The difference between the measured k_{eff} and the calculated k_{eff} for the in-sequence critical will be applied to the calculated value to obtain the true shutdown margin.

d. Acceptance Criteria

Level 1

The shutdown margin of the fully loaded, cold (68 F or 20 C), xenon-free core occurring at the most reactive time during the cycle must be at least 0.38 percent Δk/k with the analytically strongest rod (or its reactivity equivalent) withdrawn. If the shutdown margin is measured at some time during the cycle other than the most reactive time, compliance with the above criterion is shown by demonstrating that the shutdown margin is 0.38 percent Δk/k plus an exposure dependent increment which adjusts the shutdown margin at that time to the minimum shutdown margin.

Level 2

Criticality should occur within ±1.0 percent Δk/k of the predicted critical (predicted critical to be determined later).

14.2.12.3.5 Test Number 5 - Control Rod Drive System

a. Test Objective

The purposes of the control rod drive system test are: a) to demonstrate that the control rod drive (CRD) system operates properly over the full range of primary coolant temperatures and pressures from ambient to operating, and b) to determine the initial operating characteristics of the entire CRD system.

b. Prerequisites

The preoperational tests have been completed. The PSRC has reviewed and approved the test procedures and initiation of testing. The control rod drive manual control system preoperational testing must be completed on control rod drives being tested. The reactor vessel, closed cooling water system, condensate supply system and instrument air system must be operational to the extent required to conduct the test.

c. Test Procedure

The CRD tests performed during Phases II through IV of the startup test program are designed as an extension of the tests performed during the preoperational CRD system tests. Thus, after it is verified that all control rod drives operate properly when installed, they are tested periodically during heatup to assure that there is no significant binding caused by thermal expansion of the core components.

Control Rod Drive System Tests

	Test Conditions Reactor Pressure with Core Loaded psig (kg/cm^2)			
Action	**0**	**600 (42.2)**	**800 (56.2)**	**Rated**
Position Indication	all			
Insert/withdraw				
1. Single CRD Notch & continuous modes	all			
2. Gang groups Notch & continuous modes	all			
Coupling	all			
Friction	all			all
Cooling water flow rates (Total				1
Individual CRD scram		4*	4*	all

NOTE: Single CRD scrams should be performed with the charging valve closed. Do not ride the charging pump head.)

d. Acceptance Criteria

Level 1

Each CRD must have a normal withdraw speed less than or equal to 3.6 inches per second (9.14 cm/sec), indicated by a full 12-foot stroke in greater than or equal to 40 seconds.

*Refers to four CRDs selected for continuous monitoring based on slow normal accumulator pressure scram times as determined from preoperational testing, or unusual operating characteristics. The “four selected CRDs” must be compatible with the requirements of both the withdrawal sequence and the installed rod movement limitation systems.

The maximum scram times, measured with vessel pressures between 950 to 1050 psig, of individual CRDs shall comply with line 1 of the following table. (Note: Performance rated with charging headers at 1750 psig.)

		Maximum Scram Time (seconds) from Position 48 to Position		
Line	**Pressure**	**43**	**29**	**13**
1	950-1050	.31-.32	.81-.86	1.44-1.57
2	950-1050	.38-.39	1.09-1.14	2.09-2.22
3	950-1050	.30-.31	.78-.84	1.40-1.53

NOTE: For intermediate dome pressures, the scram time criteria are determined by linear interpolation at each notch position.

In the event that any CRD scram time exceeds the criteria listed in line 1 of the above table:

The maximum scram times of any CRD which failed the criteria in line 1 shall not exceed the criteria in line 2.

The average scram time of those rods which meet the criteria of line 1 should not exceed the criteria of line 3.

The total number of inoperative control rods, that is the number of rods which causes the average scram time to exceed the criteria of line 3 plus the number of control rods which exceeded the criteria of line 1, shall not be greater than 7 and they shall not occupy adjacent drive locations in any direction including the diagonal.

Level 2

In the continuous ganged rod mode, the rods shall always move together so that all rods are within two notches of all other rods in the gang.

Each CRD must have a normal insert or withdraw speed of 3.0 ± 0.6 inches per second (7.62 ± 1.52 cm/sec), indicated by a full 12-foot stroke in 40 to 60 seconds.

With respect to the control rod drive friction tests, if the differential pressure variation exceeds 15 psid (1.1 kg/cm^2) for a continuous drive in, a settling test must be performed, in which case, the differential settling pressure should not be less than 30 psid (2.1 kg/cm^2) nor should it vary by more than 10 psid(0.7 kg/cm^2) over a full stroke.

The CRD's total cooling water flow rate shall be between 0.28 and 0.34 gpm times the total number of drives.

NOTE: For BWR/6 plants the differential settling pressure should be nominally 5 psid higher at the 00 position than at any other position along the CR due to the proper functioning of the spring actuated buffer piston located at the top of the drive.

For vessel pressures below 950 psig, the maximum scram time for individually withdrawn CRDs shall comply with a figure supplied in the startup test procedure. This is the time from the opening of the main scram contactor to notch 11.

14.2.12.3.6 Test Number 6 - Source Range Monitor (SRM) Performance and Control Rod Sequence

a. Test Objective

The purpose of this test is to demonstrate that the operational sources, SRM instrumentation, and rod withdrawal sequences provide adequate information to achieve criticality and increase power in a safe and efficient manner. The effect of typical rod movements on reactor power will be determined.

b. Prerequisites

The preoperational tests have been completed, the PSRC has reviewed and approved the test procedure and the initiation of testing. The control rod drive system must be operational.

c. Test Procedure

Source range monitor count rate data will be taken during control rod withdrawals to critical and compared with stated criteria on signal and signal count-to-noise count ratio.

A withdrawal sequence has been calculated which specifies rod withdrawals. Resulting control rod patterns will be recorded periodically as the reactor is heated to rated temperature.

Movement of rods in a prescribed sequence is monitored by the Rod Control and Information System which will prevent out-of-sequence withdrawal.

As the withdrawal of each rod group is completed during ascension to low power levels, the electrical power, steam flow, control valve position, and APRM response will be recorded.

d. Acceptance Criteria

Level 1

There must be a neutron signal count-to-noise count ratio of at least 2 to 1 on the required operable SRMs or Fuel Loading Chambers (FLC).

There must be a minimum count rate of 0.7 counts/second on the required operable SRMs or Fuel Loading Chambers.

The IRMs must be on scale before the SRMs exceed the rod block set point.

14.2.12.3.7 Test Number 8 - Rod Sequence Exchange

a. Test Objective

The purpose of this test is to perform a representative sequence exchange of control rod patterns at a significant power level.

b. Prerequisites

The preoperational tests have been completed, the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

The reactor is at the correct test condition on the 100 percent load line between the rod sequence control system low power set point and the fuel conditioning nodal power limits.

c. Test Procedure

Rod patterns will be periodically exchanged during plant operations to more nearly equalize fuel assembly exposures. This test is performed as an example of the exchanges which will be made throughout plant life, and is provided to illustrate the principles involved. The control rod sequence exchange begins on the 100 percent load line by reducing core flow to minimum and reducing thermal power to between the low power set point of the Rod Control and Information System and the thermal power necessary to keep nodal powers below the PCIOMR threshold. Also, in reducing thermal power, care should be taken to avoid exceeding the design limits of the core total peaking factor. The ensuing steps involve utilizing the system process computer, specifically subprograms OD-2, 3, and P1, followed by APRM data and extensive utilization of the TIP machines. The exchange is performed a row or column at a time, starting at one side of the core and working row by row or column by column across the entire width of the core.

The Rod Sequence Exchange feature is a non-essential test and was not performed for GGNS Unit 1.

d. Acceptance Criteria

Level 1

Completion of the exchange of one rod pattern for the complementary pattern with continual satisfaction of all licensed core limits constitutes satisfaction of the requirements of this procedure.

Level 2

All nodal powers must remain below their fuel conditioning thermal limits during this test.

14.2.12.3.8 Test Number 10 - Intermediate Range Monitor (IRM) Performance

a. Test Objective

The purpose of this test is to adjust the IRM system to obtain an optimum overlap with the SRM and APRM systems.

b. Prerequisites

The preoperational tests have been completed. The PSRC has reviewed and approved the test procedures and the initiation of testing. Instrumentation for calibration has been checked and installed.

c. Test Procedure

Initially, the IRM system is set to maximum gain. After the APRM calibration, the IRM gains will be adjusted to optimize the IRM overlap with the SRMs and APRMs.

d. Acceptance Criteria

Level 1

Each IRM channel must be adjusted so that the overlap with the SRMs and APRMs is assured. The IRMs must produce a scram at 96 percent of full scale.

14.2.12.3.9 Test Number 11 - Local Power Range Monitor (LPRM) Calibration

a. Test Objective

The purpose of this test is to calibrate the local power range monitoring system.

b. Prerequisites

The preoperational tests have been completed, the PSRC has reviewed and approved the test procedures and the initiation of testing. Instrumentation for calibration has been checked and installed.

c. Test Procedure

The LPRM channels will be calibrated to make the LPRM reading proportional to the neutron flux in the water gap at the chamber elevation. Calibration factors will be obtained through the use of either an off-line or a process computer calculation that relates the LPRM reading to average fuel assembly power at the chamber height.

d. Acceptance Criteria

Level 2

Each LPRM reading will be within 10 percent of its calculated value.

14.2.12.3.10 Test Number 12 - Average Power Range Monitor (APRM) Calibration

a. Test Objective

The purpose of this test is to calibrate the average power range monitor system.

b. Prerequisites

The preoperational tests have been completed, and the PSRC has reviewed and approved the test procedures and the initiation of testing. Instrumentation for calibration has been checked and installed.

c. Test Procedure

A heat balance will generally be made each shift and after each major power level change. Each APRM channel reading will be adjusted to be consistent with the core thermal power as determined from the heat balance. During heatup a preliminary calibration will be made by adjusting the APRM amplifier gains so that the APRM readings agree with the results of constant heatup rate heat balance. The APRMs should be recalibrated in the power range by a heat balance as soon as adequate feedwater indication is available.

d. Acceptance Criteria

Level 1

The APRM channels must be calibrated to read equal to or greater than the actual core thermal power.

NOTE

Recalibration of the APRM system will not be necessary from safety considerations if at least two APRM channels per RPS trip circuit have readings greater than or equal to core power.

Technical Specification and Fuel Warranty Limits on APRM scram and rod block shall not be exceeded.

In the startup mode, all APRM channels must produce a scram at less than or equal to 15 percent of rated thermal power.

14.2.12.3.11 Test Number 13 - NSSS Process Computer

a. Test Objective

The purpose of this test is to verify the performance of the NSSS process computer under plant operating conditions.

b. Prerequisites

The preoperational tests have been completed, and the PSRC has reviewed and approved the test procedures and initiation of testing. Computer diagnostic test completed. Construction and construction testing on each input instrument and its cabling shall be completed.

c. Test Procedure

Computer system program verifications and calculational program validations at static and at simulated dynamic input conditions will be preoperationally tested at the computer supplier's site and following delivery to the plant site. Following fuel loading, during plant heatup and the ascension to rated power, the nuclear steam supply system and the balance-of-plant system process variables sensed by the computer as digital or analog signals will become available. Verify that the computer is receiving correct values of sensed process variables and that the results of performance calculations of the nuclear steam supply system and the balance-of-plant are correct. At steady-state power conditions, the Dynamic System Test Case will be performed.

As discussed in Test 19, the BUCLE off-line computation system will be used to evaluate core performance until the process computer performance is verified. A manual computation method is available at the site if both the process computer and BUCLE are not available.

d. Acceptance Criteria

Level 1

Not applicable

Level 2

Programs OD-1, Pl, and OD-6 will be considered operational when:

1. The MCPR calculated by BUCLE and the process computer either:

   (a) Are in the same fuel assembly and do not differ in value by more than 2 percent or,

   (b) For the case in which the MCPR calculated by the process computer is in a different assembly than that calculated by BUCLE, for each assembly, the MCPR and CPR calculated by the two methods shall agree within 2 percent.

2. The maximum LHGR calculated by BUCLE and the process computer either:

   (a) Are in the same fuel assembly and do not differ in value by more than 2 percent, or

   (b) For the case in which the maximum LHGR calculated by the process computer is in a different assembly than that calculated by BUCLE, for each assembly, the maximum LHGR and LHGR calculated by the two methods shall agree within 2 percent.

3. The MAPLHGR calculated by BUCLE and the process computer either:

   (a) Are in the same fuel assembly and do not differ in value by more than 2 percent, or

   (b) For the case in which the MAPLHGR calculated by the process computer is in a different assembly than that calculated by BUCLE, for each assembly, the MAPLHGR and APLHGR calculated by the two methods shall agree within 2 percent.

4. The LPRM calibration factors calculated by BUCLE and the process computer agree to within 2 percent.

5. The remaining programs will be considered operational upon successful completion of the static and dynamic testing.

14.2.12.3.12 Test Number 14 - RCIC System

a. Test Objective

The purposes of this test are to verify the proper operation of the reactor core isolation cooling (RCIC) system over its expected operating pressure and flow ranges and to demonstrate reliability in automatic starting from cold standby when the reactor is at power conditions.

b. Prerequisites

The preoperational tests have been completed and the PSRC has reviewed and approved the test procedures and initiation of testing.

c. Test Procedure

The RCIC system is designed to be tested in two ways: (1) by flow injection into a test line leading to the condensate storage tank (CST), and (2) by flow injection directly into the reactor vessel.

The earlier set of CST injection tests consists of manual and automatic mode starts at 150 psig and near rated reactor pressure conditions. The pump discharge pressure during these tests is throttled to be 100 psi above the reactor pressure to simulate the largest expected pipeline pressure drop. This CST testing is done to demonstrate general system operability and for making most controller adjustments.

Reactor vessel injection tests follow to complete the controller adjustments and to demonstrate automatic starting from a cold standby condition. "Cold" is defined as a minimum three days without any kind of RCIC operation.

After all final controller and system adjustments have been determined, a defined set of demonstration tests must be performed with that one set of adjustments. Two consecutive reactor vessel injections starting from cold conditions in the automatic mode must satisfactorily be performed to demonstrate system reliability. Following these tests, a set of CST injections are done to provide a benchmark for comparison with future surveillance tests.

After the auto start portion of certain of the above tests is completed, and while the system is still operating, small step disturbances in speed and flow command are input (in manual and automatic mode respectively) in order to demonstrate satisfactory stability. This is to be done at both low (above minimum turbine speed) and near rated flow initial conditions to span the RCIC operating range.

A demonstration of extended operation of up to two hours (or until pump and turbine oil temperature is stabilized) of continuous running at rated flow conditions is to be scheduled at a convenient time during the Startup test program.

The test sequence is summarized below:

Action	**Test Conditions**
1. Condensate storage tank injection, first phase manual start	For all RCIC testing; recirc. in POS mode and all other controllers in NORM mode B. Optional demonstration prior to controller adjustments at 150 psig reactor pressure C. Rated reactor pressure RCIC discharge 100 ± 20 psi above RPV
2. Condensate storage injection, step changes in flow for controller adjustments	A. Immediately after 1C with RCIC discharge to condensate storage tank. Manual and and automatic control modes.
3. Condensate storage tank injection, extended operation demonstration	A. In conjunction with 2A
4. Condensate storage tank injection, second phase. Hot quick start followed by stability demonstration	A. Rated reactor pressure, RCIC discharge 100 ±20 psi above RPV B. 150 psig reactor pressure RCIC discharge 100 ±20 psi above RPV
5. Reactor vessel injection, manual start, step changes for controller adjustments	A. Rated reactor pressure Manual and automatic modes
6. Reactor vessel injection hot quick start.	A. Rated reactor pressure automatic mode
7. Reactor vessel injection, cold quick start followed by stability demonstration	A. 150 psig reactor pressure, manual and automatic modes

A.

d. Acceptance Criteria

Level 1

1. The average pump discharge flow must be equal to or greater than the 100 percent rated value after 30 seconds have elapsed from automatic initiation at any reactor pressure between 150 psig (10.5 kg/cm^2) and rated.

2. The RCIC turbine shall not trip or isolate during auto or manual start tests.

NOTE: If any Level 1 criteria are not met, the reactor will only be allowed to operate up to a restricted power level defined by Figure 14.2-5 until the problem is resolved.

The basis for acceptance criteria were curves developed using the current water level control criteria and design procedure for RCIC performance. The water level criteria states that sufficient water must be maintained in the reactor vessel during abnormal transients such that the low pressure ECCS systems are not initiated. In the current design procedure, a simulation of a feedwater controller failure-minimum demand is used to evaluate the RCIC performance. The HPCS system is assumed to be inoperative, thus leaving only the smaller RCIC system to handle the inventory makeup.

The curves are only applicable to conditions of low RCIC flow or slow RCIC response and define operability in terms of RCIC performance and allowed reactor power. They are only applicable during the startup program and provide a means of continuing the test program while adjustments to the RCIC system are made.

Level 2

1. In order to provide an overspeed and isolation trip avoidance margin, the first and subsequent speed peaks associated with the transient quick start shall not exceed the rated RCIC turbine speed.

2. The speed and flow control loops shall be adjusted so that the decay ratio of any RCIC system related variable is not greater than 0.25.

3. The turbine gland seal air compressor shall be capable of preventing steam leakage to the atmosphere.

4. The differential pressure switch for the RCIC steam supply line high flow isolation trip shall be calibrated to actuate at the value specified in the plant Technical Specifications.

14.2.12.3.13 Test Number 16A - Selected Process Temperatures

a. Test Objective

The purposes of this test are 1) to assure that the measured bottom head drain temperature corresponds to bottom head coolant temperature during normal operations, 2) to identify any reactor operating modes that cause temperature stratification, 3) to determine the proper setting of the low flow control limiter for the recirculation pumps to avoid coolant temperature stratification in the reactor pressure vessel bottom head region, 4) to familiarize the plant personnel with the temperature differential limitations of the reactor system.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. System and test instrumentation have been calibrated.

c. Test Procedure

The adequacy of bottom drain line temperature sensors will be determined by comparing it with recirculation loop coolant temperature when core flow is 100 percent of rated.

During initial heatup while at hot standby conditions, the bottom drain line temperature, recirculation loop suction temperature, and applicable reactor parameters are monitored as the recirculation flow is slowly lowered to either minimum stable flow or the low recirculation pump speed minimum valve position, whichever is the greater. The effects of cleanup flow, CRD flow, and power level will be investigated as operational limits allow. Utilizing this data, it can be determined whether coolant temperature stratification occurs when the recirculation pumps are on and, if so, what minimum recirculation flow will prevent it.

Monitoring the preceding information during planned pump trips will determine if temperature stratification occurs in the idle recirculation loops or in the lower plenum when one or more loops are inactive.

All data will be analyzed to determine if changes in operating procedures are required.

d. Acceptance Criteria

Level 1

The reactor recirculation pumps shall not be started nor flow increased unless the coolant temperatures between the steam dome and bottom head drain are within 100 F (38 C).

The recirculation pump in an idle loop must not be started unless the loop suction temperature is within 50 F (28 C) of the active loop suction temperature, or the steam dome temperature if one pump is idle.

Level 2

Not applicable

14.2.12.3.13.1 Test Number 16B - Water Level Reference Leg Temperature

a. Test Objective

The purpose of this test is to measure the reference leg temperature and recalibrate the instruments if the measured temperature is different than the value assumed during the initial calibration.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. System and test instrumentation has been calibrated.

c. Test Procedure

To monitor the reactor vessel water level, four level instrument systems are provided. These systems are used, respectively, as follows:

1. Shutdown range - Water level measurement in cold, shutdown conditions

2. Narrow range - Feedwater flow and water level control functions

3. Wide range - Safety functions

4. Fuel range - Safety functions

The test will be done at rated temperature and pressure and under steady-state conditions, and will verify that the reference leg temperature of the instrument is the value assumed during initial calibration. If not, the instruments will be recalibrated using the measured value. The containment temperatures and drywell temperatures will be monitored during power ascension testing.

d. Acceptance Criteria

Level 2

1. The indicator readings on the Narrow Range Level System should agree within ±1.5 inches of the average reading.

2. The Wide Range Level System indicators should agree within ±6 inches of the average reading.

14.2.12.3.14 Test Number 17 - System Expansion

a. Test Objective

The purpose of the thermal expansion test is to confirm that the pipe suspension system is working as designed and that the pipe is free of obstructions that could constrain free pipe movement.

b. Prerequisites

The preoperational tests are complete; the PSRC has reviewed and approved the test procedure and initiation of testing. Instrumentation has been installed and calibrated.

c. Test Procedure

The thermal expansion tests consist of measuring displacements and temperatures of piping during various operating modes. The first power level used to verify expansion shall be as low as practicable. Thermal movement and temperature measurements shall be recorded at the following test points:

1. Reactor pressure vessel heatup and hold at, at least, one intermediate temperature before reaching normal operating temperature; at this time the drywell piping and suspension shall be inspected for obstruction or inoperable supports.

2. Reactor pressure vessel heatup and hold at normal operating temperature.

3. Main steam and recirculation piping heatup up and hold at normal operating temperature.

4. On three subsequent heatup cooldown cycles, measurements will be recorded at the operating and shutdown temperatures to measure possible shakedown effects.

The piping considered to be within the boundary of this test is listed below:

1. Main steam: Steam lines, including the RCIC piping on Line A, shall be tested. Those portions within the scope of the test are bounded by the reactor pressure vessel nozzles and the penetration head fittings.

2. Relief valve discharge piping: The piping attached to the main steam lines and bounded by the relief valve discharge flange and the first downstream anchor shall be within the scope of the test.

3. Recirculation piping: The recirculation piping, bounded by the reactor pressure vessel nozzles, is within the scope of the test. The RHR suction line from the branch connection to the penetration head fitting shall also be monitored during the tests.

4. Small attached piping: All small branch piping attached to those portions of the preceding piping is within the scope of the test. The small attached piping is bounded by the large pipe branch connection and the first downstream guide or anchor. Small branch pipes that cannot be monitored because of limited access are excluded from the scope of this test.

d. Acceptance Criteria

Correlation of Test Data and Analysis The predicted movements are based on mathematical calculations that are dependent on assumed nozzle movements and temperature distributions. The measured temperatures and nozzle movements must be compared with those assumed in the analysis to determine which analysis condition corresponds to the test condition. Only corresponding conditions can be used to evaluate test results. If the test conditions do not correspond to any of those assumed in the analysis, the evaluating GE Piping Design Engineer may find it necessary to calculate movements based on measurements, and compare the predicted movements with the measured movements to establish acceptability.

The thermal expansion acceptance criteria are based upon the actual movements being within a prescribed range of the movements predicted by analysis. Measured movements are not expected to correspond precisely with those mathematically predicted. Therefore, a range is specified for the measured movement. The ranges are based on consideration of measurement accuracy, suspension free play, and piping temperature distribution. If the measured movement remains within the specified range, the piping is expanding in a manner consistent with predictions and is therefore acceptable. For the locations to be monitored, predicted displacements and actual measurements will be compared.

Level 1

The Level 1 movement ranges provided in Table I and the Startup Test Procedure are intended to set bounds on thermal movement which, if exceeded, requires that the test be placed on hold. Pipe will not necessarily converge smoothly to predicted movements with increase in operating temperature: During the first part of the test, vessel movements will often move the pipe in a direction opposite of stress report predictions; the pipe may also advance in a stepwise fashion due to friction constraint. Level 1 criteria discount spurious movement measurements that could result in unnecessary test holds but still maintain safe limits on movement.

To assure that the criteria are applied at relevant test conditions, the criteria cannot be applied before the vessel and piping temperatures are at meaningful values. In addition, a voting logic is used to discount spurious movements due to instrument malfunction. If the free thermal expansion of the piping is obstructed, movement discrepancies would occur at multiple locations because of coupling effects; therefore, in specified cases, if only one instrument out of several indicates movements are not within Level 1 criteria, that measurement will be discounted as spurious.

Main Steam Thermal Evaluation - In accordance with the voting logic, main steam thermal limits have been exceeded if:

1. Both of the pairs of “M” transducers S2MX and S6MX or S6MY and S7MY exceed limits specified, or

2. Any of the other main steam “M” transducers exceed limits specified.

Main Steam Prerequisites - Thermal limits application:

1. Thermal transducers 1 and 5 must indicate that piping is at specified operating temperature.

2. Thermal transducers SA10 must indicate that the RCIC line is at specified operating temperature. (Applicable to steam line A only, when evaluating movement transducers SA2 and SA6.)

Recirculation Thermal Evaluation - In accordance with the voting logic, recirculation thermal limits have been exceeded if:

1. Both of the pair of "M" transducers R3MX and R5MX or R3MZ and R5MZ exceed limits specified, or

2. Any of the other recirculation "M" transducers exceed limits specified.

Recirculation Piping Prerequisites - Thermal limits application:

Recirculation thermal transducers must indicate that piping and vessel are at the specified operating temperature.

Level 2

Level 2 limits on piping displacements are provided in Table I.

14.2.12.3.15 Test Number 18 - Core Power Distribution

a. Test Objective

The purpose of this test is to determine the reproducibility of the TIP system readings.

b. Prerequisites

Preoperational tests are complete, and the PSRC has approved the test procedures and initiation of testing. The TIP system and process computer are operable. The reactor is at steady state.

c. Test Procedure

TIP reproducibility consists of a random noise component and a geometric component. The geometric component exists due to variation in the water gap geometry and TIP tube orientation from TIP location to location. Measurement of these components is obtained by taking repetitive TIP readings at a single TIP location, and by analyzing pairs of TIP readings taken at TIP locations which are symmetrical about the core diagonal of fuel loading symmetry.

One set of TIP data will be taken at the 50 percent power level and at least one other set at 75 percent power or above. TIP data will be taken with the reactor operating with an octant symmetric rod pattern and at steady-state conditions.

Table I
THERMAL EXPANSION EVALUATION CRITERIA

Pipeline Description	Sensor Identification	Level 1 Range	(inches)	Level 1 Range	(inches)
Steam Line A	SA2-MX	-2.310	-1.610	1.69	-2.24
	SA6-MX	-0.99	-3.12	-1.70	-2.35
	SA6-MY	1.08	-0.04	0.79	0.41
	SA6-MZ	1.78	0.33	1.18	0.93
	SA7-MY	2.75	1.58	2.26	2.21
	SA8-MY	1.42	0.66	1.17	0.91
	SA9-MX	-1.64	-2.44	-1.90	-2.19
Steam Line B	SB2-MX	-1.65	-2.35	-1.79	-2.22
	SB6-MX	-1.48	-3.48	-2.36	-2.59
	SB6-MY	1.86	-0.15	1.05	0.66
	SB6-MZ	-0.55	-2.56	-1.70	-1.41
Steam Line C	SC2-MX	-1.65	-2.35	-1.79	-2.22
	SC6-MX	-1.53	-3.53	-2.43	-2.65
	SC6-MY	1.93	-0.07	1.12	0.74
	SC6-MZ	2.56	0.55	1.70	0.74
Steam Line D	SD2-MX	-1.61	-2.31	-1.69	-2.24
	SD6-MX	-0.99	-3.12	-1.70	-2.35
	SD6-MY	1.29	0.16	0.79	0.41
	SD6-MZ	-1.78	-0.33	-1.18	-0.93
Recirc Loop A	RA1-MY	0.56	0.02	0.39	0.20
	RA2-MZ	0.65	1.15	0.78	1.02
	RA3-MX	-0.19	1.01	0.31	0.52
	RA3-MZ	-0.07	1.13	0.41	0.65
	RA5-MX	-1.15	0.37	-0.50	-0.28
	RA5-MY	-0.94	-2.94	-1.84	-2.03
	RA5-MZ	-0.84	0.72	-0.24	0.11
	RA6-MZ	-1.95	-0.01	-1.08	-0.88

Table I
THERMAL EXPANSION EVALUATION CRITERIA

Pipeline Description	Sensor Identification	Level 1 Range	(inches)	Level 1 Range	(inches)
Recirc Loop B	RB1-MY	0.56	0.02	0.39	0.20
	RB2-MZ	-0.65	-1.15	-0.78	-1.02
	RB3-MX	0.19	-1.01	-0.31	-0.52
	RB3-MZ	0.07	-1.13	-0.41	-0.65
	RB5-MX	1.15	-0.37	0.50	0.28
	RB5-MY	-0.94	-2.94	-1.84	-2.03
	RB5-MZ	0.84	-0.72	0.24	-0.11
	RB6-MZ	1.95	0.01	1.08	0.88

NOTE 1.:The listed limits are for operating conditions with the vessel and steam lines at 550 F and recirculation lines at 530 F.

Table II
TEMPERATURE TRANSDUCERS

Transducer A	B	C	D	Test Temperature Range (F)
SA1-T	SB1-T	SC1-T	SD1-T	70 to 561
SA5-T	SB5-T	SC5-T	SD5-T	70 to 561
SA10-T	-	-	-	70 to 561
RA4-T	RB4-T	-	-	70 to 528
-	RB7-T	-	-	70 to 528

The total TIP reproducibility is obtained by dividing the standard deviation of the symmetric TIP pair nodal ratios by √2. The nodal TIP ratio is defined as the nodal BASE value of the TIP in the lower right half of the core divided by its symmetric counterpart in the upper left half. The total TIP reproducibility value that is compared with the test criterion is the average value of the data sets taken.

The random noise uncertainty is obtained from successive TIP runs made at the common hole, with each of the TIP machines making six runs. The standard deviation of the random noise is derived by taking the square root of the average of the variances at nodal levels 5 through 22, where the nodal variance is obtained from the fractional deviations of the successive TIP values about their nodal mean value.

The geometric component of TIP reproducibility is obtained by statistically subtracting the random noise component from the total TIP reproducibility.

d. Acceptance Criteria

Level 1

Not applicable

Level 2

The total TIP uncertainty (including random noise and geometrical uncertainties), obtained by averaging the uncertainties for all data sets, shall be less than 6.0 percent.

14.2.12.3.16 Test Number 19 - Core Performance

a. Test Objective

The purposes of this test are: a) to evaluate the core thermal power and flow, and b) to evaluate whether the following core performance parameters are within limits: 1) maximum linear heat generation rate (MLHGR), 2) minimum critical power ratio (MCPR), and 3) maximum average planar linear heat generation rate (MAPLHGR).

b. Prerequisites

The preoperational tests have been completed, the PSRC has reviewed and approved the test procedures and initiation of testing. System instrumentation installed and calibrated and test instrumentation calibrated.

c. Test Procedure

The core performance evaluation is employed to determine the principle thermal and hydraulic parameters associated with core behavior. These parameters are:

Core flow rate
Core thermal power level
MLHGR
MAPLHGR
MCPR

The core performance parameters listed above will be evaluated by manual calculation techniques or may be obtained from the process computer.

If the process computer is used as a primary means to obtain these parameters, it must be proven that it agrees with BUCLE within 2 percent on all thermal parameters (see subsection 14.2.12.3.11), or the results must be corrected to do so. If the BUCLE and process computer results do not agree within 2 percent for any thermal parameter, the parameter calculated by the process computer will be corrected by a multiplication factor to bring it within the 2 percent criteria.

d. Acceptance Criteria

Level 1

Steady-state reactor power shall be limited to the rated MWt and values on or below the 105-percent steam flow rod line.

The MLHGR of any rod during steady-state conditions shall not exceed the limit specified by the plant Technical Specifications.

The MCPR during steady-state conditions shall not exceed the limit specified by the plant Technical Specifications.

The MAPLHGR during steady-state conditions shall not exceed the limit specified by the plant Technical Specifications.

Core flow shall not exceed its rated value.

14.2.12.3.17 Test Number 20 - Steam Production Startup Test

a. Test Objective

The purpose of this test is to demonstrate that the nuclear steam supply system is providing sufficient steam to satisfy all appropriate warranties as defined in the contract.

b. Prerequisites

All plant instrumentation used in performing the test shall be calibrated by methods mutually agreed upon by GGNS and GE.

Only equipment essential to normal plant operation shall be operating.

The reactor shall be at steady-state power and flow and at as-near rated conditions as possible.

c. Test Procedure

The warranty demonstration consists of recording sufficient data under steady-state conditions to determine the reactor power level, the pressure and quality of the steam, and the steam flow rate from the reactor.

The measurements will include the temperature, pressure, and flow rate of feed-flow entering the reactor; the energy added to the reactor water by the recirculation drive pumps; the flow rate through and the temperature entering and leaving the reactor cleanup system; the flow rate and temperature of the control rod drive cooling water; the carry over of reactor water into the steam lines; and the steam pressure outside the drywell near the MSIV.

Each set of measurements shall be taken at frequent intervals - every 5 or 10 minutes, as appropriate - for a total test run duration of 4 hours. The average measured quantity suitably corrected for all calibration factors, is used to determine the NSSS output during the test run. Where the contract requires a 100-hour demonstration, two test runs shall be made: one in the first 50 hours and one in the second 50 hours. The demonstrated output is the average of the values from the two test runs. During the balance of the 100 hours demonstration, the NSSS output shall be held constant within ±5 percent of the nominal steam flow rate as indicated by the installed plant feedwater instrumentation.

Should the 100-hour warranty run be interrupted once for any reason and a second subsequent time for any reason not due to the fault of the customer, subject to the provisions of the contract, it shall be repeated. If the test is interrupted a second or subsequent time for any reason due to the fault of the customer or the power grid to which the station is connected, it shall be resumed upon coming to full power and continued until the desired test period is accumulated, provided that the minimum continuous period full power operation has been 24 hours.

d. Acceptance Criteria

Level 1

The NSSS parameters as determined by using normal operating procedures shall be within the appropriate license restrictions.

The NSSS will be capable of supplying steam in an amount and quality corresponding to the final feedwater temperature and other conditions shown on the Rated Steam Output Curve in the NSSS technical description. The Rated Steam Output Curve provides the warrantable reactor vessel steam output as a function of feedwater temperature, as well as warrantable steam conditions at the outboard main steam isolation valves.

Thermodynamic parameters are consistent with the 1967 ASME Steam Tables. Correction techniques for conditions that differ from the preceding will be mutually agreed upon prior to the test performance.

14.2.12.3.18 Test Number 21 - Core Power - Void Mode

a. Test Objective

The purpose of this test is to measure the stability of the core power-void dynamic response and to demonstrate that its behavior is within specified limits.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. System instrumentation has been installed and calibrated and test instrumentation calibrated.

c. Test Procedure

The core power-void loop mode, that results from a combination of the neutron kinetics and core thermal hydraulic dynamics, is least stable near the natural circulation end of the rated 100 percent power rod line. A fast change in the reactivity balance is obtained by a pressure regulator step change (see Test 22) and by moving a very high worth rod only one or two notches.

d. Acceptance Criteria

Level 1

The transient response of any system-related variable to any test input must not diverge.

14.2.12.3.19 Test Number 22 - Initial Pressure Controller (IPC)

a. Test Objective

The purposes of this test are: a) to determine the optimum settings for the initial pressure control (IPC) loop by analysis of the transients induced in the reactor pressure control system by means of the pressure controller, b) to demonstrate the capability of the IPC to maintain stable pressure control for various IPC single failure situations and c) to demonstrate smooth pressure control transition between the control valves and bypass valves when reactor steam generation exceeds steam used by the turbine.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

The pressure set point will be decreased rapidly and then increased rapidly by about 10 psi (0.7 kg/cm^2), and the response of the system will be measured in each case. It is desirable to accomplish the setpoint change in less than 1 second. At specified test conditions, the load limit set point will be set so that the transient is handled by control valves, bypass valves, and both. The regulators will be tested by simulating a failure of a selected pressure regulator so that the other regulators will take over control. The response of the system will be measured and evaluated, and regulator settings will be optimized. The Grand Gulf plant has three pressure regulators. The average output of the three is the controlling value. When one channel deviates by a given amount, that channel is switched out and the averaged value of the other two is used for control.

d. Acceptance Criteria

NOTE: The criteria are applicable to beginning of life conditions. The controller settings necessary to meet these criteria are also adequate for end-of-cycle reactor conditions

Level 1

The decay ratio must be no greater than 1.0 for each pressure control system related process variable that exhibits oscillatory response to pressure controller changes.

Level 2

Pressure control system related variables may contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response must be less than or equal to 0.25.

Pressure control deadband, delay, etc., shall be small enough that steady-state limit cycles, if any, shall produce turbine steam flow variations no larger than ±0.5 percent of rated flow.

When in the recirculation POS mode, the pressure response time from initiation of pressure set point change to the turbine inlet pressure peak shall be less than or equal to 10 seconds.

For all pressure regulator transients, the peak neutron flux and/or peak vessel pressure shall remain below the scram settings by 7.5 percent and 10 psi, respectively (maintain a plot of power versus the peak variable values along the 100 percent rod line).

The variation in incremental regulation (ratio of the maximum to the minimum value of the quantity, "incremental change in pressure control signal/incremental change in steam flow," for each flow range) shall meet the following:

Percent of Steam Flow Obtained With Valves Wide Open	Variation
0 to 85%	≤4:1

Percent of Steam Flow Obtained With Valves Wide Open	Variation
85% to 97%	≤2:1
85% to 99%	≤5:1

14.2.12.3.20 Test Number 23 - Feedwater System

14.2.12.3.20.1 Test Number 23A - Feedwater Pump Trip

a. Test Objective

The purpose of this test is to demonstrate the capability of the automatic core flow runback feature to prevent low water level scram following the trip of one feedwater pump. This test will be performed after the Maximum Feedwater Runout Capability Test (23D).

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked and calibrated as appropriate.

c. Test Procedure

One of the two operating feedwater pumps will be tripped, and the automatic recirculation runback circuit will act to drop the power to within the capacity of the remaining feedwater pump. Prior to the test, a simulation of the feedwater pump trip will be done to verify the runback capability of the recirculation system.

d. Acceptance Criteria

Level 1

Not applicable

Level 2

A scram must not occur from low water level following a trip of one of the operating feedwater pumps. There should be greater than 3-inch water level margin to scram for a feedwater pump trip initiated at 100 percent power conditions.

14.2.12.3.20.2 Test Number 23B - Water Level Set Point, Manual Feedwater Flow Changes

a. Test Objective

The purpose of this test is to verify that the feedwater system has been adjusted to provide acceptable reactor water level control.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

Reactor water level set point changes of approximately 3 to 6 inches (8 to 15 cm) will be used to evaluate (and adjust, if necessary) the feedwater control system settings for all power and feedwater pump modes. The level set point changes will also demonstrate core stability to subcooling changes.

d. Acceptance Criteria

Level 1

The transient response of any level control system-related variable to any test input must not diverge.

Level 2

1. Level control system-related variables may contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response must be less than or equal to 0.25.

2. The open loop dynamic flow response of each feedwater actuator (turbine or valve) to small (10 percent) step disturbances shall be:

a.	Maximum time to 10 percent of a step disturbance	≤1.1 sec
b.	Maximum time from 10 percent to 90 percent of a step disturbance	≤1.9 sec
c.	Peak overshoot (percent of step disturbance)	≤15 percent

(1) The average rate of response of the feedwater actuator to large (>20 percent of pump flow) step disturbances shall be between 10 percent and 25 percent rated feedwater flow/second. This average response rate will be assessed by determining the time required to pass linearly through the 10 percent and 90 percent response point.

(2) The maximum settling time is ±5 percent; <14 seconds.

(d) At steady-state operation, the input scaling to the mismatch gain should be adjusted such that the mismatch gain output is within ±1 inch.

14.2.12.3.20.3 Test Number 23C - Loss of Feedwater Heating

a. Test Objective

The purpose of this test is to demonstrate adequate response to a feedwater temperature loss.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

The condensate/feedwater system will be studied to determine the single failure that will cause the largest loss in feedwater heating. This event will then be performed at between 80 and 90 percent power with the recirculation flow near its rated value.

d. Acceptance Criteria

Level 1

1. For the feedwater heater loss test, the maximum feedwater temperature decrease due to a single failure case must be 100 F. The resultant MCPR must be greater than the fuel thermal safety limit.

2. The increase in simulated heat flux cannot exceed the predicted Level 2 value by more than 2 percent. The predicted value will be based on the actual test values of feedwater temperature change and power level.

Level 2

The increase in simulated heat flux cannot exceed the predicted value referenced to the actual feedwater temperature change and power level.

14.2.12.3.20.4 Test Number 23D - Maximum Feedwater Runout Capability

a. Test Objective

The purpose of the test is to determine that the maximum feedwater runout capability is compatible with the safety analysis assumptions in subsection 15.1.2.3.2.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures, and initiation of instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

A feedwater runout transient is an input to the safety analysis, since it results in a positive reactivity insertion to the core. The pump performance curves will be used to determine the relationship between feedwater turbine speed, the feedwater flow rate and the reactor vessel pressure. The turbine speed range will then be calibrated with the maximum speed set with some margin below the speed which gives the maximum allowable flow at a vessel pressure of 1080 psia and the minimum speed determined by the speed which yields 0 percent flow at 865 psia vessel pressure. Additionally, for good level control system performance, it is highly desirable to allow: 1) 115 percent NBR flow at 1080 psia, and 2) 80 percent NBR flow at 1042 psia vessel pressure in the one pump tripped condition. If necessary, adjustments will be made to meet the above specifications. Adjustable equipment (e.g., feedpump turbine speed control loops, mechanical speed limiters, feedwater control system function generators, etc.) will be set to prevent the feedwater pumps from exceeding their maximum allowed output regardless of the feedwater controller action.

Data collected during plant operation will be used to verify that the preceding adjustments are adequate. The limited speeds should still provide adequate feedflow in the one feedpump trip case.

d. Acceptance Criteria

Level 1

Maximum speed attained shall not exceed the speeds which will give the following flows with the normal complement of pumps operating:

1. 130 percent flow at 1080 psia

2. 130 + 0.2 (1080 - P-rated) percent NBR at P-rated psia

Level 2

The maximum speed must be greater than the calculated speeds required to supply:

1. With rated complement of pumps - 115 percent NBR at 1080 psia

2. One feedwater pump tripped condition - 80 percent NBR at 1042 psia

14.2.12.3.21 Test Number 24 - Turbine Valve Surveillance

a. Test Objective

The purpose of this test is to demonstrate the acceptable procedures and maximum power levels for surveillance testing of the main turbine control, stop, and bypass valves without producing a reactor scram.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

Individual main turbine control, stop, and bypass valves are tested routinely during plant operation as required for turbine surveillance testing. At several test points the response of the reactor will be observed, and although it is not required, it is recommended that the maximum possible power level for performance of these tests along the 100 percent load line be established. First actuation should be between 45 and 65 percent power, and used to extrapolate to the next test point between 70 and 90 percent power and ultimately to the maximum power test condition with ample margin to scram. Note proximity to APRM flow bias scram point and fuel preconditioning envelope. The turbine valves will be tested manually and with the automatic turbine testing (ATT) feature of the turbine control system. Rate of valve stroking and timing of the close-open sequence will be such that the minimum practical disturbance is introduced and that fuels preconditioning limits are not exceeded.

d. Acceptance Criteria

Level 2

1. Peak neutron flux must be at least 7.5 percent below the scram trip setting. Peak vessel pressure must remain at least 10 psi below the high pressure scram setting. Peak heat flux must remain at least 5.0 percent below its scram trip point.

2. Peak steam flow at each line must remain 10 percent below the high flow isolation trip setting.

14.2.12.3.22 Test Number 25 - Main Steam Isolation Valves

14.2.12.3.22.1 Test Number 25A - MSIV Function Tests

a. Test Objective

The purposes of this test are: a) to functionally check the main steam line isolation valves (MSIVs) for proper operation at selected power levels, b) to determine isolation valve closure times, and c) to determine maximum power at which full closures of a single valve can be performed without a scram.

Prior to Startup Testing, data will be taken of actual MSIV stroke length and position limit switch actuation points by direct measurement at each MSIV. From this data, extrapolation factors for closure time will be calculated, and included in the Startup Test Procedures. During the startup test these factors, based on actual rather than assumed valve positions, will be applied to the closure times obtained by valve limit switch actuation signals to the control room.

The extrapolation factors to be used assume linear valve motion. However, errors in valve closure time determination due to any nonlinearity will be small and overshadowed by the effect of decreasing closure times due to steam line flow (by about 1 full second from no flow to full steam line flow), and is in the conservative direction. In addition, the extrapolation method is consistent with the method used to satisfy plant technical specifications surveillance testing of MSIV closure times.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

At 5 percent and greater reactor power levels, individual fast closure of each MSIV will be performed to verify its functional performance and to determine closure times. The MSIV closure times will be determined from the MSL isolation data. MSIV closure time nominally equals the interval from deenergizing solenoids until the valve reaches 90 percent closed, plus the period from 10 percent closed to 90 percent closed times 1/8.

To determine the maximum power level at which full individual closures can be performed without a scram, first actuation will be performed between 40 and 65 percent power and used to extrapolate to the next test point between 60 and 85 percent power, and ultimately to the maximum power test condition with ample margin to scram.

d. Acceptance Criteria

Level 1

The MSIV stroke time (t_s) for any individual valve shall be 3.0 seconds ≤ t_s ≤ 5.0 seconds. Total effective closure (t_t) (including delay time) for any individual MSIV shall be ≤ 5.5 seconds.

Level 2

During full closure of individual valves, peak vessel pressure must be 10 psi (0.7 kg/cm^2) below scram, peak neutron flux must be 7.5 percent below scram, and steam flow in individual lines must be 10 percent below the isolation trip setting. The peak heat flux must be 5 percent less than its trip point.

14.2.12.3.22.2 Test Number 25B - Full Reactor Isolation

a. Test Objective

The purpose of this test is to determine the reactor transient behavior that results from the simultaneous full closure of all MSIVs.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

A test of the simultaneous full closure of all MSIVs will be performed at 95 to 100 percent of rated thermal power. Correct performance of the RCIC and relief valves will be shown. Reactor process variables will be monitored to determine the transient behavior of the system during and following the main steam line isolation.

d. Acceptance Criteria

The acceptance criteria are based on the reactor beginning-of-life operating conditions at the time of the trip. A parametric study of these conditions will be available to adjust the criteria for variations in the actual initial conditions of the test.

Relief valve acceptance criteria are contained in startup test 26 (Relief Valve).

Level 1

1. The positive change in vessel dome pressure occurring within 30 seconds after closure of all MSIV valves must not exceed the Level 2 criteria by more than 25 psi. The positive change in simulated heat flux shall not exceed the Level 2 criteria by more than 2 percent of rated value.

2. Feedwater control system settings must prevent flooding of the steam lines.

Level 2

1. The RCIC system shall adequately take over water level protection. The relief valves must reclose properly (without leakage) following the pressure transient.

   For the full MSIV closure from full power, predicted analytical results based on beginning of cycle design-basis analysis, assuming no equipment failures and applying appropriate parametric corrections, will be used as the basis to which the actual transient is compared. The following table specifies the upper limits of these criteria during the first 30 seconds following initiation of the indicated conditions.

Initial Conditions		**Criteria**	
Power (%)	**Dome Pressure (psia)**	**Increase In Heat Flux (%)**	**Increase In Dome Pressure (psi)**
100	1040	*	*

*Defined in the Transient Safety Analysis Design Report.

2. Initial action of the RCIC and HPCS shall be automatic when water Level 2 is reached, and system performance shall be within specifications.

3. Recirculation runback shall occur. Recirculation pump trip shall be initiated when Level 2 is reached.

14.2.12.3.22.3 Test Number 25C - Main Steam Line Flow Venturi Calibration

a. Test Objective

The purpose of this test is to calibrate the main steam flow venturis at selected power levels over the entire core flow range. The final calibration takes place with the data accumulated along the 100 percent rod line.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

Beginning at approximately 40 percent core thermal power, pertinent plant data will be taken along the 75 percent rod line at selected power levels. The same process will be repeated along the 100 percent rod line. The accumulated data will then be compared against the calibration curves and a known flow source to verify that acceptable steam flow measurements have been made.

d. Acceptance Criteria

Level 1

Not applicable

Level 2

1. The accuracy of the flow venturis relative to the calibrated feedwater flow shall be at least ±5 percent of rated flow at flow rates between 20 and 120 percent of rated steam line flow. The repeatability/noise shall be within ±15 percent of rated flow.

2. The flow venturi dp shall be equal to or greater than 79.3 psi at rated steam flow.

14.2.12.3.23 Test Number 26 - Relief Valves

a. Test Objective

The purposes of this test are: (1.) to verify that the relief valves function properly (can be open and closed manually), (2.) to verify that the relief valves reseat properly after operation, (3.) to verify that there are no major blockages in the relief valve discharge piping, and (4.) to confirm proper overall functioning of the low-low set pressure relief logic.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

A functional test of each safety relief valve (SRV) shall be made as early in the startup program as practical. This is normally the first time the plant reaches 250 psig. The test is then repeated at rated reactor pressure. Bypass valves (BPV) response is monitored during the low pressure test and the electrical output response is monitored during the rated pressure test. The test duration will be about 10 seconds to allow turbine valves and tailpipe sensors to reach a steady state.

The tailpipe pressure sensor responses will be used to detect the opening and subsequent closure of each SRV. The BPV and electrical output responses will be analyzed for anomalies indicating a restriction in an SRV tailpipe. In addition GGNS will measure SRV tailpipe backpressure on the longest and shortest tailpipes.

Valve capacity will be based on certification by ASME code stamp with the applicable documentation being available in the on-site records. Note that the nameplate capacity/ pressure rating assumes that the flow is sonic. This will be true if the back pressure is not excessive.

A major blockage of the line would not necessarily be offset and it should be determined that none exists through the BPV response signatures.

Vendor bench test data of the SRV opening responses will be available on-site for comparison with design specifications.

During pressurization transients such as MSIV full closures and turbine trips/generator load rejection the operation of the safety grade low-low pressure relief logic system will be monitored. A comparison between the reactor pressure behavior and SRV actuations will be made to confirm open/close set points and containment load mitigation through the prevention of subsequent simultaneous SRV actuations. Recirculation drive flow, loop vibration, and pump head should be recorded for one pump as a non-cavitation check during low-low SRV action.

d. Acceptance Criteria

Level 1

1. There should be a positive indication of steam discharge during the manual actuation of each valve.

2. The low-low set pressure relief logic shall function to preclude subsequent simultaneous SRV actuations following the initial SRV actuation due to original pressurization transient.

Level 2

1. Pressure control system-related variables may contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response must be less than or equal to 0.25.

2. The temperature measured by thermocouples on the discharge side of the valves shall return to within 10 F of the temperature recorded before the valve was opened. Tailpipe pressure sensors shall return to their initial state upon valve closure.

3. During the 250 psig functional test the steam flow through each relief valve, as measured by the initial and final bypass valve position, shall not be less than 10 percent of valve position under the average of all valve responses.

4. During the rated pressure test the steam flow through each relief valve, as measured by electrical output shall not be less than 0.5 percent of rated MWe less than the average of all the valve responses.

5. When the low-low pressure relief logic functions the open/close actions of the SRVs shall occur within ±15 psi of their design points.

6. The reclosure pressure set point of all SRVs operating in non low-low set power mode will be no more than 120 psig below the nominal power mode set point.

7. Discharge line back pressure shall be compatible with information presented on the Nuclear Boiler Process Flow Diagrams.

14.2.12.3.24 Test Number 27 - Turbine Trip and Generator Load Rejection

a. Test Objective

The purpose of this test is to demonstrate the response of the reactor and its control systems to protective trips in the turbine and the generator.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. All controls and interlocks are checked and instrumentation calibrated.

c. Test Procedure

Turbine trip (closure of the main turbine stop valves within ~0.1 second) and generator load rejection (closure of the main turbine control valves in about 0.1 to 0.2 second) will be performed at selected power levels during the Startup Test Program. At low power levels (<40 percent), reactor protection is provided by high neutron flux and high vessel pressure scrams. At higher power levels (>40 percent), the reactor will scram by sensing loss of stop and control valve hydraulic fluid pressure in anticipation of valve closure. Backup scram action is provided by high neutron flux and high vessel pressure.

A generator load rejection will be performed at low power level such that nuclear boiler steam generation is just within bypass value capacity to demonstrate scram avoidance. For this test, the recirculation system is in manual, and the operator may intervene to prevent high or low water level scrams. At an intermediate power level, in excess of bypass capacity, a turbine trip will be performed, and the response of the plant to this trip and scram will be determined.

As 100 percent power is approached, there is little difference for a partial bypass valve capacity plant in the reactor pressure transient response to a generator or turbine trip event. However, the accident analysis shows the generator trip is the more limiting of the two. Additionally, for the GGNS breaker-and-a-half switchyard design, there is no automatic station service power switching which sometimes causes a different plant response to the turbine or generator trip at other BWRs. For these reasons and since the residual steam in the turbine may cause a slight overspeed, a generator trip at 100 percent power will be performed at GGNS.

It should be noted that above 40 percent power, the recirculation pump trip (RPT) feature automatically trips both recirculation pumps in response to both a turbine trip and a generator trip. The transient pressure rise will be limited by opening the bypass valves initially, and the safety valves later, if required.

d. Acceptance Criteria

The acceptance criteria for reactor pressure and heat flux are based on beginning-of-life conditions parameterized to allow for variations in the actual initial conditions of the test.

Bypass valve capacity is verified during steady-state operation at Test Condition 2 and dynamically during the generator load rejection which is done within bypass capacity at Test Condition 2.

A method of inducing a generator load rejection will be chosen which will maximize the expected turbine overspeed.

Level 1

1. For turbine and generator trips at power levels greater than 50 percent NBR, there should be a delay of less than 0.1 second following the beginning of control or stop valve closure before the beginning of bypass valve opening. The bypass valves should be opened to a point corresponding to greater than or equal to 80 percent of their capacity within 0.3 second from the beginning of control or stop valve closure motion.

2. Feedwater system settings must prevent flooding of the steam line following these transients.

3. The two pump drive flow coastdown transient during the first 3 seconds must be equal to or faster than that specified in Test 30 (see subsection 14.2.12.3.27).

4. The positive change in vessel dome pressure occurring within 30 seconds after either generator or turbine trip must not exceed the Level 2 criteria by more than 25 psi.

   The positive change in simulated heat flux shall not exceed the Level 2 criteria by more than 2 percent of rated value.

Level 2

1. There shall be no MSIV closure during the first three minutes of the transient, and operator action shall not be required during that period to avoid the MSIV trip.

2. The positive change in vessel dome pressure and in simulated heat flux which occurs within the first 30 seconds after the initiation of either generator or turbine trip must not exceed the predicted values.

   (Predicted values will be referenced to actual test conditions of initial power level and dome pressure and will use Beginning of Life (BOL) nuclear data. Worst case design or Technical Specification values of all hardware performance shall be used in the prediction, with the exception of control rod insertion time and the delay from beginning of turbine control valve or stop valve motion to the generation of the scram signal. The predicted pressure and heat flux will be corrected for the actual measured values of these two parameters.)

3. For the generator trip within the bypass valves capacity, the reactor shall not scram for initial thermal power values within that bypass valve capacity.

4. The measured bypass capability (in percent of rated power) shall be equal to or greater than 35 percent.

5. Low water level total recirculation pump trip, HPCS, and RCIC shall not be initiated.

6. Recirculation low frequency motor generator (MG) set shall take over after the initial recirculation pump trips, and adequate vessel temperature difference shall be maintained.

7. Feedwater level control shall avoid loss of feedwater due to high level (L8) trip during the event.

14.2.12.3.25 Test Number 28 - Shutdown From Outside the Main Control Room

a. <u>Test Objective</u>

The purpose of this test is to demonstrate that the reactor can be brought from a normal initial steady-state power level to the point where cooldown is initiated and under control with reactor vessel pressure and water level controlled from outside the control room.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate. Operating procedures governing remote shutdown have been approved. Communications, as required, are operable. All test participants have been thoroughly briefed in their duties.

c. Test Procedure

The test will be performed at a low power level and will consist of demonstrating the capability to scram and initiate controlled cooling from outside the control room. The reactor will be scrammed and isolated from outside the control room after a simulated control room evacuation. Reactor pressure and water level will be controlled using SRV, RCIC, and RHR from outside the control room during the subsequent cooldown. The cooldown will continue until the RHR shutdown cooling mode is placed in service from outside the control room. All other operator actions not directly related to vessel water level and pressure will be performed in the main control room.

d. Acceptance Criteria

Level 1

During a simulated control room evacuation, the reactor must be brought to the point where cooldown is initiated and under control, and the reactor vessel pressure and water level are controlled using equipment and controls outside the control room.

14.2.12.3.26 Test Number 29 - Recirculation Flow Control System

14.2.12.3.26.1 Test Number 29A - Valve Position Control

a. Test Objective

The purpose of this test is to demonstrate the capability of the recirculation flow control system when in the valve position (POS) mode.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. All controls are checked and instrumentation calibrated.

c. Test Procedure

The testing of the Recirculation Flow Control System follows a “building block” approach while the plant is ascending from low- to high-power levels. Components and inner control loops are tested first, followed by drive flow control and plant power maneuvers to adjust and then demonstrate the outer loop controller performance. While operating at low power, with the pumps using the low frequency power supply, small step changes will input into the position controller and the response recorded.

d. Acceptance Criteria

Level 1

The transient response of any recirculation system-related variables to any test input must not diverge.

Level 2

1. Recirculation system-related variables may contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response must be less than or equal to 0.25.

2. During Test Condition 3 and Test Condition 6, while operating on the high speed (60 Hz) source, gains and limiters shall be set to obtain the following responses:

   (a) Maximum rate of change of valve position shall be 10 ± 1 percent per second

   (b) Delay time for position demand step shall be:

   For step inputs of 0.5 percent to 5 percent - ≤0.15 second
   For step inputs of 0.2 percent to 0.5 percent (see Figure 14.2-7)

(c) Response time for position demand step shall be:

For step inputs of 0.5 percent to 5 percent - $\leq$0.45 second
For step inputs of 0.2 percent to 0.5 percent (see Figure 14.2-7)

(d) Overshoot after a small position demand input (1 to 5 percent) step shall be less than 10 percent of the magnitude of input.

14.2.12.3.26.2 Test Number 29B - Recirculation Flow Loop Control

a. Test Objective

The purposes of this test are a) to demonstrate the core flow system's control capability over the entire flow control range, including both core flow neutron flux and load following modes of operation, and b) to determine that all electrical compensators and controllers are set for desired system performance and stability.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. All controls are checked and instrumentation calibrated.

c. Test Procedure

Following the initial position mode tests of Test 29A, the final adjustment of the position loop gains, flow loop gains, and preliminary values of the flux loop adjustments will be made on the mid

power line. This will be the most extensive testing of the recirculation control system. The core power distribution will be adjusted by control rods to permit broader range of maneuverability with respect to PCIOMR. In general, the controller dials and gains will be raised to meet the maneuvering performance objectives. Thus, the system will be set to be the slowest that will perform satisfactorily, in order to maximize stability margins and to minimize equipment wear by avoiding controller overactivity.

Because of PCIOMR power maneuvering rate restrictions, the fast-flow maneuvering adjustments are performed along a midpower rod line, and an extrapolation made to the expected results along the 100-percent rod line.

For commercial operation, the flux loop and automatic load following loop will be set slower, and the operator will limit manual mode. If PCIOMRs are ever withdrawn, the tested faster auto settings can be inserted onto the controller with only a brief dynamic test, rather than a full startup test.

The automatic load following feature as discussed in AECM-85/0131 is a non-essential test and was not performed for GGNS Unit 1.

d. Acceptance Criteria

Level 1

The transient response of any recirculation system-related variable to any test input must not diverge.

Level 2

1. Flow Loop Criteria

(a) The decay ratio of the flow loop response to any test inputs shall be less than 0.25.

(b) The flow loops maintain equal steady-state flow in the two loops. Flow loop gains should be set to correct a flow imbalance in about 20 seconds ± 5 seconds.

(c) The delay time for flow demand step (less than or equal to 5 percent) shall be 0.4 seconds or less.

(d) The response time for flow demand step (less than or equal to 5 percent) shall be 1.1 seconds or less.

(e) The maximum allowable flow overshoot for step demand less than or equal to 5 percent of rated shall be 6 percent of the demand step.

(f) The flow demand step settling time shall be less than or equal to 6 seconds.

2. Flux Loop Criteria

(a) Flux overshoot to a flux demand step shall not exceed 2 percent of rated for a step demand less than or equal to 20 percent of rated.

(b) The delay time for flux response to a flux demand step shall be less than or equal to 0.8 second.

(c) The response time for flux demand step shall be less than or equal to 2.5 seconds.

(d) The flux setting time shall be less than or equal to 15 seconds for a flux demand step less than or equal to 20 percent of rated.

3. Load Following Loop Criteria

(a) The decay ratio of the load following response shall be less than or equal to .25 percent.

(b) The response to a step input of less than 10 percent in load demand shall be such that the load demand error is within 10 percent of the magnitude of the step within 10 seconds.

(c) When a load demand step of greater than 10 percent is applied (N percent), the load demand error must be within 10 percent of the magnitude of the step within N seconds. If PCIOMR restrictions apply, this test can be performed at a lower rod line and extrapolated to the rated rod line.

4. Scram Avoidance and General Criteria

For test maneuvers for any one of the above loops the trip avoidance margins must be at least the following:

(a) For APRM $\geq$7.5 percent

(b) For simulated heat flux $\geq$5.0 percent

(c) The load following loop response shall produce steam flow variations no greater than 0.5 percent of rated steam flow.

5. Flux Estimator Test Criteria

(a) Switching between estimated and actual flux should not exceed 5 times/5 minutes at steady-state.

(b) During flux step transient, there should be no switching to actual flux; or, if switching does occur, it should switch back to estimated flux within 20 seconds of the start of the transient.

6. Flow Control Valve Duty Test Criteria

The flow control valve duty cycle in any operating mode shall not exceed 0.2 percent Hz. Flow control valve duty cycle is defined as:

$$\frac{\text{Integrated valve movement in percent;(\% Hz)}}{\text{2 x time span in seconds}}$$

14.2.12.3.27 Test Number 30 - Recirculation System

14.2.12.3.27.1 Test Number 30A - One Pump Trip

a. Test Objective

The purposes of this test are 1) to obtain recirculation system performance data during the pump trip, flow coastdown, and pump restart, and 2) to verify that the feedwater control system can satisfactorily control water level without a resulting turbine trip/scram.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

Single recirculation pump trips will be made at designated power levels. Reactor operating parameters, such as water level, simulated heat flux, and APRM level will be recorded during the transient to determine margins with respect to limits.

d. Acceptance Criteria

Level 1

Not applicable

Level 2

1. The reactor water level margin to avoid a higher level trip shall be ≥3.0 inches during the one pump trip.

2. The simulated heat flux margin to avoid a scram shall be ≥5.0 percent during the one pump trip for recovery.

3. The APRM margin to avoid a scram shall be ≥7.5 percent during the one pump trip recovery.

4. The time from zero pump speed to full pump speed shall be greater than 3 seconds.

14.2.12.3.27.2 Test Number 30B - RPT Trip of Two Pumps

a. Test Objective

The purpose of the test is to record and verify acceptable performance of the recirculation two-pump circuit trip system.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

Both recirculation pumps are tripped at the designated power level, and the flow coastdown transient is recorded.

d. Acceptance Criteria

Level 1

The two-pump drive flow coastdown transient during the first 3 seconds must be bounded by the curves specified on Figure 14.2-6, adjusted for transmitter time delay and time constant.

Level 2

Not applicable

14.2.12.3.27.3 Test Number 30C - System Performance

a. Test Objective

The purpose of this test is to record recirculation system parameters during the power test program.

b. Prerequisites

The preoperational tests are complete; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

Recirculation system parameters will be recorded at several power-flow conditions and in conjunction with single-pump trip recoveries and internals vibration testing (if applicable).

d. Acceptance Criteria

Level 1

Not applicable

Level 2

1. The core flow shortfall shall not exceed 5 percent at rated power.

2. The drive flow shortfall shall not exceed 5 percent at rated power.

14.2.12.3.27.4 Test Number 30D - Recirculation Pump Runback

a. Test Objective

The purpose of this test is to verify the adequacy of the recirculation runback to mitigate a scram upon the loss of one feedwater pump.

b. Prerequisites

The preoperational tests have been completed. The PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

While operating at near rated recirculation flow, a loss of a feedwater pump will be simulated. The transient and final condition will be studied to determine the adequacy of the system in preventing a scram during the scheduled loss of a single feedwater pump test (Test 23A).

d. Acceptance Criteria

Level 1

Not applicable

Level 2

Not applicable

14.2.12.3.27.5 Test Number 30E - Recirculation System Cavitation

a. Test Objective

The purpose of this test is to verify that no recirculation system cavitation will occur in the operable region of the power-flow map.

b. Prerequisites

The preoperational tests have been completed. The PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

Both the jet pumps and the recirculation pumps will cavitate at conditions of high flow and low power where NPSH demands are high and little feedwater subcooling occurs. However, the recirculation flow will automatically run back upon sensing a decrease in subcooling (as measured by the difference between the main steam and recirculation loop temperature), to lower the reactor power. The maximum recirculation flow is limited by appropriate stops which will run back the recirculation flow away from the possible cavitation region. It will be verified that these limits are sufficient to prevent operation where recirculation pump or jet pump cavitation is predicted to occur. t is standard procedure to monitor the plant's process variables for changes indicating incipient cavitation during the approach to the interlock trip points. At Grand Gulf, this would include monitoring both standard recirculation process sensors and the sensors installed for the internal vibration test (No. 34).

d. Acceptance Criteria

Level 1

Not applicable

Level 2

Runback logic settings must be adequate to prevent operation in areas of potential cavitation.

14.2.12.3.28 Test Number 31 - Loss of Turbine-Generator and Offsite Power

a. Test Objective

The purpose of this test is to determine the reactor transient performance during the loss of the main generator and all offsite power, and to demonstrate acceptable performance of the station electrical supply system. Loss of offsite power will be maintained for sufficient time to demonstrate that necessary equipment, controls, and indications are available to remove decay heat from the core using only emergency power supplies and distribution systems.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate. Required electrical systems will be aligned for full-power operation.

c. Test Procedure

The loss of auxiliary power test will be performed at 20 to 30 percent of rated power. The proper response of reactor plant equipment, automatic switching equipment, and the proper sequencing of the diesel generator load will be checked. Appropriate reactor parameters will be recorded during the resultant transient. Offsite power will not be restored for at least 30 minutes. The reactor pressure acceptance criteria is based on a realistic prediction for the test condition.

d. Acceptance Criteria

Level 1

1. Reactor protection system actions shall prevent violation of fuel thermal limits.

2. All safety systems, such as the reactor protection system, the diesel generator (including start and load times), and HPCS, must function properly without manual assistance; and HPCS and/or RCIC system action, if necessary, shall keep the reactor water level above the initiation level of low pressure core spray, LPCI, and automatic depressurization systems.

Level 2

Proper instrument display to the reactor operator shall be demonstrated, including power monitors, pressure, water level, control rod position, suppression pool temperature, and reactor cooling system status. Displays shall not be dependent on specially installed instrumentation.

14.2.12.3.29 Test Number 33 - Drywell Piping Vibration

a. Test Objective

The purpose of this test is to verify that the main steam, recirculation, and RCIC steam piping vibration is within acceptable limits and to verify that, during operating transient loads, pipe stresses are within code limits.

b. Prerequisites

The preoperational tests are complete; the PSRC has reviewed and approved the test procedure and initiation of testing. Instrumentation has been installed and calibrated.

c. Test Procedure

This test is an extension of Test Number 17 (subsection 14.2.12.3.14), system expansion, and the preoperational vibration tests. Consult the specification of Test 17 for piping considered to be within the scope of testing.

Because of limited access due to high-radiation levels, no visual observation is required during the startup phase of the testing. Remote measurements of piping vibrations shall be made during the following steady-state conditions:

1. Recirculation flow at minimum flow
2. Recirculation flow at 50 percent of rated
3. Recirculation flow at 75 percent of rated
4. Recirculation and main steam flow at 100 percent of rated
5. RCIC turbine steam line at 100 percent of rated
6. RHR suction piping at 100 percent of rated flow in shutdown cooling mode

During the operating transient load testing, the amplitude of displacement and number of cycles per transient of the main steam and recirculation piping will be measured, and the displacements compared with acceptance criteria. Remote vibration and deflection measurements shall be taken during the following transients:

1. Recirculation pump start

2. Recirculation pump trip at 100 percent of rated flow

3. Turbine control valve closure at 100 percent power

4. Manual discharge of each SRV valve at 1,000 psig and at planned transient tests that result in SRV discharge

For the locations to be monitored, predicted displacements and actual measurements will be compared.

d. Acceptance Criteria

Level 1

1. Operating Transients: Level 1 limits on piping strain and displacements are prescribed in Table III and in the Startup Test Procedure. These limits are based on keeping the loads on piping and suspension components within safe limits. If any one of the transducers indicates that these movements have been exceeded, the test shall be placed on hold.

2. Operating Vibration: Level 1 limits on piping strain and displacement are prescribed in Table IV and in the Startup Test Procedure. These limits are based upon keeping piping stresses within safe limits. If any one of the transducers indicates that the prescribed limits are exceeded, the test shall be placed on hold.

Level 2

1. Operating Transients: Transducers have been placed near points of maximum anticipated movement. Where movement values have been predicted, maximum amplitudes are prescribed for the measured pipe vibration. These amplitudes are based on instrument accuracy and suspension free play. Where no movements have been predicted, limits on displacement have been

prescribed. Allowable amplitudes for each transducer are prescribed in Table III and in the Startup Test Procedure.

2. Operating Vibration: Acceptable levels of operating vibration are prescribed in Table IV and in the Startup Test Procedure. The evaluation criteria take two forms: limits on vibratory displacement and limits on strain. The limits have been set, based on consideration of analysis, operating experience, and protection of pipe-mounted components.

Table III
Transient Vibration Criteria

Pipeline Description	**Sensor Identification**	**Level 2 Peak-to-Peak Amplitude (inches)**	**Level 1 Peak-to-Peak Amplitude (inches)**
Steam Line A	SA6-DX	0.10	0.14
	SA6-DY	0.08	0.11
	SA6-DZ	0.07	0.10
	SA8-DY	0.060	0.110
	SA9-DX	0.060	0.476
Steam Lines B and C	SB6-DX/SC6-DX	0.12	0.20
	SB6-DY/SC6-DY	0.09	0.14
	SB6-DZ/SC6-DZ	0.08	0.12
Steam Line D	SD6-DX	0.10	0.14
	SD6-DY	0.08	0.11
	SD6-DZ	0.07	0.10
Recirc Loops A and B	RA3-DX/RB3-DX	0.060	0.082
	RA3-DZ/RB3-DZ	0.060	0.082
	RA5-DX/RB5-DX	0.060	0.107
	RA5-DY/RB5-DY	0.060	0.101
	RA5-DZ/RB5-DZ	0.060	0.086

Table III
Transient Vibration Criteria (Continued)

Pipeline Description	**Sensor Identification**	**Level 2 Peak-to-Peak Amplitude (inches)**	**Level 1 Peak-to-Peak Amplitude (inches)**
Steam Line A	SA3-S	0.257×10^{-3}	0.656×10^{-3}
	SA4-S	0.257×10^{-3}	0.656×10^{-3}
	SA11-S	0.010×10^{-3}	0.376×10^{-3}
	SA12-S	0.010×10^{-3}	0.376×10^{-3}
Steam Lines B and C	SB3-S/SC3-S	0.274×10^{-3}	0.660×10^{-3}
	SB4-S/SC4-S	0.274×10^{-3}	0.660×10^{-3}
Steam Line D	SD3-S	0.257×10^{-3}	0.656×10^{-3}
	SD4-S	0.257×10^{-3}	0.656×10^{-3}
Recirc Loop A	RA7-S	0.012×10^{-3}	0.277×10^{-3}
	RA8-S	0.012×10^{-3}	0.277×10^{-3}
	RA9-S	0.008×10^{-3}	0.277×10^{-3}
	RA10-S	0.008×10^{-3}	0.277×10^{-3}

NOTE 1.: The listed limits are for operating conditions with vessel and steam lines at 550 F and recirculation lines at 530 F.

STEADY-STATE VIBRATION CRITERIA

Pipeline Description	**Sensor Identification**	**Level 2 Peak-to-Peak Amplitude (inches)**	**Level 1 Peak-to-Peak Amplitude (inches)**
Steam Line A	SA6-DX	0.042	0.082
	SA6-DY	0.02	0.04
	SA6-DZ	0.06	0.12
	SA8-DY	0.054	0.110
	SA9-DX	0.238	0.476
Steam Lines B and C	SB6-DX/SC6-DX	0.066	0.132
	SB6-DY/SC6-DY	0.04	0.08
	SB6-DZ/SC6-DZ	0.088	0.176

STEADY-STATE VIBRATION CRITERIA

Pipeline Description	**Sensor Identification**	**Level 2 Peak-to-Peak Amplitude (inches)**	**Level 1 Peak-to-Peak Amplitude (inches)**
Steam Line D	SD6-DX	0.042	0.176
	SD6-DY	0.02	0.04
	SD6-DZ	0.06	0.12
Recirc Loops A and B	RA3-DX/RB3-DX	0.050	0.102
	RA3-DZ/RB3-DZ	0.058	0.116
	RA5-DX/RB5-DX	0.026	0.052
	RA5-DY/RB5-DY	0.024	0.046
	RA5-DZ/RB5-DZ	0.018	0.036
Steam Line A	SA3-S	0.059×10^{-3}	0.118×10^{-3}
	SA4-S	0.059×10^{-3}	0.118×10^{-3}
	SA11-S	0.041×10^{-3}	0.081×10^{-3}
	SA12-S	0.041×10^{-3}	0.081×10^{-3}
Steam Lines B and C	SB3-S/SC3-S	0.087×10^{-3}	0.173×10^{-3}
	SB4-S/SC4-S	0.087×10^{-3}	0.173×10^{-3}
Steam Line D	SD3-S	0.059×10^{-3}	0.118×10^{-3}
	SD4-S	0.059×10^{-3}	0.118×10^{-3}
Recirc Loop A	RA7-S	0.025×10^{-3}	0.05×10^{-3}
	RA8-S	0.025×10^{-3}	0.05×10^{-3}
	RA9-S	0.025×10^{-3}	0.05×10^{-3}
	RA10-S	0.025×10^{-3}	0.05×10^{-3}

NOTE 1.: The listed limits are for operating conditions with vessel and steam lines at 550 F and recirculation lines at 530 F.

14.2.12.3.30 Test Number 34 - Vibration Measurements

a. Test Objective

The purposes of this test are to obtain vibration measurements on the reactor internal components and to demonstrate the mechanical integrity of the system to flow-induced vibration. Testing is in response to NRC Regulatory Guide 1.20 which describes a vibration measurement program and an inspection program.

b. Prerequisites

Test procedures and initiation of testing have been approved by the PSRC. All instrumentation has been checked and calibrated.

c. Test Procedure

Vibration amplitudes and frequencies obtained from the sensors mounted on the various components will be monitored and recorded. The measured amplitudes and frequencies are then compared to the acceptance criteria to ensure that all measured vibration amplitudes are within acceptable levels.

The test program consists of preoperational tests, precritical tests, and hot power tests performed with the system at normal operating pressure and temperature.

Sensors used for the measurements are resistance wire strain gages, displacement sensors, and accelerometers with double integrating output signal conditioning. Sensors will be installed in a manner to indicate the most probable mode of vibration as indicated by analysis.

d. Acceptance Criteria

Level 1

The peak stress intensity may exceed 10,000 psi (single amplitude) when the component is deformed in a manner corresponding to one of its normal or natural modes, but the fatigue usage factor must not exceed 1.0.

Level 2

The peak stress intensity shall not exceed 10,000 psi (single amplitude) when the component is deformed in a manner corresponding to one of its normal or natural modes. This is the low stress limit which is suitable for sustained vibration in the reactor environment for the design life of the reactor components.

14.2.12.3.31 Test Number 35 - Recirculation System Flow Calibration

a. Test Objective

The purpose of this test is to perform complete calibration of the installed recirculation system flow instrumentation.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

During the testing program at operating conditions which allow the recirculation system to be operated as would be required to achieve rated flow at rated power, the jet pump flow instrumentation will be adjusted to provide correct flow indication based on the jet pump flow. After the relationship between drive flow and core flow is established, the flow biased APRM system will be adjusted to match this relationship.

d. Acceptance Criteria

Level 1

Not applicable

Level 2

Jet pump flow instrumentation shall be adjusted such that the jet pump total flow recorder will provide a correct core flow indication at rated conditions.

The APRM flow-bias instrumentation shall be adjusted to function properly at rated conditions.

The flow control system shall be adjusted to limit the maximum core flow to 102.5 percent of rated by limiting the flow control valve opening position.

14.2.12.3.32 Test Number 36 - Isolation Reactor Stability

a. Test Objective

The purposes of this test are a) to demonstrate that an isolated reactor has satisfactory dynamic stability at very low power and medium-to-high-pressure conditions and b) to determine any higher pressure operating restrictions due to isolated reactor instability.

b. Prerequisites

The preoperational tests have been completed. The PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

To enable use of several BWR alternative operational capabilities, each reactor must first demonstrate its dynamic capability in the hot isolated situation. To be able to perform a black startup without external power, or to operate the RHR system in the steam condensing mode, any operating upper boundary on isolated reactor pressure must be determined. This test serves to demonstrate the reactor stability and to help define related operating procedures and limits.

To take transient data, the plant simulates the MSIV closed situation by closing both the main turbine stop valves and bypass valves at about 600 psig reactor pressure. Transient data can be recorded, knowing that the pressure set point can be quickly lowered to go on BPV control to stabilize any unexpected oscillations and thus avoid a plant trip and subsequent test delays.

Two dynamic disturbances are used to observe the isolated reactor transient. One is to move a control rod in and out, and the second is to trip open one BPV and reclose it. These maneuvers are performed with the reactor at very low power (less than 2 percent) and at two pressure conditions (about 600 psig and again at 900-950 psig). The main feedwater pumps will be off and makeup water will be supplied by the RCIC and/or CRD Systems. The recirculation pumps are also off and the MSIVs opened.

d. Acceptance Criteria

Level 1

Not applicable

Level 2

1. The transient response of any system-related variable to any test input must not diverge.

2. For expected small- and medium-sized inputs or disturbances, the reactor must not diverge beyond a scram trip setting in less than 3 minutes.

3. Any steady pressure limit cycle shall not exceed ± 100 psi. For those limit cycles whose period is less than 10 seconds, the allowed maximum is ± 20 psi.

14.2.12.3.33 Test Number 70 - Reactor Water Cleanup System

a. Test Objective

The purpose of this test is to demonstrate specific aspects of the mechanical ability of the reactor water cleanup system. (This test, performed at rated reactor pressure and temperature, is actually the completion of the preoperational testing that could not be done without nuclear heating.)

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

With the reactor at rated temperature and pressure, process variables will be recorded during steady-state operation in three modes as defined by the System Process Diagram: Blowdown, Hot Shutdown with loss of RPV recirculation pumps, and Normal.

The calibration of bottom head flow indicator G33-R610 will be checked. With the RWCU system taking flow from only the RPV bottom head and using RWCU flow indicator G33-R609 as standard, five data points are taken from approximately 75 gpm to maximum flow. The maximum flow rate in the bottom head drain line section of the RWCU is not exceeded, as specified for the Hot Shutdown with loss of RPV recirculation pumps mode, and the 70 gpm trip set point for low suction is not approached.

d. Acceptance Criteria

Level 1

Not applicable

Level 2

1. The temperature at the tube side outlet of the nonregenerative heat exchangers shall not exceed 130 F (54 C) in the Blowdown mode and shall not exceed 120 F in the Normal mode.

2. The pump available NPSH will be 13 feet or greater during the Hot Shutdown with loss of RPV recirculation pumps mode, as defined in the process diagrams.

3. The cooling water supplied to the nonregenerative heat exchangers shall be within the flow and outlet temperature limits indicated in the process diagrams and system specification.

4. During two-pump operation at rated core flow, the bottom head temperature as measured by the bottom drain line thermocouple should be within 30 F (17 C) of the recirculation loop temperatures.

5. Recalibrate bottom head flow indicator (R610) against RWCU flow indicator (R609) if the deviation is greater than 10 gpm.

6. Pump vibration shall be less than or equal to the limits given by the Hydraulic Institute Standards.

14.2.12.3.34 Test Number 71 - Residual Heat Removal System

a. Test Objective

The purpose of this test is to demonstrate the ability of the residual heat removal (RHR) system to remove the residual and decay heat from the nuclear system so that refueling and nuclear servicing can be performed and to condense steam while the reactor is isolated from the main condenser.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

With the reactor above 10 percent power, the condensing mode of the RHR system will be tuned and demonstrated. Condensing heat exchanger performance characteristics will be demonstrated. Final demonstration of the condensing mode will be done from an isolated condition. During the first suitable reactor cooldown, the shutdown cooling mode of the RHR system will be demonstrated. The decay heat load is insignificant during the startup test period. Use of this mode with low core exposure could result in exceeding the 100 F/hr cooldown rate of the vessel if both RHR heat exchangers are used simultaneously. Late in the test program, after accumulating significant core exposure, this demonstration will more adequately demonstrate the heat exchanger capacity.

d. Acceptance Criteria

Level 1

The transient response of any system-related variable to any test input must not diverge.

Level 2

The RHR system shall be capable of operating in the steam condensing, suppression pool cooling, and shutdown cooling modes (with both one and two heat exchangers) at the flow rates and temperature differentials indicated on the process diagrams. System-related variables may contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response must be less than or equal to 0.25.

14.2.12.3.35 Test Number 72 - Drywell Cooling System

a. Test Objective

The purpose of this test is to verify the ability of the drywell atmosphere cooling system to maintain design conditions in the drywell during operating conditions and post-scram conditions.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

During heatup and power operation, data will be taken to ascertain that the drywell atmospheric conditions are within design limits.

d. Acceptance Criteria

Level 2

The drywell cooling system shall maintain drywell air temperature and humidity at or below the design values as specified for the NSSS equipment.

14.2.12.3.36 Test Number 74 - Offgas System

a. Test Objective

The purpose of this test is to verify the proper operation of the offgas system over its expected operating parameters.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Procedure

The N64 offgas system is designed to provide for holdup and decay of radioactive gases in the offgas from the air ejector system before discharge to the atmosphere. The offgas system further minimizes the release of radioactive particulate matter into the atmosphere and also minimizes the ignition potential in the offgas through recombination of radiolytic hydrogen and oxygen under controlled conditions.

The offgas system consists of preheaters, catalytic recombiners, condensers, gas coolers, desiccant dryers, high efficiency filters, activated carbon adsorbers, refrigerated glycol solution storage and pumping equipment, vault refrigerators, and the necessary piping, valves, monitoring equipment, process instrumentation, and controls. The driving force for the system flow is provided by the last stage air ejector of the main condenser air ejector assembly. In the event of a low dilution steam flow, a valve in the process offgas line between the main condenser and the steam jet air ejector closes automatically and remains closed until proper steam flow has been established. An air purge is provided for drying out the system at startup and for purging gas mixtures prior to maintenance. Throughout most of the offgas system, there are two parallel lines of piping and equipment; the second line is to be used as standby equipment should the first line malfunction.

System Flow/Pressure - At startup flow, the pressures at selected locations will be recorded and checked to see that they are within design specifications. Pressure recordings will be taken again at normal operating flow.

The following offgas system tests will be done at various power levels throughout plant startup while at steady-state conditions:

Hydrogen Analyzer - Check that the hydrogen analyzer is functioning and record the level of hydrogen in the recombiner effluent.

Dew Point - Check that the dew point in the offgas system complies with design specifications.

Temperature - Monitor the temperature of the charcoal vault, charcoal beds, the active and standby catalytic recombiner, glycol tank, and the cooler-condenser discharge to see that the specified limits are met.

Recombiner Performance - Since the recombiner performance is least efficient in the 10 percent to 20 percent power range, it should be inspected closely in this range for correct initial operation. This is done by comparing the percentage of hydrogen dry discharge (as a function of the catalyst bed temperature) to expected performance values.

Dilution Steam Flow - Readings of the offgas dilution steam flow are taken to ensure that a hydrogen concentration of less than or equal to 4 percent is maintained in the recombiner feed.

Radionuclide Residence Times - Provided that reasonable and sufficient fission gases are present in the offgas, measurements should be made of at least one radionuclide to determine the decontamination factor(s) across one or several charcoal beds.

Pre and After Filters - If sufficient particulate fission gas daughter products are present, measurements of decontamination factors across the pre and after filters should be made. This is to confirm that the filters are operating properly during normal operating conditions.

Radiolytic Gas Production - Calculate the radiolytic gas production rate based on recombiner differential temperatures and verify that the production rate is within the design value.

Desiccant Dryer Performance - Monitor the effluent dew point of a desiccant bed during its operating cycle to verify that discharge limits are met.

d. Acceptance Criteria

Level 1

The release of radioactive gaseous and particulate effluents must not exceed the limits specified in the site Technical Specifications.

Flow of dilution steam to the noncondensing stage must not fall below 92 percent of the specified normal value when the steam jet air ejectors are pumping.

Level 2

The system flow, pressure, temperature, and dew point shall comply with the process data sheets supplied to the site.

The catalytic recombiner, the hydrogen analyzer, the desiccant dryers, the activated carbon beds, and the filters shall be working properly during operation, i.e., there shall be no gross malfunctioning of these components.

14.2.12.3.37 Test Number 75 - Cooling Water Systems

a. Test Objective

The purpose of this test is to verify that the component closed cooling water (CCW) system, the turbine building cooling water (TBCW) system, and standby service water (SSW) systems are adequate to remove plant heat loads with the reactor at rated temperature.

b. Prerequisites

The preoperational tests are complete; the PSRC has approved the test procedures and initiation of testing.

c. Test Procedure

Following initial heatup, with the reactor at rated temperature, data will be taken to verify that the CCW, TBCW, and SSW systems are capable of adequately removing plant heat loads. Flow rate adjustments will be made as necessary to achieve satisfactory system performance. The test will be repeated at selected power levels to verify continued satisfactory performance at higher heat loads.

d. Acceptance Criteria

Level 2

The TBCW, CCW, and SSW systems remove plant heat loads and maintain plant cooling requirements. The TBCW and CCW systems supply cooling water at 95 F or less. The SSW system supplies cooling water at 90 F or less.

14.2.12.3.38 Test Number 76 - ESF Equipment Area Cooling

a. Test Objective

The purpose of this test is to verify that the RCIC, and RHR “A” and “B” room coolers are capable of removing the postulated post-accident design heat loads.

b. Prerequisites

The preoperational tests are complete; the PSRC has approved the test procedures and initiation of testing.

c. Test Procedure

In conjunction with the RCIC, and RHR “A” and “B” pumps running under nuclear heat conditions, perform a heat balance on the associated room coolers and extrapolate the results to post-accident design heat load conditions. The heat balances will be performed by measuring air or water flows and temperatures. These data will be used to determine each cooler's heat transfer characteristics.

d. Acceptance Criteria

Level 2

The RCIC, and RHR “A” and “B” room coolers are capable of removing the postulated post-accident design heat loads.

14.2.12.3.39 Test Number 77 - MSIV Leakage Control System

a. Test Objective

The purpose of this test is to demonstrate the ability of the MSIV leakage control system (MSIV-LCS) to depressurize the piping between the MSIVs and outboard motor-operated isolation valve, maintain this piping at a slight subatmospheric pressure, and direct allowable MSIV leakage into the secondary containment for treatment by the standby gas treatment system.

b. Prerequisites

The preoperational tests are complete; the PSRC has reviewed and approved the test procedures and initiation of testing.

c. Test Procedure

The reactor will be scrammed or shut down from rated temperature and pressure, and the MSIVs will be subsequently closed. It will be demonstrated that after being manually placed in service, the MSIV-LCS inboard and outboard subsystems can be initiated provided reactor and main steam line pressure are below 20 psig permissives. The piping between the MSIVs will be depressurized, and the inboard and outboard blowers will take suction there maintaining slightly subatmospheric pressure while discharging to secondary containment in the long term leakage control mode.

d. Acceptance Criteria

Level 2

1. Upon being manually placed in service, the inboard and outboard MSIV-LCS subsystems initiate automatically.

2. The inboard and outboard MSIV-LCS subsystems depressurize the piping within the allowed time limits.

3. The inboard and outboard MSIV-LCS blowers maintain the piping between the MSIVs slightly subatmospheric by removing the existing MSIV leakage.

14.2.12.3.39a Test Number 78 - In-Plant Safety Relief Valve Test

a. Test Objectives

The purposes of this test are (a) to verify the design adequacy of the plant piping equipment and structures for the hydrodynamic loads imposed during actuation of the SRVs and (b) to expand the existing Mark III containment data base to verify that design predictions of SRV discharge line pressures, suppression pool boundary pressures, strains on submerged structures, and the response of piping equipment and buildings are conservative.

b. Prerequisites

The preoperational tests have been completed; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

c. Test Description

Initially, shakedown tests are included in the test matrix to ensure correct operation of the instrumentation and the data acquisition system.

The test matrix provides for single valve actuations of one of the SRVs to demonstrate and determine the internal line and quencher pressures. The test matrix also provides for multiple valve actuations to demonstrate and determine symmetrical and asymmetrical design load cases by discharging groups of SRVs and sequential SRV actuations.

d. Acceptance Criteria

Level 1

Level 1 criteria have been established to ensure that the plant is operated within design and Technical Specification limits as outlined by the supplemental documents which are a part of the startup test procedure.

Level 2

Level 2 criteria have been established to monitor parameters as related to expected performance during the testing as outlined by the supplemental documents which are a part of the startup test procedure.

14.2.12.3.40 Test Number 79 - Penetration Cooling

a. Test Objectives

The purpose of this test is to demonstrate the ability to cool the concrete surrounding selected high temperature water-cooled and non-water-cooled pipe penetrations in the containment wall with the minimum design capability of cooling system components available.

b. Prerequisites

The preoperational tests are complete; the PSRC has reviewed and approved the test procedures and initiation of testing. Instrumentation has been installed and calibrated.

c. Test Procedure

The penetration cooling tests consist of measuring guard pipe temperatures surrounding selected main steam and RCIC piping penetrations in the auxiliary building. The RCIC piping penetration which will be monitored is the RCIC steam supply line, containment/ auxiliary building penetration number 17. Measurements from a series of temperature sensors will be taken at rated reactor temperature in several test conditions. The measurements will be compared to the analytically permitted temperatures for both Level 1 and Level 2 criteria. The main steam line tunnel temperature will be monitored during power ascension testing.

d. Acceptance Criteria

Level 1

The guard pipe temperature adjacent to the selected containment penetrations shall not exceed the analytically predicted value which corresponds to a maximum concrete temperature of 230 F.

Level 2

The guard pipe temperature adjacent to the selected containment penetrations shall not exceed the analytically predicted value which corresponds to a maximum concrete temperature of 200 F.

14.2.12.4 Special Test Procedures

Special tests are those tests which do not fall clearly into the preoperational or startup test categories. For example, they may begin during the preoperational test phase and continue through the startup test phase. The following general descriptions define the objectives for each special test.

14.2.12.4.1 Special Test Number 1 - Visual Steady-State Vibration Monitoring Program

a. Test Objectives

The purpose of this test is to verify that steady-state vibrations and transient-induced pipe motion are within acceptable limits for Non-NSSS Safety-Related Piping, designated as ASME Class 1, 2, or 3.

b. Prerequisites

The system piping to be tested is supported and restrained in conformance with the design drawings. Instrumentation has been installed and calibrated.

c. Test Procedure

During preoperational testing, the system piping will be visually inspected for vibration. If visual inspection detects questionable vibration, the system will be checked using a vibration monitor. Transient loads on selected systems will be obtained by monitoring pump stop/start events.

d. Acceptance Criteria

The measured piping vibrations shall be within the following limits:

0.125 inch (peak to peak) for nuclear piping

0.250 inch (peak to peak) for nonnuclear piping

Dynamic movements measured during transient loading shall be within the margin of 25 percent or 0.25 inch, whichever is greater, of the analytical value.

The total stress due to dynamic loading, plus all other combined stresses, shall not exceed ASME Section III, or ANSI B31.1 allowable stresses.

14.2.12.4.2 Special Test Number 2 - Verification Test of Pipe Vibration and Temperature Sensors on NSSS Piping

a. Test Objective

The purpose of this test is to verify operability and calibration of the temporary instrumentation (C88) used to measure thermal expansion and vibration on NSSS piping.

b. Prerequisites

Displacement and temperature sensors on NSSS piping must be calibrated. Main steam piping must be at ambient temperature. Recirculation piping must be at ambient temperature and filled with water.

c. Test Procedure

This test is performed by doing pull tests on the lanyard potentiometers and doing heat response tests on the RTDs and verifying that these sensors are operable.

d. Acceptance Criteria

The cold pipe condition must be 0 inch on lanyard pot channels (0 V dc ±250 mV) and must return to the original reading after being pulled ±25 mV.

The RTD channels should read ambient temperature of the pipe ±3 F and should return to that reading within 3 minutes of the removal of the heat source +3 F, -0 F.

14.2.12.4.3 Special Test Number 3 - NSSS Piping Pre-operational Monitoring Program

a. Test Objective

The purpose of this test is to verify that the reactor main steam system and recirculation system piping have no obstruction to thermal expansions, its suspension components are functioning in the specified manner, and thermal expansions and vibrations are as predicted.

b. Prerequisites

The system piping to be tested is supported and restrained in conformance with the design drawings. Instrumentation has been installed and calibrated, as appropriate.

c. Test Procedure

During the initial reactor pressure vessel heatup in preoperational testing, the main steam and recirculation piping will be visually inspected, and remote thermal expansion measurements will be obtained while at 300 F ±50 F and at the maximum preoperational temperature.

In addition, this piping will be visually inspected, and remote vibration measurements will be obtained with the recirculation system at minimum flow, intermediate flow, and maximum preoperational flow, for steady-state vibration.

Remote vibration and deflection measurements will be obtained during the recirculation pump cold starts and the recirculation pump trips from maximum preoperational flow for transient vibration.

The following piping shall be within the boundaries of this test:

1. Main Steam Piping - Steam lines including the RCIC piping on Line A shall be tested. Those portions within the scope of the test are bounded by the reactor pressure vessel nozzles and the drywell penetration head fittings.

2. Recirculation Piping - The recirculation piping, bounded by the reactor pressure vessel nozzles, is within the scope of the test. The RHR suction line from the branch connection to the drywell penetration head fitting shall also be monitored during the tests.

d. Acceptance Criteria

The piping response to test conditions shall be considered acceptable if it is within the limits specified or if the GE Piping Design Subsection reviews the test results and determines that the tests verify that the piping responded in a manner consistent with the predictions of the stress report or that the tests verify that piping stresses are within the ASME Code limits.

Thermal Expansion Evaluation - Pipe will not necessarily converge smoothly to predicted movements with an increase in temperature. During the first part of the test, vessel movements will often move the pipe in a direction opposite that of stress report predictions. The pipe may also advance in a stepwise fashion due to friction constraint. To ensure that the thermal limits are applied at relevant test conditions, the limits cannot be applied before the vessel and piping temperatures are stabilized at the values specified. In addition, a voting logic is used to discount spurious movements due to instrument malfunction. If the free thermal expansion of the piping is obstructed, movement discrepancies would occur at multiple locations because of coupling effects; therefore, in specified cases, if only one instrument out of a pair indicates movements are not within limits, that measurement will be discounted as spurious.

Main Steam Thermal Evaluation - In accordance with the voting logic, main steam thermal limits have been exceeded if:

1. Any of the following pairs exceed limits (both transducers must exceed limits):

   SA2-MX and SA6-MX
   SB2-MX and SB6-MX
   SC2-MX and SC6-MX
   SD2-MX and SD6-MX
   SA6-MY and SA7-MY
   SB6-MY and SB7-MY
   SC6-MY and SC7-MY
   SD6-MY and SD7-MY

2. Any of the other individual main steam transducers exceed limits.

Main Steam Prerequisites - Thermal limits application:

1. The RTDs must indicate that piping is at the specified operating temperature.

2. RTD lC88-SAIO-T must indicate that the RCIC line is at the specified operating temperature, when evaluating thermal movements of the RCIC line and the following steam line A transducers: SA6-MX, SA6-MY, SA6-MZ, and SAZ-MX.

Recirculation Thermal Evaluation - In accordance with the voting logic, recirculation thermal limits have been exceeded if:

1. Any of the following pairs exceed limits (both transducers must exceed limits):

   RA3-MX and RA5-MX
   RB3-MX and RB5-MX
   RA3-MZ and RA5-MZ
   RB3-MZ and RB5-MZ

2. Any of the other individual recirculation system transducers exceed limits.

Recirculation Piping Prerequisites - Thermal limits application. Recirculation system RTDs must indicate that piping and vessel are at the specified operating temperatures.

Vibration Evaluation - Limits have been exceeded if any one of the transducers exceeds the transient or steady-state limits specified.

Level 1

During the course of the tests, the remote measurements shall be regularly checked to determine compliance with Level 1 limits. If trends indicate that Level l limits may be violated, the measurements shall be monitored at more frequent intervals. The test shall be held or terminated as soon as Level 1 limits are violated and the Supervising Test Engineer and the Responsible Piping Design Engineer shall be advised.

Level 2

During the course of each test, measurements shall be checked for compliance with Level 2 limits. Failure to meet Level 2 limits shall be reported to the Supervising Test Engineer and the Responsible Piping Design Engineer.

14.2.12.4.4 Special Test Number 4 - BOP System Piping Vibration Monitoring Program

a. Test Objective

The purpose of this test is to verify that the piping vibrations experienced during operational steady-state conditions will be within the allowable design limits, and that dynamic effects due to fast valve closure and relief valve opening will cause neither structural damage nor malfunction of the systems to be tested.

b. Prerequisites

The system piping to be tested is supported and restrained in conformance with the design drawings. Instrumentation has been installed and calibrated.

c. Test Procedure

This test is performed by monitoring and recording piping peak-to-peak displacements at selected points as the system undergoes steady-state vibration, and during transient loadings such as fast valve closure or sudden relief valve opening.

d. Acceptance Criteria

"Steady State Vibration"

The measured deflections shall not exceed the expected limits provided by the GGNS Steady State Vibration Limits in the Special Test Procedure. If the measured deflection is greater than the expected limit but is less than or equal to the acceptable deflection limit given in the Special Test Procedure, the testing may continue and the results may be evaluated for acceptance.

The measured deflections shall not exceed the acceptable limits provided in the Special Test Procedure. If the test measurements exceed the acceptable deflection, testing may continue, pending engineering evaluation. If the evaluation determines that the measured deflection is unacceptable, the system or the affected portion shall be isolated and secured. Testing shall be continued or repeated after corrective actions have been implemented.

"Transient Vibration"

The measured deflections shall not exceed the expected limits provided by the GGNS Dynamic Vibration Limits in the Special Test Procedure. If the measured deflections exceed the expected limits but are less than the acceptable limits the testing may continue, provided the measured deflections are evaluated.

The dynamic movements measured during transient loading shall not exceed the acceptable limits provided by the Special Test Procedure. If the measured deflections exceed the acceptable deflection limits, the plant shall be placed into a mode of operation that would minimize the potential of repeating the transient until such time as an engineering evaluation has been completed.

(The total stress due to dynamic loading, plus all other combined stresses, shall not exceed ASME Section III or ANSI B31.1 allowable stresses.)

14.2.12.4.5 Special Test Number 5 - BOP System Piping Expansion Monitoring Program

a. Test Objective

The purpose of this test is to verify that the piping systems are free to expand thermally as designed and to ensure that the spring hangers, snubbers, and structural members are not restricting thermal movement.

b. Prerequisites

The system piping to be tested is supported and restrained in conformance with the design drawings. Instrumentation has been installed and calibrated.

c. Test Procedure

The test is performed by monitoring and recording piping temperature and thermal movements at selected points as the system goes through one complete thermal cycle. Selected piping spring hanger and snubber movements will also be monitored and recorded.

d. Acceptance Criteria

At no time during the entire thermal cycle, i.e., cold to hot, to cold, shall there be any evidence of thermal blocking in the piping systems, unless it is intended by design.

The measured thermal movement shall be within ±25 percent of the analytical value or ±0.25 inch, whichever is greater, at a given test temperature per Table I, supplied in the special test procedure.

Spring hanger movement shall remain within the hot and cold set points, and snubbers shall not become fully extended or retracted per Table II, supplied in the special test procedure.

14.2.12.4.6 Special Test Number 6 - Verification Test of Pipe Displacement and Temperature Sensors on BOP Piping

a. Test Objective

The purpose of this test is to verify operability and calibration of the temporary instrumentation (C88) used to measure thermal expansion and vibration on BOP piping.

b. Prerequisites

Displacement and temperature sensors on BOP piping must be calibrated. BOP piping must be at ambient conditions.

c. Test Procedure

This test is performed by doing pull tests on the lanyard potentiometers, doing tap tests on accelerometers, and doing heat response tests on the RTDs and verifying that these sensors are operable.

d. Acceptance Criteria

1. Lanyard Potentiometer Channels

   At ambient conditions the channel must read 5 Vdc ±250 mV.

   After the lanyard potentiometer channel is tested, the second ambient reading must agree with the first to within ±25 mV.

2. RTD Channels

   At ambient conditions the channels should read ±3 F of the pipe temperature.

   After the RTD channel is tested, the second ambient reading must be ±0.3 V, -0.0 V of the first ambient reading.

   For those RTDs that cannot be tested in a normal fashion, the criteria shall be that the actual pipe temperatures and the RTD values respond in a similar fashion from ambient to a higher temperature condition.

3. Pressure Transducer Channel

   At ambient conditions the channel must read 5 Vdc ±0.1 V.

   After the pressure transducer channel is tested, the second ambient reading must be ±0.05 V of the first ambient reading.

14.2.12.4.7 Special Test Number 7 - Verification Test of the C88 Data Acquisition System Signals

a. Test Objective

   The purpose of this test is to verify the operability and calibration of the signal conditioning and display equipment of the C88 data acquisition system.

b. Prerequisites

   The C88 data acquisition system signal conditioning and display equipment must be installed and calibrated.

c. Test Procedure

This test is performed by verifying the accuracy and linearity of the C88 data acquisition system for a signal corresponding to the process parameter and verifying that the C88 display is within 2 percent of the process indication.

The following parameters in safety-related systems will be monitored:

System	**Parameters**
Neutron Monitoring System (NMS)	APRM Output APRM Heat Flux APRM Flow Biased Rod Block LPRM Output Recirc Sys Drive Flow
Reactor Core Isolation Cooling (RCIC)	RCIC Steamline ΔP RCIC Control Valve Position RCIC Stop Valve Position RCIC Steam Admission Valve Position RCIC Initiation RCIC Vessel Injection Valve Position RCIC Discharge Flow RCIC Turbine Speed RCIC Turbine Controller Outputs RCIC Flow Controller Outputs RCIC Steam Pressure RCIC Discharge Pressure RCIC Suction Pressure RCIC Turbine Exhaust Pressure RCIC Suction Pressure Controller

System	Parameters
4.16 kV Power Distribution	Bus 16AB Energized Loss of Offsite Power Bus 15AA Energized Bus 17AC Energized
High Pressure Core Spray (HPCS)	HPCS Flow HPCS Discharge Pressure HPCS Injection Valve Position HPCS Initiation
HPCS Diesel Generator (HPCS D/G)	HPCS D/G Voltage HPCS D/G Current HPCS D/G Watts HPCS D/G Frequency HPCS D/G Initiation
Low Pressure Core Spray (LPCS)	LPCS Flow LPCS Initiation
Residual Heat Removal (RHR)	RHR Initiation RHR Heat Exchanger Level RHR Heat Exchanger Inlet Pressure RHR Heat Exchanger Pressure Controller Output RHR Heat Exchanger Level Controller Output RHR System Flow RHR Service Water (SSW) Flow
Rod Control and Information (RCIS)	Rod Scram Times Selected Rod Pilot Solenoid

System	Parameters
Nuclear Boiler/ Nuclear Steam Supply Shutoff	Outboard MSIV Position Inboard MSIV Position MSIV Isolation Initiation Signal Vessel Wide Range Level
Standby Diesel Generator (D/G)	D/G Voltage D/G Current D/G Watts D/G Frequency D/G Initiation D/G Trip

d. Acceptance Criteria

The display of the C88 system must be within 2 percent of the process indication corresponding to the C88 channel being tested.

TABLE 14.2-1: Deleted

TABLE 14.2-2: Deleted

TABLE 14.2-3: STARTUP TEST PROGRAM

STI NO.	TEST NAME	COLD TEST OR OPEN RPV	HEAT UP	TEST CONDITIONS 1	2	3	4	5	6	WARRANTY
1	Chemical & Radiochemical	X	X	X		X		X	X	
2	Radiation Measurements	X	X	X		X			X	
3	Fuel Loading	X								
4	Full Core Shutdown Margin	X								
5	CRD	X	X		X	X			X	
6	6SRm Perf & control Rod Seq.	X	X	X						
8	Rod Sequence Exchange							X		
10	IRM Performance	X	X	X						
11	LPRM Calibration		X	X		X			X	
12	APRM Calibration		X	X	X	X		X	X	X
13	Process Computer	X	X	X[3]		X			X	
14	RCIC		X		X					
16	Selected Process Temperatures		X	X	X	X	X		X	
17	System Expansion	X	X	X		X			X	
18	Core Power Distribution					X			X	

TABLE 14.2-3: STARTUP TEST PROGRAM (Continued)

STI NO.	TEST NAME	COLD TEST OR OPEN RPV	HEAT UP	TEST CONDITIONS 1	2	3	4	5	6	WARRANTY
19	Core Performance			X	X	X	X	X	X	X
20	Steam Production									X
21	Core Power-Void Mode Response						X	X		
22	Pressure Controller: Set Point Changes			X,BP	X	X, no BP	X	X	X,A	
23	FM System: FW Pump Trip								M[14]	
	Water Level Set Point Change		X	X	X	X	X	X	X,A	
	Heater Loss								X[12]	
	Maximum Runout Capability								X	
24	Turbine Valve Surveillance					X[4]		X[5], SP	X[7,8], SP	
25	MSIVs: Each Valve		X			X		X[8],SP	X[5,8], SP	
	Full Isolation								X[2,6,13], SD	
26	Relief Valves:		X[13]		X[4,13]				X	

TABLE 14.2-3: STARTUP TEST PROGRAM (Continued)

STI NO.	TEST NAME	COLD TEST OR OPEN RPV	HEAT UP	TEST CONDITIONS 1	2	3	4	5	6	WARRANTY
27	Turbine Stop Valve Trip and Generator Load Rejection			X[19]	X,L, SP				X[2],SD	
28	Shutdown From Outside C Room				X[2], SD					
29	Recirculation Flow Control System			X,L		M,A,L			M[5], A[5], L[5]	
30	Recirc. System: Trip One Pump					X[13]			X[13]	
	Trip Two Pumps					X[13]			X	
	System Performance				X	X	X	X	X	
	Runback					X				
	Non-Cavit Verif				X	X				
31	Loss of T-G Offsite Power				X[13], SP					
33	Drywell Piping Vibration		X		X	X		X	X	
34	RPV Internals Vibration		X		X	X		X	X	
35	Recirc. System flow Calibration					X			X	

TABLE 14.2-3: STARTUP TEST PROGRAM (Continued)

STI NO.	TEST NAME	COLD TEST OR OPEN RPV	HEAT UP	TEST CONDITIONS 1	2	3	4	5	6	WARRANTY
36	Isolated Reactor Stability		X[15]							
70	Reactor Water Cleanup System		X			X				
71	Residual Heat Removal System		X	X					X	
72	Drywell Atmosphere Cooling		X		X				X	
74	Offgas System		X	X		X			X	
75	Cooling Water Systems		X	X		X			X	
76	ESF EQ. Area Cooling				X[16]				X[17]	
77	MSIV Leakage Control				X[18]					
78	IN-Plant SRV Testing					X				
79	Penetration Cooling		X						X	

TABLE 14.2-3: STARTUP TEST PROGRAM (Continued)

1. See Figure 14. 2-4 for Test Conditions region map.
2. Perform Test 5, timing of 4 slowest control rods in conjunction with these scrams.
3. Between Test Conditions 1 and 3.
4. Between Test Conditions 2 and 3.
5. Between Test Conditions 5 and 6
6. Before 100% Load Rejection.
7. Future maximum power test point.
8. Determine maximum power without scram
9. Perform at 100% Core Flow, 50% ±.5% Power.
10. Deleted.
11. 70-80% Power
12. 80-90% Power
13. Do STI 33 in conjunction with this test.

L = Local Flow Control Mode

M = Master Manual Flow Control Mode

X = Local or Master Manual Flow Control Mode

A = Automatic Flow Control Mode

SP = Scram Possibility

SE = Scram Expected

SD = Scram Definite

BP = Bypass Valve Response

* = Do either Stop Valve or Control Valve Trip

TABLE 14.2-3: STARTUP TEST PROGRAM (Continued)

14. Demonstrate Recirculation System Runback Feature.

15. <2 percent power @ 600 psig and 900 psig.

16. In conjunction with STI 14.

17. In conjunction with STI 71.

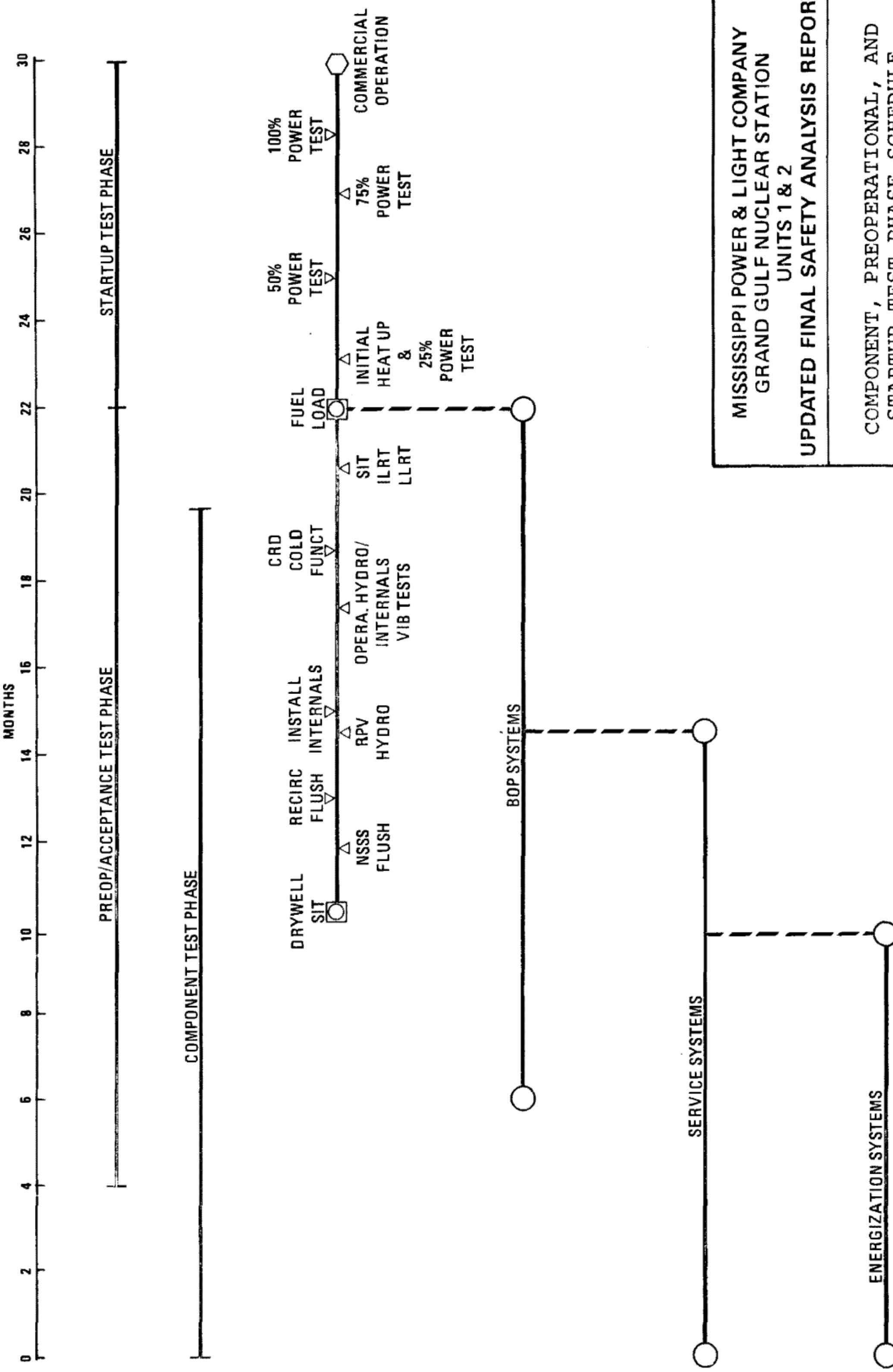
18. In conjunction with STI 28 or any time a reactor isolation and depressurization are convenient.

19. 60 to 80 percent power, 95 percent core flow.

TABLE 14.2-4: Deleted

[redacted]

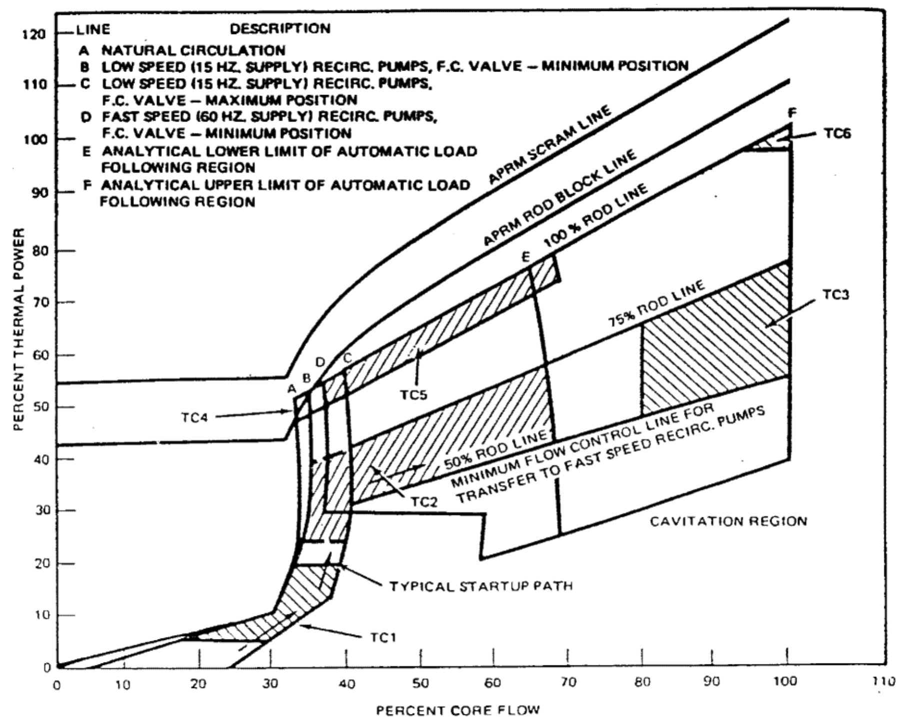
[redacted]



MISSISSIPPI POWER & LIGHT COMPANY
GRAND GULF NUCLEAR STATION
UNITS 1 & 2
UPDATED FINAL SAFETY ANALYSIS REPORT

COMPONENT, PREOPERATIONAL, AND STARTUP TEST PHASE SCHEDULE

FIGURE 14.2-3

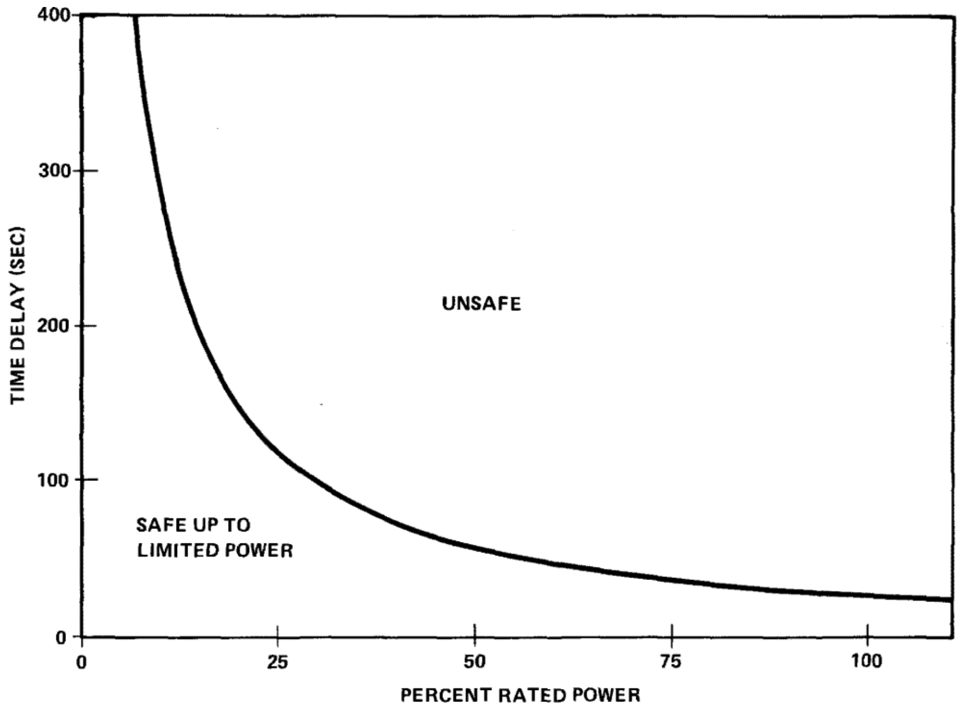


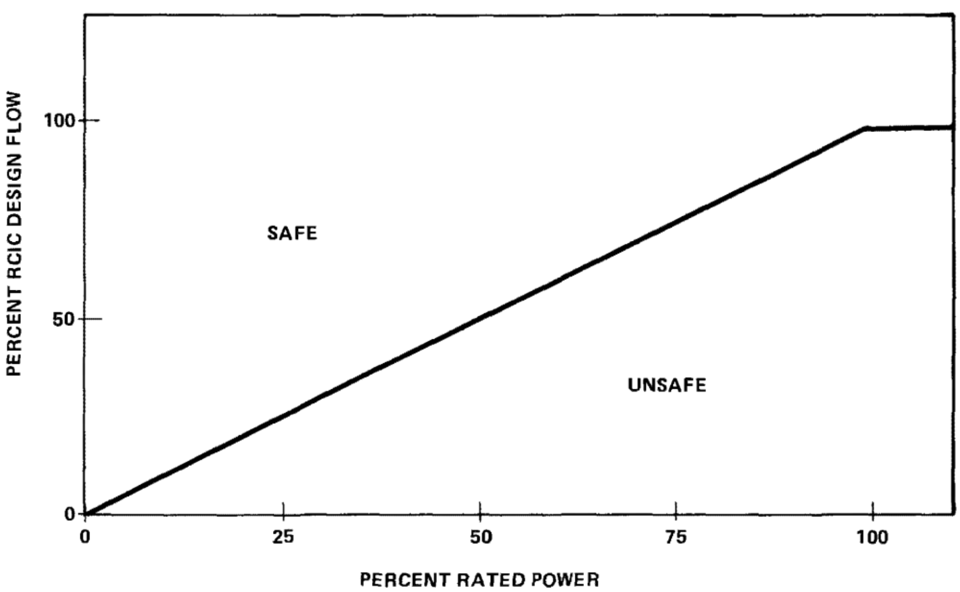
TEST CONDITION (TC) DEFINITIONS

TEST CONDITION	DESCRIPTION
1	PRIOR TO AND AFTER MAIN GENERATOR SYNCHRONIZATION, FROM 5 TO 20 PERCENT THERMAL POWER, LOW SPEED RECIRCULATION PUMPS.
2	AFTER MAIN GENERATOR SYNCHRONIZATION, FROM 50 TO 75 PERCENT ROD LINES, AT OR BELOW THE ANALYTICAL LOWER LIMIT OF AUTOMATIC LOAD FOLLOWING, AND WITH THE LOWER POWER-FLOW CORNER WITHIN BYPASS VALVE CAPACITY.
3	FROM 50 TO 75 PERCENT CONTROL ROD LINES, GREATER THAN 80 PERCENT CORE FLOW, AND WITHIN MAXIMUM ALLOWED RECIRCULATION CONTROL VALVE POSITION.
4	THE NATURAL CIRCULATION CONDITION, WITHIN 5 PERCENT POWER FROM THE INTERSECTION OF THE NATURAL CIRCULATION LINE AND THE 100 PERCENT ROD LINE.
5	FROM THE 100 PERCENT ROD LINE TO 5 PERCENT BELOW THE 100 PERCENT ROD LINE BETWEEN FAST SPEED RECIRCULATION PUMPS, F.C. VALVE – MINIMUM POSITION, AND 5 PERCENT ABOVE THE ANALYTICAL LOWER LIMIT OF THE AUTOMATIC LOAD FOLLOWING.
6	WITHIN +0 TO -5 PERCENT OF 100 PERCENT THERMAL POWER, AND WITH +0 TO -5 PERCENT CORE FLOW.

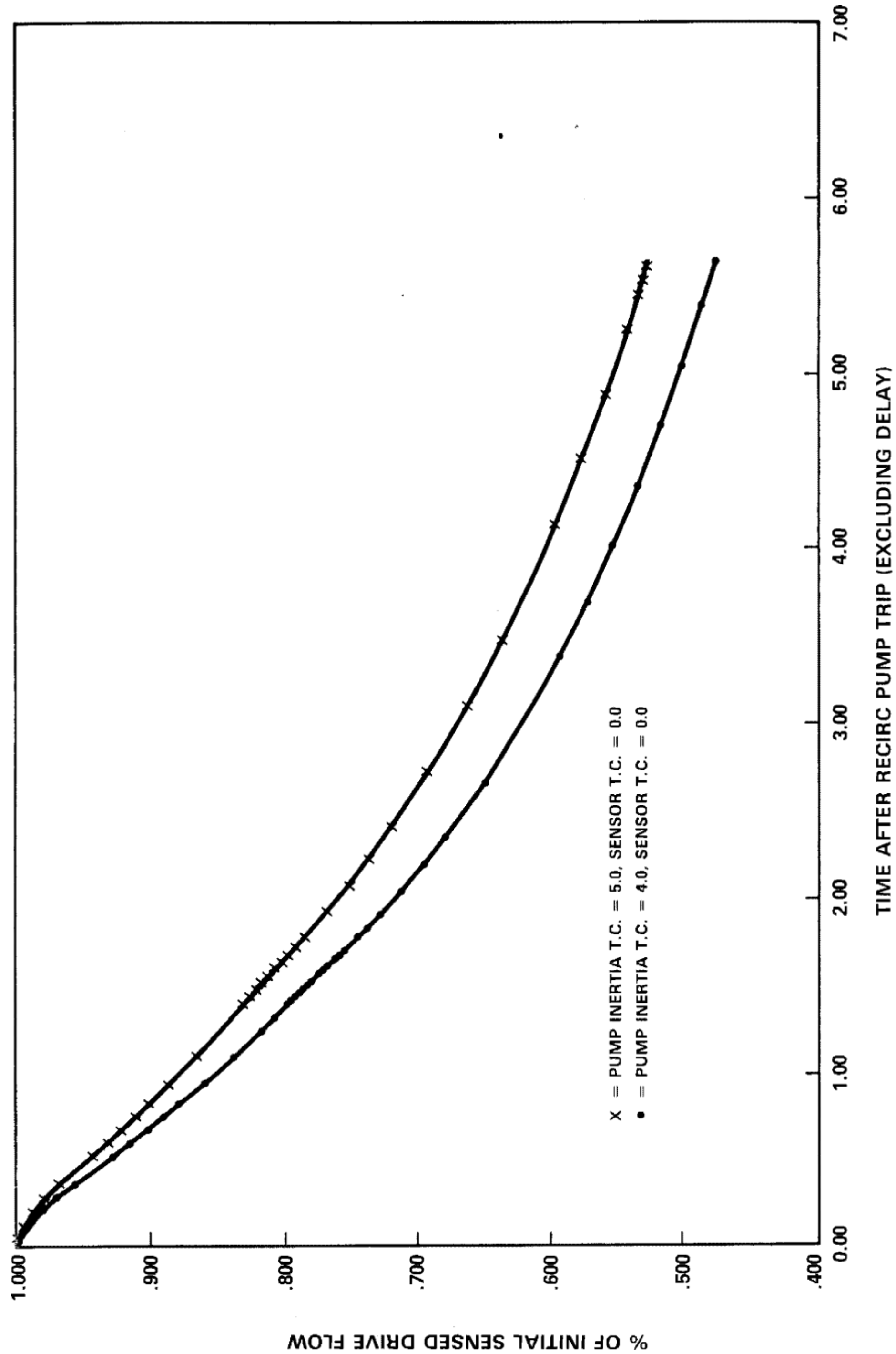
NOTE: THE GGNS UNIT 1 POWER FLOW MAP GENERATED AS A RESULT OF THE INITIAL STARTUP TEST PROGRAM WAS PROVIDED IN AECM-86/0066, DATED FEBRUARY 28, 1986.

MISSISSIPPI POWER & LIGHT COMPANY GRAND GULF NUCLEAR STATION UNITS 1 & 2 UPDATED FINAL SAFETY ANALYSIS REPORT	STARTUP TEST CONDITION THERMAL POWER VS. CORE FLOW FIGURE 14.2-4





MISSISSIPPI POWER & LIGHT COMPANY GRAND GULF NUCLEAR STATION UNITS 1 & 2 UPDATED FINAL SAFETY ANALYSIS REPORT	RCIC ACCEPTANCE CRITERIA CURVES FOR CAPACITY AND ACTUATION TIME FIGURE 14.2-5



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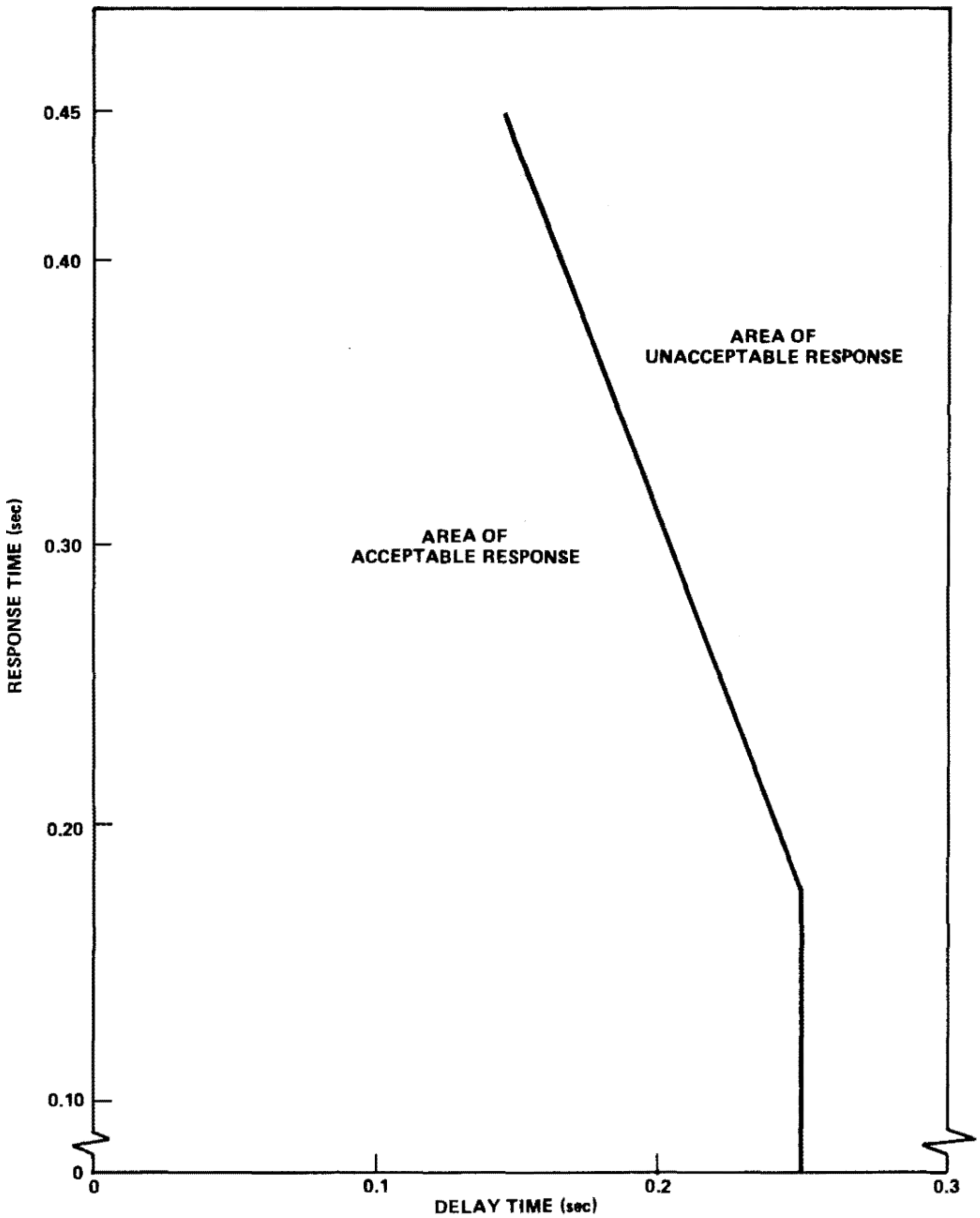
UPDATED FINAL SAFETY ANALYSIS REPORT

GRAND GULF RPT COAST-DOWN
REQUIREMENT (SENSOR T.C. =0.0 SEC)

FIGURE 14.2-6



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TRADE-OFF CURVE FOR
STEP SIZES 0.2% TO 0.5%
FIGURE 14.2-7