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This section is not applicable to an USAR.

CHAPTER 14.0

INITIAL TEST PROGRAM

14.2 INITIAL TEST PROGRAM

14.2.1 SUMMARY OF TEST PROGRAM AND OBJECTIVES

The Initial Test Program encompassed the scope of events following completion of construction and construction-related inspections and tests and terminating with Power Ascension Testing. The Initial Test Program was conducted in two separate and sequential subprograms: the Preoperational Test Program and the Initial Startup Test Program. At the conclusion of these subprograms, the plant was ready for normal power operation. Testing during the Initial Test Program was accomplished in four sequential phases:

Preoperational Test Program

Phase I - Preoperational Testing

Initial Startup Test Program

Phase II - Initial Fuel Loading and Zero Power Testing

Phase III - Low Power Physics Testing

Phase IV - Power Ascension Testing

Prior to preoperational testing of a particular system, certain prerequisite and construction tests were conducted in order to verify the integrity, proper installation, cleanliness, and functional operability of the system components.

14.2.1.1 Preoperational Test Program

The Preoperational Test Program is defined as that part of the Initial Test Program that commences with the completion of construction and construction-related inspections and tests and terminates with commencement of nuclear fuel loading.

The Preoperational Test Program included both safety-related and nonsafety-related preoperational tests. The Preoperational Test Program used a graded approach to determine the extent of testing to be performed. The safety-related preoperational tests (Table 14.2-1) demonstrated the capability of safety-related structures, systems, and components to meet performance requirements and to satisfy design criteria. The nonsafety-related preoperational tests (Table 14.2-2) were conducted on nonsafety-related systems and components to satisfy reliability and availability. Preoperational tests were conducted on those systems that:

a. Are relied upon for safe shutdown and cooldown of the reactor under normal plant conditions and for maintaining the reactor in a safe condition for an extended shutdown period;

b. Are relied upon for safe shutdown and cooldown of the reactor under transient and postulated accident conditions and for maintaining the reactor in a safe condition for an extended shutdown period following such conditions;

c. Are relied upon for establishing conformance with safety limits or limiting conditions for operations that are included in the technical specifications;

d. Are classified as engineered safety features actuation systems or are relied upon to support or ensure operation of engineered safety features actuation systems within design limits;

e. Are assumed to function during an accident or for which credit is taken in the accident analysis;

f. Are used to process, store, control, or limit the release of radioactive materials.

The objectives of the Preoperational Test Program were to:

a. Verify that plant components and systems, including alarms and indications, are constructed and fulfill their design intent;

b. Demonstrate, to the extent practicable, proper system/component response to postulated accidents;

c. Familiarize plant staff operating, technical, and maintenance personnel with plant operation.

The completion of preoperational testing constituted the completion of Phase I of the Initial Test Program.

14.2.1.2 Initial Startup Test Program

The Initial Startup Test Program is defined as that part of the Initial Test Program that commences with the start of nuclear fuel loading and terminates with the completion of power ascension testing. The initial startup tests (Table 14.2-3) ensured that fuel loading was accomplished in a safe manner, confirmed the design basis, demonstrated, where practical, that the plant operates and responds properly to anticipated transients and postulated accidents, and ensured that the plant can be safely brought to rated capacity and sustained power operation.

The objectives of the Initial Startup Test Program were to:

a. Accomplish a controlled, orderly, and safe initial core loading;

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

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

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

e. Provide sufficient testing of transient and accident conditions to verify safe operation during transient or accident conditions.

The completion of initial startup testing constituted the completion of Phases II, III, and IV of the Initial Test Program.

14.2.2 ORGANIZATION AND STAFFING

14.2.2.1 General Description

The Operating Agent, as defined in Section 1.4, was responsible for the overall administration and technical direction of the WCGS startup program. In recognition of this responsibility, the Director of Nuclear Operations, under the direction of the Vice President - Nuclear, established a startup organization to coordinate and direct the comprehensive planning, development, implementation and performance of the test program. The Startup Organization was headed by the Startup Manager who reported to the Plant Manager both administratively and technically.

During the preoperational startup program, the Startup Manager acted to coordinate activities between the Startup Organization, the construction staff, and the operating staff.

Prior to commencing preoperational testing activities, a Joint Test Group (JTG) as described in Section 14.2.3.2.2 was formed to review and recommend for approval startup administrative procedures, preoperational test procedures, and preoperational test results. A Plant Safety Review Committee (PSRC) as described in Section 14.2.3.2.3 was organized with the Plant Manager acting as chairman and it reviewed and recommended for approval initial startup test procedures and results.

14.2.2.2 Startup Organization

The Startup Organization was directly responsible for the conduct of the WCGS preoperational test program. The duties and responsibilities of the startup organization also included:

a. Familiarization of support personnel with specific tests.

b. Direction to support personnel and others during performance of tests including appropriate interface with station operators.

c. Authority to disallow or terminate testing due to conditions which could endanger personnel or equipment.

d. Identification of deficiencies that could adversely affect test performance.

e. Assembly of test data and preparation of test reports for evaluation of test results by others.

The Startup Organization was composed of system startup engineers, technicians, planners, craft labor, and other support personnel. The Operating Agent provided these personnel and used contractors to supply manpower for those positions that it could not staff. The staffing level for the Startup Organization increased as the test program progressed and construction activities decreased. Typical schedules for the test program are given in Section 14.2.11. Staffing and training of personnel involved in testing at WCGS were planned to provide sufficient manpower to support the testing schedule.

The Startup Organization reported administratively and technically to the Startup Manager; the duties performed by key individuals within the Startup Organization are summarized below.

14.2.2.2.1 Startup Manager

The Startup Manager had the authority and responsibility, as delegated by the Plant Manager, for the overall direction and administration of the functions and activities required to conduct the Startup Program. The responsibilities and duties of the Startup Manager also included:

a. Development of plans and schedules regarding the status of the startup program.

b. Review and approval of administrative and technical test procedures and results.

c. Continuing analysis of construction and equipment installation schedules for compatibility with testing schedules and recommendations for corrective actions to minimize conflict.

d. Review and submittal of design related problems requiring engineering resolution, encountered by the Startup Organization in accordance with the appropriate Startup Administrative Procedures.

e. Maintaining liaison with all organizations supporting Startup and coordinating their activities.

14.2.2.2.2 Startup Section

The Startup Section was comprised primarily of the System Test Group, the Electrical Test Group and the Instrumentation and Control Group which had primary responsibility within the Startup Organization to perform testing. This section also reviewed and recommended the acceptance of system or subsystem turnover documentation from Construction and coordinated system turnover and any subsequent system rework. It was responsible for preparing the test procedures, conducting the tests, and reporting the test results. For preoperational testing, this section documented the test results and presented them before the Joint Test Group for its review and recommendation for approval.

14.2.2.2.3 Operations Technical Support Section

The Operations Technical Support Section was responsible for providing technical support to the Startup Section during testing. The areas in which this support was given were instrumentation and control, chemistry, computer, health physics and reactor engineering.

This section was a permanent part of the WCGS operating staff until these functions were incorporated into other sections. They were involved in training, procedure preparation, and general preparation for support of plant operations.

14.2.2.2.4 Startup Scheduling Section

The Startup Scheduling Section prepared and updated the Startup Schedule, utilizing input from cognizant system startup engineers and the construction organizations.

14.2.2.2.5 Quality Control Section

The Quality Control Section formulated and implemented the Startup Quality Control Program. This program monitored the conduct of the Startup Organization's testing activities by reviewing administrative and technical test procedures, by witnessing major evolutions and selected flushes, hydros, and preoperational tests and by reviewing turnover packages. The Quality Control Section was under the direction of the Director - Quality. They provided support to the Startup Manager.

14.2.2.2.6 Startup Technical Support Section

The Startup Technical Support Section was responsible for providing technical support to the Startup Organization during the conduct of the Startup Program. Their responsibilities included test procedure and test results review and approval, technical planning of major milestone activities, startup organization training and startup program compliance to FSAR commitments.

14.2.2.3 Operating Staff

The WCGS operating staff was involved in the startup program in several capacities throughout preoperational and initial startup testing. This involvement included review of test procedures and results and the direct participation in test activities. Operating staff personnel were utilized by the startup organization as required for performance of testing under the direction of system startup engineers. Station operators assisted system startup engineers in performing tests and in the routine operations of systems. The operating staff directed the fuel loading and was responsible for plant operation during initial startup testing.

The operating staff was divided into sections headed by the Superintendent Operations, Superintendent of Maintenance, Superintendent of Plant Support, Superintendent of Technical Support, Nuclear Training Manager and Superintendent Regulatory Quality and Administrative Services. These section superintendents reported administratively and technically to the Plant Manager. The duties and responsibilities of the operating staff during plant operations are described in Chapter 13.0.

14.2.2.4 Major Participating Organizations

14.2.2.4.1 Bechtel

Bechtel provided engineering input into the startup program. Bechtel was contacted to provide personnel experienced in nuclear plant startup to augment the startup organization for WCGS. Bechtel employees were assigned consistent with the startup program schedules.

14.2.2.4.2 Daniel International Corporation (DIC)

DIC, as contractor for WCGS, was responsible for the construction completion, and orderly release of components and turnover of systems to KG&E consistent with the startup program schedules. This responsibility included:

a. Certification that documentation for components, systems and structures, as required by purchase and installation specifications, is complete and available; and the maintenance of these certification files which provide the documentary evidence, and

b. Provision of dedicated craft manpower support as required for performance of the startup program.

14.2.2.4.3 Westinghouse Electric Corporation

Westinghouse, as the Nuclear Steam Supply System (NSSS) supplier, was responsible for providing technical assistance to KG&E during preoperational and initial startup testing performed on the NSSS equipment and systems. Technical assistance is defined as technical guidance, advice and counsel based on current engineering, installation, and testing practices. Westinghouse employees were assigned consistent with the Startup Program schedules. This responsibility included:

a. Assignment of personnel to provide advice and assistance to KG&E for test and operation of all equipment and systems in the Westinghouse area of responsibility.

b. Supportive engineering services, including special assistance during the initial fuel loading.

c. Providing test procedure outlines and technical assistance for tests of Westinghouse furnished components and systems.

14.2.2.4.4 General Electric (GE)

GE is the supplier and installer of the turbine generator. GE supplied technical support for the startup and testing of the turbine generator. Some of the prerequisite testing (i.e., turbine oil flush) was performed by the GE personnel. GE has supplied recommended procedures for starting, operating, and shutting down equipment in their technical manuals for the turbine generator.

14.2.2.5 Quality Assurance

The KG&E Quality Branch was responsible for assuring the quality of construction, plant testing, and operations activities in accordance with the WCGS Quality Program which is described in Chapter 17.2.

14.2.2.6 Qualifications of Key Personnel

The qualifications for key plant operating personnel are described in Chapter 13.0.

The qualification requirements for startup personnel involved in the WCGS startup program conformed to capability levels per ANSI N45.2.6 and Regulatory Guide 1.8 recommendations.

All test personnel were indoctrinated in the startup administrative procedures, methods and controls.

14.2.3 TEST PROCEDURES

The Initial Test Program was conducted in accordance with detailed preoperational and initial startup test procedures. KG&E maintained the overall responsibility for test procedure preparation, review, and approval during the preparational stages. KG&E was responsible for final procedure revision, review, and approval. These activities were completed in a timely fashion to ensure that the approved procedures for satisfying FSAR testing equipment commitments were available for review approximately 60 days prior to scheduled implementation or fuel load for preoperational and initial startup tests, respectively. Preoperational and initial start-up testing commitments not available for review approximately 60 days prior to scheduled implementation or fuel load, respectively, were handled on a case- by-case basis.

The following sections describe the general methods employed to control procedure development and review, and they also describe the responsibilities of the various organizations which participated in this process. The detailed controls and methods were described in the startup administrative procedures.

14.2.3.1 Procedure Preparation

Test procedures for the powerblock systems and components were developed by Westinghouse and Bechtel. Bechtel also prepared test procedures for the site safety-related systems and components. Test procedures for the site nonsafety-related systems and components were developed by various entities as coordinated by KG&E.

The format and content of the test procedures developed for the standard plant and safety-related site systems and components reflected the guidance provided in Regulatory Guide 1.68. The procedures contained as a minimum the following sections:

1.0 Objectives

The objectives section identified the general results to be accomplished by the test.

2.0 Acceptance Criteria

The acceptance criteria section clearly defined quantitative and/or qualitative criteria against which the success or failure of the test procedure is judged.

3.0 References

The references section identified those FSAR sections, vendor manuals, drawings, etc. that were pertinent to the performance and/or development of the test procedure.

4.0 Test Equipment

The test equipment section identified temporary equipment required to conduct the test procedure and/or collect data.

5.0 Notes and Precautions

The notes and precautions sections listed limitations and precautions necessary to ensure personnel and equipment safety. Additional instructions needed to clarify the test procedure were also listed in this section.

6.0 Prerequisites

The prerequisites section identified those prerequisite tests and initial conditions that had to be completed and/or satisfied prior to the performance of the test procedure.

7.0 Test Procedure

The test procedure section provided a detailed step-by-step test method and instructions for data collection. All nonstandard arrangements required by the test procedure section were restored either in the test procedure section or the system restoration section.

8.0 Test Data Sheets

The test data sheet section provided specific forms for data collection. Additional instructions, if necessary, were also identified for each data sheet.

9.0 System Restoration

The system restoration section returned the system to a safe operating or standby condition. Instructions for the removal and/or return of system temporary modifications required by the prerequisite and/or test procedure sections were clearly defined.

The procedural sections included, as applicable, appropriate requirements for initials and/or signatures to control the performance and sequencing of the test.

The test procedures were prepared using the latest design information available and functional requirements provided by the design engineers. This information was utilized in developing the detailed test methods which verified the ability of systems and components to function within their design specifications. The procedure preparation efforts were started more than 2 years before the first procedure to be performed. This early start allows for an orderly development of the test procedure program and of the test procedures.

The test procedures were reviewed by the cognizant design organization to ensure that the test procedure objectives and acceptance criteria are consistent with current design document requirements. Subsequent changes to test procedure objectives or acceptance criteria during the preparational stage were based on approved changes to design documents with the design organization's concurrence.

14.2.3.2 Procedure Review and Approval

Following initial procedure preparation, and prior to submittal to the JTG for review and approval recommendation, the test procedures were reviewed by the SNUPPS utilities (KG&E and Union Electric). Review comments were resolved between the SNUPPS utilities and the writing organization.

A final revision was made by the writing organization, incorporating all applicable design changes, and was submitted to the utilities for their review and approval.

Each utility had various organizations, groups, and committees, such as a startup organization, initial test group, and a plant safety review committee, comprised of individuals having appropriate technical backgrounds and experience. Individuals within these organizations, groups, and committees were responsible for:

a. Reviewing procedures for accuracy and technical content;

b. Verifying that the procedure has been revised to incorporate known design changes;

c. Verifying procedure compatibility with field installation of equipment;

d. Verifying procedure conformance with FSAR requirements and plant operating technical specifications;

e. Reviewing procedures against reactor operating and testing experiences of similar power plants.

14.2.3.2.2 Joint Test Group (JTG)

A subcommittee of the PSRC, the JTG was organized by the Operating Agent to review preoperational test procedures and preoperational test results.

The primary JTG functions were to:

a. Review preoperational test procedures and recommend their approval by the Startup Manager.

b. Evaluate and authorize changes to preoperational test procedures as detailed in the Startup Administrative Manual.

c. Evaluate preoperational test procedure results and recommend their approval to the Startup Manager and Plant Manager.

d. Review safety-related aspects of the startup administrative procedures.

Membership in the JTG included the following personnel or their designated representatives:

a. Superintendent Operations - Chairman

b. Superintendent of Plant Support

c. Superintendent of Regulatory, Quality and Administrative Services

d. Startup Technical Support Supervisor

e. Assistant Startup Manager

f. Operations Quality Assurance (non-voting member)

g. Bechtel Power Corporation-Engineering (non-voting member)

h. Westinghouse-Engineering (non-voting member)

Others were requested to provide technical support to the JTG. This support was based on the procedure being reviewed, required technical expertise or other applicable factors. Participation in the JTG meeting was with the concurrence of the JTG and was limited to technical input only.

14.2.3.2.3 Plant Safety Review Committee (PSRC)

The PSRC was organized by the Operating Agent to ensure effective coordination of the engineering, construction, and operations activities affecting the startup program.

The appropriate PSRC members ensured sufficient review of initial startup test procedures and results.

The primary PSRC startup functions were:

a. Review all initial startup test procedures and make recommendations to the Plant Manager.

b. Evaluation and authorization of changes to initial startup test procedures.

c. Evaluation of initial startup test procedure results.

Membership in the PSRC is given in Section 17.2.1.4.

14.2.4 CONDUCT OF TEST PROGRAM

14.2.4.1 Administrative Procedures

The conduct of the preoperational startup program was controlled by administrative procedures. The preparation, maintenance, and implementation of these procedures was the responsibility of the Startup Manager. The startup administrative procedures prescribed controls for startup activities such as:

a. Organization and interfaces;

b. Indoctrination and training;

c. Preparation, review, approval, and modification of test procedures;

d. Format and content of test procedures;

e. Tagging procedures;

f. Test scheduling and test conduct;

g. Test deficiencies and resolution;

h. Startup quality control; and

i. Startup document control.

14.2.4.2 Turnover from Construction to KG&E Startup

Construction completion was scheduled in accordance with engineered system or subsystem boundaries. As systems or sub- systems were completed to support Startup testing, a turnover of the system or subsystem to KG&E Startup was processed. Turnover was conducted in accordance with established administrative procedures.

As part of the turnover process, each safety-related system or subsystem received physical walkdowns to provide assurance of readiness for Startup testing and verification that installation requirements had been met. Walkdowns were performed jointly by KG&E Startup and KG&E Construction personnel under the direction of the KG&E Construction Manager. Discrepancies identified during the walkdowns were tracked and resolved in accordance with established administrative and quality procedures.

The system or subsystem Turnover Package prepared by the constructor was reviewed by KG&E Construction and KG&E Startup personnel for accuracy, completeness and acceptability for Startup testing. In conjunction with the Turnover Package review, Startup personnel verified that the system or subsystem procurement and installation documentation review had been performed by Construction, and that discrepancies had been addressed. Acceptance of the Turnover Package by Startup followed satisfactory completion of the Turnover Package review. The Startup Manager was responsible for the approval and acceptance of the system or subsystem and the associated Turnover Package.

Individual components could be released to Startup for calibration, testing or temporary operation prior to turnover.

All components released in this manner were incorporated into the scope of a subsequent system or subsystem turnover.

14.2.4.3 Component and Prerequisite Testing

Upon Startup acceptance of a turned-over system, subsystem, or released component, prerequisite-type testing was performed to demonstrate proper operability and functional ability in support of, and prior to, the performance of preoperational testing. Local containment leak rate testing, as described in Section 14.2.12.2.13, was performed at WCGS as part of the prerequisite test program.

Administrative procedures were established to ensure that all prerequisites were met before testing was initiated. Upon completion of all prerequisite tests applicable to a system or subsystem, a documented review was conducted by Startup personnel to verify that appropriate documentation was able and that required prerequisite tests had been satisfactorily completed. All deficiencies which would prevent performance of preoperational tests or generate negative test results were identified and dispositioned prior to implementation of the preoperational tests.

14.2.4.4 Preoperational Testing

Technical direction and administration, including test execution and data recording, of the preoperational testing were the responsibility of the startup organization. The system startup engineers were responsible for the performance of tests and providing appropriate interface with station operators. The Startup Manager was responsible for the administration and surveillance of all testing activities during the preoperational test program.

14.2.4.5 Initial Startup Testing

During the initial startup testing phase, the Plant Manager had overall authority and responsibility for the startup program. The Startup Organization provided support to the plant operating staff which had responsibility for performing equipment operations and maintenance in accordance with the provisions of the plant operating license. The WCGS operating staff was also responsible for ensuring that the conduct of testing did not place the plant in an unsafe condition at any time.

The shift supervisors had the authority to terminate or disallow testing at any time.

14.2.4.6 Test Prerequisites

Each test procedure contained a set of prerequisites and initial conditions as prescribed by the startup administrative procedures. The system startup engineer ensured that all specified prerequisites were met prior to performing the test. The format for test procedures is described in Section 14.2.3.1.

14.2.4.7 Test Evaluation

Upon completion of system preoperational testing, the test results were submitted to the JTG for its review and subsequent recommendation for approval to the Startup Manager and Plant Manager.

Between each major phase of the initial startup test program, the test results for all tests that were performed were reviewed by the PSRC. This review ensured that all required systems were tested satisfactorily and that test results were approved before proceeding to the next stage of testing.

These reviews are described in Section 14.2.5.

14.2.4.8 Design Modifications

Modifications to the design of the equipment during the test program could be initiated in order to correct deficiencies discovered as a result of testing. Any such modifications were either developed by the original design organization or other designated organizations. Modifications made to components or systems after completion of preoperational or initial startup testing were reviewed for retesting requirements on affected portions of the system.

14.2.5 REVIEW, EVALUATION, AND APPROVAL OF TEST RESULTS

The responsibility for review, evaluation, and recommendation for approval of test results from all preoperational tests rested with the JTG. In the case of all initial start-up tests, it rested with the PSRC.

Following completion of a preoperational test, the responsible system startup engineer assembled the test data package for submittal to the members of the JTG for evaluation. Each test data package was reviewed to ensure that the test has been performed in accordance with the approved procedure and that all required data, checks, and signatures were properly recorded and that system performance met the approved acceptance criteria.

Members of the JTG reviewed the evaluation findings and recommended corrective action to be taken to resolve any outstanding deficiencies. If the deficiencies were not resolved to the satisfaction of the JTG, then appropriate retesting was required. If the evaluation indicated that deficiencies in the test method were responsible for unsatisfactory test results, the test procedure was revised accordingly before retesting was initiated. The review and approval process for procedure revisions was carried out in the manner described in Section 14.2.3. Whenever an evaluation of test results indicated deficiencies in system performance, the JTG referred the problem to the responsible engineering organization for evaluation.

If the test documentation and system performance were acceptable, the JTG recommended approval of the test by the Startup Manager and the Plant Manager.

Following each major phase of the initial startup test program, the PSRC verified that all required tests were performed and that the test results were approved. This verification ensured that all required systems were operating properly and that testing for the next major phase was conducted in a safe and efficient manner. This type of review was performed to the extent required before major initial startup test phases such as fuel load, initial criticality, and power ascension. During the power ascension phase, review and approval of initial startup test procedure results was completed as described in KMLNRC-84-235.

14.2.6 TEST RECORDS

Test procedures and test data relating to preoperational and initial startup testing are retained in accordance with the measures described in Section 17.2.17.

14.2.7 CONFORMANCE OF TEST PROGRAMS WITH REGULATORY GUIDES

The regulatory guides applicable to the test program are listed, with positions, in Appendix 3A, Conformance to NRC Regulatory Guides.

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

Available information on reactor operating experiences was utilized in the development of the Initial Test Program, as follows:

a. Bechtel reviewed and distributed pertinent Licensee Event Reports for use in the development of preoperational test procedures as follows:

1. The Licensee Event Summary Reports and other pertinent information were reviewed on a periodic basis, and those reports deemed to be useful for updating test procedures and items of a generic nature were cataloged. A summary of these reports was distributed within Bechtel.

2. Copies of the specific reports were then made and distributed for use in the preparation of procedures. In addition, these reports were coded and filed in a computer retrieval system.

b. The operating experience assessment for Wolf Creek Generating Station Unit No. 1 (WCGS) was conducted by the nuclear divisions and plant staff who possess the appropriate experience in the area of concern. The sources of operating experience information included the use of the NETWORK and the INPO/NSAC SEEIN system. An administrative system which controlled the flow of information from NETWORK, INPO/NSAC SEEIN, etc., to the cognizant organizations including the Independent Safety Engineering Group (ISEG) was developed and functioning prior to fuel load.

The Licensing Section was responsible for coordinating the review of the NRC Information and Enforcement (IE) Bulletins, Circulars, and Information Notices.

The Startup Group reviewed information provided by the other KG&E Nuclear Divisions and information provided by Bechtel and Westinghouse to determine its effect on the Wolf Creek Initial Test Program, making revisions to test and administrative procedures as required.

An instrumented auxiliary feedwater water-hammer test was performed only at Wolf Creek. (This test was not required to be performed. It was being performed for the purpose of gathering engineering data only.) Procedure S-O3AL04, Auxiliary Feedwater System Water Hammer Test, required a visual and audible water hammer test and was completed prior to the issuance of an operating license. See new Section 14.2.12.1.10.

Procedure S-070017, Loss of Heater Drain Pump Test, was performed on Callaway only. This test was conducted to verify analytical assumptions. No additional loss of heater drain pump tests are required, since the data obtained from the first unit test is equally valid for subsequent units. See Section 14.2.12.3.41.

Procedure S-07SF09 RCCA or Bank Worth Measurement at Power, was performed at 50 percent power only at Callaway. Wolf Creek and Callaway have the same core and Nuclear instrumentation system design and the test at Callaway is considered a prototypical test for Wolf Creek. This position was accepted by the NRC in a July 3, 1985 letter to KG&E.

A natural circulation test was performed at Callaway only to demonstrate the length of time to stabilize natural circulation, core flow distribution, and the ability to establish and maintain natural circulation. Operators participating in the tests were able to recognize when natural circulation had stabilized and were able to control saturation margin, RCS pressure, and heat removal rate without exceeding specified operating limits. These tests were conducted insofar as possible to include all available licensed operators. Licensed operators were trained in these same areas on the simulator. The simulator has full capability of simulating natural circulation, using Westinghouse data initially. When the above tests were accomplished on the Callaway plant, actual data was incorporated into the Wolf Creek simulator program. See Chapter 18, item I.G.1, and Section 14.2.12.3.43.

14.2.9 TRIAL USE OF PLANT OPERATING AND EMERGENCY PROCEDURES

The plant operating procedures were utilized, where applicable during the test program, to support testing, maintain plant conditions, and facilitate training. The trial use of operating procedures served to familiarize operating personnel with systems and plant operation during the testing phase and also served to ensure the adequacy of the procedures under actual or simulated operating conditions before plant operation begins. The emergency procedures were verified during startup as plant conditions, testing, and training warrant. Surveillance tests were performed as conditions warrant during the testing program, to demonstrate their adequacy.

Plant operating procedures were developed in approximately the same time frame as the preparation of preoperational and initial startup tests. The operating procedures were revised as necessary to reflect experience gained during the testing program.

14.2.10 INITIAL FUEL LOADING, CRITICALITY, AND POWER ASCENSION

Prior to the commencement of fuel loading, required preoperational test procedures were evaluated, and appropriate remedial action was taken if the acceptance criteria was not satisfied. At the completion of fuel loading, the reactor upper internals and pressure vessel head were installed, and additional mechanical and electrical tests were performed to prepare the plant for nuclear operation. After final precritical tests, nuclear operation of the reactor began. This phase of testing included initial criticality, low power testing, and power level ascension. The purpose of these tests was to establish the operational characteristics of the unit and core, to acquire data for the proper calibration of setpoints, and to ensure that operation is within license requirements. Section 14.2.12.3 summarizes the tests which are performed from fuel load to rated power. The fuel loading and post loading tests are described below.

14.2.10.1 Fuel Loading

The Plant Manager or his designated representative with technical assistance provided by Westinghouse, was responsible for the coordination of initial core loading. The overall process of initial core loading was, in general, directed from the operating floor of the containment structure by a licensed senior reactor operator. The licensed senior reactor operator had no additional responsibilities other than core load operations.

The core configuration was specified as part of the core design studies conducted well in advance of fuel loading. In the event mechanical damage was sustained during core loading operations to a fuel assembly of a type for which no spare was available onsite, an alternate core loading scheme could have been determined. Any such changes would have been approved by the appropriate Westinghouse personnel.

Core loading procedures specified the condition of fluid systems to prevent inadvertent changes in boron concentration of the reactor coolant; the movement of fuel to preclude the possibility of mechanical damage; the conditions under which loading could proceed; and the responsibility and authority for continuous and complete fuel and core component accountability.

The following conditions were met prior to core loading:

a. The reactor containment structure was complete and containment integrity had been demonstrated.

b. Fuel handling tools and equipment were checked out and operators familiarized in the use and operation of equipment. Inspections of fuel assemblies, rod cluster control assemblies, and reactor vessel were satisfactorily completed.

c. The reactor vessel and associated components were in a state of readiness to receive fuel. The water level was maintained above the bottom of the nozzles and recirculation maintained to ensure the required boron concentration could be increased via the recirculation path or directly to the open vessel.

Criteria for safe loading required that loading operations stop immediately if any of the following conditions occur.

a. An unanticipated increase in the neutron count rates by a factor of two occurs on all responding nuclear channels during any single loading step after the initial nucleus of eight fuel assemblies is loaded.

b. An unanticipated increase in the count rate by a factor of five on any individual responding nuclear channel during any single loading step after the initial nucleus of eight fuel assemblies is loaded.

c. An unanticipated decrease in boron concentration greater than 20 ppm is determined from two successive samples of the reactor coolant.

Loading operations could not be restarted until the situation was evaluated. An alarm in the containment and main control room was coupled to the source range channels with a setpoint equal to or less than five times the current count rate. This alarm automatically alerts the loading operation personnel of high count rate, and an immediate stop of all operations would be required until the situation was evaluated. In the event the evacuation alarm was actuated during core loading and after it has been determined that no hazards to personnel exist, preselected personnel would be permitted to reenter the containment to evaluate the cause and determine future action.

The core was assembled in the reactor vessel and submerged in the reactor grade water containing sufficient dissolved boric acid to maintain a calculated core effective multiplication factor of 0.95 or lower. The refueling pool could be wet or dry during initial core loading. Core moderator, chemistry conditions (particularly boron concentration) were prescribed in the core loading procedure document and verified by chemical analysis of moderator samples taken prior to and during core loading operations.

At least two artificial neutron sources were introduced into the core at specified points in the core during the loading program to ensure a detector response of at least 2 counts per second attributable to neutrons.

Core loading instrumentation consisted of two permanently installed source range (pulse type) nuclear channels and two temporary incore source range channels. A third temporary channel could also be used as a spare. The permanent channels, when responding, were monitored in the main control room, and the temporary channels were installed and monitored in the containment. At least one permanent channel was equipped with an audible count rate indicator. Both plant channels have the capability of displaying the neutron flux level on a strip chart recorder. The temporary channels indicated on scalers, and a minimum of one channel was recorded on a strip chart recorder. Normally minimum count rates of two counts per second attributable to core neutrons were required on at least two of the four (i.e. two temporary and two permanent source range detectors) available nuclear source channels at all times following installation of the initial nucleus of eight fuel assemblies. A response check of nuclear instruments to a neutron source was performed within 8 hours prior to loading of the core, or upon resumption of loading if delay was for more than 8 hours.

Fuel assemblies, together with inserted components (control rod assemblies, burnable, poison assemblies, source spider, or thimble plugging devices) were placed in the reactor vessel one at a time, according to a previously established and approved sequence developed to provide reliable core monitoring with minimum possibility of core mechanical damage. The core loading procedure documents prescribed the successive movements of each fuel assembly and its specified inserts from its initial position in the storage racks to its final position in the core. Fuel assembly status boards were maintained throughout the core loading operation.

An initial nucleus of eight fuel assemblies, one containing a neutron source, is the minimum source-fuel nucleus which permitted subsequent meaningful inverse count rate monitoring. This initial nucleus was determined by calculation to be markedly subcritical ($K_{eff} \leq 0.95$) under the required conditions of loading.

Each subsequent fuel addition was accompanied by detailed neutron count rate monitoring to determine that the just-loaded fuel assembly did not excessively increase the count rate and that the extrapolated inverse count rate ratio was behaving as expected. These results for each loading step were evaluated before the next fuel assembly was loaded. The final, as loaded, core configuration was subcritical ($K_{eff} \leq 0.95$) under the required loading conditions.

14.2.10.2 Initial Criticality

Prior to initial criticality, the following tests were performed and the results evaluated.

a. At the completion of core loading, the reactor upper internals and pressure vessel head were installed. A pressure test was conducted after filling, and venting was completed to check the leaktightness of the vessel head installation.

b. Mechanical and electrical tests were performed on the control rod drive mechanisms. These tests included a complete operational checkout of the mechanisms and calibration of the individual rod position indicators.

c. Tests were performed on the reactor trip circuits to test manual trip operation, and actual control rod assembly drop times were measured for each control rod assembly. At all times that the control rod drive mechanisms were being tested, the boron concentration in the coolant was maintained so that the shutdown margin requirements specified in the Technical Specifications were met. During individual RCCA or RCC bank motion, source range instrumentation was monitored for unexpected changes in core reactivity.

d. The reactor control and reactor protection systems were checked with simulated inputs to produce trip signals for various trip conditions.

e. A functional electrical and mechanical check was made of the incore nuclear flux mapping system near normal operating temperature and pressure.

Initial criticality was achieved by a combination of shutdown and control bank withdrawal and reactor coolant system boron concentration dilution. The plant conditions, precautions, and specific instructions for the approach to criticality were specified by approved procedures.

Initially, the shutdown and control banks of control rods were withdrawn incrementally in the normal withdrawal sequence, leaving the last withdrawn control bank partially inserted in the core to provide effective control when criticality was achieved. The boron concentration in the reactor coolant system was reduced and criticality achieved by boron dilution or by subsequent rod withdrawal following boron dilution. Throughout this period, samples of the primary coolant were obtained and analyzed for boron concentration.

Inverse count rate ratio monitoring using data from the normal plant source range instrumentation was used as an indication of the proximity and rate of approach to criticality. Inverse count rate ratio data was plotted as a function of rod bank position during rod motion and as a function of reactor makeup water addition during reactor coolant system boron concentration reduction.

14.2.10.3 Low Power Testing

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

Procedures specified the sequence of tests and measurements to be conducted and the conditions under which each was performed in order to ensure both safety of operation and the validity and consistency of the results obtained. If test results deviated significantly from design predictions, if unacceptable behavior had been revealed, or if unexplained anomalies had developed, the plant would have been brought to a safe stable condition and the situation reviewed to determine the course of subsequent plant operation.

These measurements were made at low power and primarily at or near normal operating temperature and pressure. Measurements were made in order to verify the calculated values of control rod bank reactivity worths, the isothermal temperature coefficient under various core conditions, differential boron concentration reactivity worth, and critical boron concentrations as functions of control rod configuration. In addition, measurements of the relative power distributions were made, and concurrent tests were conducted on the instrumentation, including source and intermediate range nuclear channels.

Gamma and neutron radiation surveys were performed at selected points throughout the station. Periodic sampling was performed to verify chemical and radio-chemical analysis of the reactor coolant.

14.2.10.4 Power Level Ascension

After the operating characteristics of the reactor were verified by low power testing, a program of power level ascension brought the unit to its full rated power level in successive stages. At each successive stage, hold points were provided to evaluate and approve test results prior to proceeding to the next stage. The minimum test requirements for each successive stage of power ascension were specified in the initial startup test procedures.

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

Secondary system heat balance measurements ensured that the indications of power level were consistent and provide bases for calibration of the power range nuclear channels. The ability of the reactor coolant system to respond effectively to signals from primary and secondary instrumentation under a variety of conditions encountered in normal operations was verified.

At prescribed power levels, the dynamic response characteristics of the primary and secondary systems were evaluated. System response characteristics were measured for design step load changes, rapid load reduction, and plant trips.

Adequacy of radiation shielding was verified by gamma and neutron radiation surveys at selected points throughout the station at various power levels. Periodic sampling was performed to verify the chemical and radio-chemical analysis of the reactor coolant.

14.2.11 TEST PROGRAM SCHEDULE

Detailed schedules for testing were prepared, reviewed, and revised on a continuing basis as plant construction progressed.

Preoperational tests which were not performed according to schedule were reviewed on a case-by-case basis. Administrative procedures were established to ensure that all prerequisites were met before testing was initiated. Upon completion of all prerequisite tests applicable to a system or subsystem, a documented review was conducted by Start-up personnel to verify that appropriate documentation was available and that required prerequisite tests were satisfactorily completed. All deficiencies which would have prevented performance of preoperational tests or generated negative test results were identified and dispositioned prior to implementation of the preoperational tests.

Preoperational testing was scheduled to commence approximately 18 months prior to fuel loading. The preoperational tests were performed and sequenced during this period as a function of system turnover, system interrelationships, and acceptance for testing.

Initial startup testing was scheduled to be conducted over a period of approximately 3 to 5 months, commencing with fuel loading. The sequential schedule for initial startup tests ensured, insofar as practicable, that test requirements were completed prior to exceeding 25-percent power for all plant structures, systems, and components that are relied upon to prevent, limit, or mitigate the consequences of postulated accidents.

The development of the test procedures was an ongoing process consisting of preparation, review, and revision. Preoperational test procedures were available for NRC review approximately 60 days prior to the performance of an individual test. If an individual test procedure was not available 60 days prior to the test, the NRC was notified of the test date and the date the test procedure was available. Initial startup test procedures were available for NRC review at least 60 days prior to fuel loading.

14.2.12 INDIVIDUAL TEST DESCRIPTIONS

Test abstracts were provided for both safety-related and selected nonsafety-related preoperational tests. The abstracts included test prerequisites and summaries of test methods, objectives, and acceptance criteria.

14.2.12.1 Safety-Related Preoperational Test Procedures

The following sections contain test abstracts used for safety- related preoperational tests. Table 14.2-1 provides an index of these tests.

The preoperational test procedures were designated SO3 (Safety- Related/Common to WCGS and Callaway), SU3 (Safety-Related/WCGS Specific), SO4 thru SO9 (Nonsafety-Related/Common to WCGS and Callaway) and SU4 thru SU9 (Nonsafety-Related/WCGS Specific) as appropriate.

14.2.12.1.1 Steam Dump System Preoperational Test (S-03AB01)

14.2.12.1.1.1 Objectives

a. To demonstrate the operability of the steam dump control system control circuits in both the average temperature and steam pressure modes of operation.

b. To demonstrate the operation of the main steam dump valves and main steam cooldown valves, including valve response to safety signals.

c. To verify the operation of the main steam line drain valves' control circuits, including valve response to a turbine trip signal.

d. To verify the operation of the main steam to turbine-driven feedwater pump supply valves' control logics, including valve response to an auxiliary feedwater actuation signal (AFAS).

e. To verify the operation of the main steam atmospheric relief valves' control circuits.

14.2.12.1.1.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are completed.

b. Required electrical power supplies and control circuits are operational.

14.2.12.1.1.3 Test Method

a. Operability of the steam dump control system control circuits is verified in both the average temperature and steam pressure modes.

b. Operability of the main steam dump valves' and main steam cooldown valves' control circuits is verified, including valve response to turbine impulse low pressure, low-low average temperature, and condenser shell high pressure signals.

c. Operability of the main steam line drain valves' control circuits is verified, including valve response to a turbine trip signal.

d. Operability of the main steam to turbine-driven auxiliary feedwater pump supply valves' control logics is verified, including valve response to an AFAS.

e. Operability of the main steam atmospheric relief valves' control circuits is verified.

14.2.12.1.1.4 Acceptance Criteria

a. The response of the main steam dump valves and the main steam cooldown valves to the associated turbine impulse low pressure, low-low average temperature, and condenser shell high pressure signals is in accordance with system design.

b. The main steam line drain valves open on receipt of a turbine trip signal.

c. The main steam to turbine-driven auxiliary feedwater pump supply valves open on receipt of an AFAS.

d. The response of the main steam atmospheric relief valves to pressure signals is in accordance with system design.

14.2.12.1.2 Main Steam Safety Valve Test (SU3-AB02)

14.2.12.1.2.1 Objectives

To verify the pressure relief setpoints of the main steam safety valves.

NOTE: This objective may be accomplished either by bench testing or with a pneumatic test device.

14.2.12.1.2.2 Prerequisites

The following prerequisites apply when a pneumatic test device is used.

a. Required instrument calibration is complete.

b. Hot Functional Testing is in progress.

c. A Source of compressed air is available to provide air to the air set pressure device installed on the valve under test.

The following prerequisites apply when bench testing is performed.

a. Bench testing facility is available.

b. An approved WCGS procedure is available to accomplish bench testing.

c. A source of compressed gas is available to provide pressure to the valve under test.

14.2.12.1.2.3 Test Method

The following test method applied when a pneumatic test device is used.

Main steam pressure is adjusted within the required range, and air is admitted to the air set pressure device on the safety valve under test. Actual lift pressure is calculated, using the steam pressure and converted air pressure at the time of lift.

The following test applies when bench testing is performed.

With the main steam safety valve mounted on the bench test facility, the spring assembly is preheated and the safety valve is pressurized with compressed gas. Actual set pressure is determined at the time of lift.

14.2.12.1.2.4 Acceptance Criteria

Each main steam safety valve lifts within its respective setpoint tolerance.

14.2.12.1.3 Main Steam Line Isolation Valve Test (S-03AB03)

14.2.12.1.3.1 Objectives

a. To verify the response of the main steam bypass, drain, and auxiliary feedwater turbine warmup valves to steam line isolation signals.

b. To demonstrate the operability of the main steam isolation valve control circuits, including control circuit response to a steam line isolation signal (SLIS).

14.2.12.1.3.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The main steam line isolation valve accumulators are charged, and the associated hydraulic systems are operational.

14.2.12.1.3.3 Test Method

An SLIS is initiated, and the response of the main steam bypass, main steam drain, and auxiliary feedwater turbine warmup valves is verified.

14.2.12.1.3.4 Acceptance Criteria

a. The main steam bypass, drain, and auxiliary feedwater turbine warmup valves close on receipt of an SLIS.

14.2.12.1.4 Main Steam System Preoperational Test (S-03AB04)

14.2.12.1.4.1 Objectives

a. To determine, during hot functional testing, the operating times of the main steam isolation valves, main steam bypass valves, main steam dump valves, main steam cooldown valves, and the main steam atmospheric relief valves.

b. To verify the response of the main steam isolation valves to steam line isolation signals.

14.2.12.1.4.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. Hot functional testing is in progress.

d. The condenser is available to receive steam from the main steam system.

14.2.12.1.4.3 Test Method

a. The main steam isolation valves, main steam bypass valves, main steam dump valves, main steam cooldown valves, and the main steam atmospheric relief valves are operated, and operating times are recorded.

b. An SLIS is initiated, and the response of the main steam isolation valves is verified.

14.2.12.1.4.4 Acceptance Criteria

a. The operating times of the main steam isolation valves, main steam dump valves, main steam bypass valves, main steam cooldown valves, and the main steam atmospheric relief valves are within design specifications.

b. The main steam isolation valves close on receipt of a steam line isolation signal.

14.2.12.1.5 Main Feedwater System Preoperational Test (S-03AE01)

14.2.12.1.5.1 Objectives

a. To demonstrate the operation of the feedwater system valves and to verify the response of the feedwater system valves to a feedwater isolation signal (FIS).

b. To perform the initial operation of the steam generator feedwater pumps (SGFP).

14.2.12.1.5.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The closed cooling water system is available to provide cooling water to the SGFP lube oil coolers.

d. The compressed air system is available to provide air to system air-operated valves.

e. The steam seal system is available to provide seal steam and packing exhaust for the SGFPs.

f. The main turbine is available for turning gear operation.

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

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

i. The auxiliary steam system is available to provide steam flow to the SGFP turbines.

14.2.12.1.5.3 Test Method

a. Feedwater system valves are operated, and the proper response of required system valves to an FIS is verified.

b. The turbine-driven SGFPs are operated as limited by steam, and operating data are recorded.

c. The motor-driven SGFP is operated, and operating data are recorded.

14.2.12.1.5.4 Acceptance Criteria

a. The feedwater control valves, steam generator feedwater isolation valves, feedwater chemical injection isolation valves, and feedwater bypass control valves close on receipt of an FIS.

b. The closing time of the feedwater isolation valves is within design specifications.

c. The performance of the motor-driven SGFP is within design specifications.

14.2.12.1.6 Steam Generator Level Control Test (S-03AE02)

14.2.12.1.6.1 Objectives

a. To demonstrate the operability of the feedwater control valves (FWCVs).

b. To demonstrate the operability of the FWCV bypass valves.

c. To demonstrate the response of the FWCVs and bypass valves to signals generated by the steam generator level control system.

14.2.12.1.6.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.1.6.3 Test Method

a. The FWCVs are operated from their respective controllers, and the FWCVs' response to feedwater flow, steamline flow, and steam generator level is verified.

b. The FWCV bypass valves are operated from their respective controllers, and their response to steam generator level and neutron flux signal is verified.

14.2.12.1.6.4 Acceptance Criteria

a. The response of the FWCVs to feedwater flow, steamline flow, and steam generator level is in accordance with system design.

b. The response of the FWCV bypass valves to steam generator level and neutron flux signal is in accordance with system design.

14.2.12.1.7 Auxiliary Feedwater Motor-Driven Pump and Valve Preoperational Test (S-03AL01)

14.2.12.1.7.1 Objectives

To demonstrate the operability of the motor-driven auxiliary feedwater pumps, determine by flow test their ability to supply water to the steam generators, and verify their response to safety signals. The operation of system motor-operated valves, including their response to safety signals, is also verified.

14.2.12.1.7.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

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

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

14.2.12.1.7.3 Test Method

a. Performance characteristics of the motor-driven auxiliary feedwater pumps are verified while discharging to the steam generators.

b. System component control circuits are verified, including the operation of the motor-driven auxiliary feedwater pumps and system valves on receipt of safety signals.

14.2.12.1.7.4 Acceptance Criteria

a. Motor-driven auxiliary feedwater pump performance characteristics must be within design specifications.

b. Motor-driven auxiliary feedwater pumps automatically start on receipt of an engineered safety features actuation signal (ESFAS) in the absence of an SIS signal and a Class IE 4.16 kV bus undervoltage signal.

c. Auxiliary feedwater suction valves from essential service water system open, and suction valves from condensate storage tank close, on condensate storage tank low-suction-pressure signals, coincident with an auxiliary feedwater pump ESFAS.

14.2.12.1.8 Auxiliary Feedwater Turbine-Driven Pump and Valve Preoperational Test (SU3-AL02)

14.2.12.1.8.1 Objectives

a. To verify the auxiliary feedwater pump turbine mechanical trip and throttle valve automatic operation on an auxiliary feedwater actuation signal (AFAS).

b. To perform the initial coupled operation of the turbine-driven auxiliary feedwater pump. Full flow characteristics of the turbine-driven pump will be demonstrated during hot functional testing.

c. To perform five consecutive, successful, cold starts of the turbine-driven auxiliary feedwater pumps.

14.2.12.1.8.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b Required electrical power supplies and control circuits are operational.

c. The steam generators are available to receive water from the auxiliary feedwater pumps.

d. The steam generator blowdown system is available to maintain the normal operating levels in the steam generators during auxiliary feedwater pump operation.

e. The auxiliary steam system is available to supply steam to the auxiliary feedwater pump turbine.

f. For the performance characteristic test of this pump, hot functional testing (HFT) is in progress.

14.2.12.1.8.3 Test Method

a. An AFAS is simulated, and opening of the mechanical trip and throttle valve is verified.

b. The turbine-driven auxiliary feedwater pump is operated during HFT, and performance characteristics are recorded.

c. The ability of the turbine-driven auxiliary feedwater pumps to start successfully five consecutive times from cold conditions is verified.

14.2.12.1.8.4 Acceptance Criteria

a. The auxiliary feedwater pump mechanical trip and throttle valve opens automatically on an AFAS.

b. Operating characteristics of the turbine-driven auxiliary feedwater pump are in accordance with design.

c. The turbine driven auxiliary feedwater pump starts successfully five consecutive times from a cold start.

14.2.12.1.9 Auxiliary Feedwater Motor-Driven Pump Endurance Test (SU3-AL03)

14.2.12.1.9.1 Objectives

a. To demonstrate that the motor-driven auxiliary feedwater pumps can operate for 48 continuous hours without exceeding any of their limiting design specifications.

b. To demonstrate that the motor-driven auxiliary feedwater pumps can operate for 1 hour after a cooldown from the 48-hour test.

c. To demonstrate that the room environmental conditions are not exceeded during the 48-hour test.

14.2.12.1.9.2 Prerequisites

a. Required component testing, instrument calibration and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The appropriate auxiliary feedwater pump room coolers are operational.

d. The condensate storage tank is available as a water source and to receive recirculation flow.

14.2.12.1.9.3 Test Method

Each motor-driven pump is started and operated for 48 hours after reaching rated speed and rated discharge pressure and flow, or a greater pressure and less flow. During the endurance run, pump- operating data and the pump room environmental conditions are recorded. At the completion of each endurance test, the pump is cooled for 8 hours and until pump data returns to within 20°F of the original pretest data. The pump is then started and operated for 1 hour.

14.2.12.1.9.4 Acceptance Criteria

a. The operating parameters (vibration, bearing temperatures, etc.) of each motor-driven auxiliary feedwater pump do not exceed the design specifications.

b. The environmental conditions of each motor-driven auxiliary feedwater pump room do not exceed the design specifications.

14.2.12.1.10 Auxiliary Feedwater System Water Hammer Test (S-03AL04)

14.2.12.1.10.1 Objectives

To demonstrate that the injection of auxiliary feedwater at rated flow into a steam generator at or near normal operating temperatures will not cause damaging water hammer to the steam generators and/or feedwater system.

14.2.12.1.10.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The steam generators are at or near normal operating temperature.

d. The condensate storage tank is available as a water source.

14.2.12.1.10.3 Test Method

Auxiliary feedwater is injected into each steam generator. The feedwater system piping and the steam generators are monitored visually and audibly to verify that no damaging water hammer occurs.

14.2.12.1.10.4 Acceptance Criteria

No damaging water hammer occurs.

14.2.12.1.11 Auxiliary Feedwater Turbine-Driven Pump Endurance Test (SU3-AL05)

14.2.12.1.11.1 Objectives

a. To demonstrate that the turbine-driven auxiliary feedwater pump can operate for 48 continuous hours without exceeding any of its limiting design specifications.

b. To demonstrate that the turbine-driven auxiliary feedwater pump can operate for 1 hour after a cool down from the 48-hour test.

c. To demonstrate that the room environmental conditions are not exceeded during the 48-hour test.

14.2.12.1.11.2 Prerequisites

a. Required component testing, instrument calibration and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The appropriate auxiliary feedwater pump room coolers are operational.

d. The condensate storage tank is available as a water source and to receive recirculation flow.

e. A steam source is available.

14.2.12.1.11.3 Test Method

The pump is started and operated for 48 hours after reaching rated speed and rated discharge pressure and flow, or a greater pressure and less flow. The turbine-driven auxiliary feedwater pump operating steam is as close to normal operating temperature as possible and is at least 400°F. During the endurance run, pump-operating data and the pump room environmental conditions are recorded. At the completion of the endurance test, the pump is cooled for 8 hours and until pump data returns to within 20 F of the original pretest data. The pump is then started and operated for 1 hour.

14.2.12.1.11.4 Acceptance Criteria

a. The operating parameters (vibration, bearing temperatures, etc.) do not exceed the design specifications.

b. The environmental conditions of the turbine-driven auxiliary feedwater pump room do not exceed the design specifications.

14.2.12.1.12 Reactor Coolant Pump Initial Operation (S-03BB01)

14.2.12.1.12.1 Objectives

To demonstrate the operating characteristics of the reactor coolant pumps and verify the operation of their associated oil lift pumps.

14.2.12.1.12.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The chemical and volume control system is available to provide seal water to the reactor coolant pump seals.

d. The component cooling water system is available to supply cooling water to the reactor coolant pumps.

14.2.12.1.12.3 Test Method

The reactor coolant pumps and associated oil lift pumps are operated, and pump operating data are recorded.

14.2.12.1.12.4 Acceptance Criteria

Reactor coolant pump and oil lift pump operating characteristics are within design specifications.

14.2.12.1.13 Pressurizer Relief Tank Cold Preoperational Test (SU3-BB02)

14.2.12.1.13.1 Objectives

To demonstrate that the reactor makeup water system can supply design pressurizer relief tank (PRT) spray flow against design backpressure. The operation of the PRT nitrogen isolation valves, including their response to a containment isolation signal, is also verified.

14.2.12.1.13.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The reactor makeup water system is available to supply water to the PRT.

d. The service gas system is available to pressurize the PRT.

14.2.12.1.13.3 Test Method

a. With a design backpressure in the PRT, a reactor makeup water pump is operated to obtain the spray flow to the PRT.

b. The response of the PRT nitrogen isolation valves to a containment isolation signal is verified.

14.2.12.1.13.4 Acceptance Criteria

a. The reactor makeup water system supplies the design spray flow to the PRT with design backpressure in the PRT.

b. PRT nitrogen isolation valves close on receipt of a containment isolation signal. Valve closure times are within design specifications.

14.2.12.1.14 RTD Bypass Flow Measurement (SU3-BB03)

At WCGS, test S-07BB01 (USAR Section 14.2.12.3.3) was used to satisfy the requirement for verification of design specifications.

14.2.12.1.15 Pressurizer Pressure Control Test (S-03BB04)

14.2.12.1.15.1 Objectives

To demonstrate the stability and response of the pressurizer pressure control system, including the verification of pressurizer pressure alarm and control functions.

14.2.12.1.15.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The plant is at normal operating temperature and pressure with all reactor coolant pumps running, and hot functional testing is in progress.

14.2.12.1.15.3 Test Method

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

b. Pressurizer pressure is varied, and pressurizer pressure control system alarm and control setpoints are verified.

14.2.12.1.15.4 Acceptance Criteria

a. The pressurizer pressure control system responds, in accordance with system design, to an increase and decrease in system pressure.

b. Pressurizer pressure control system alarm and control setpoints are within design specifications.

14.2.12.1.16 Reactor Coolant System Hot Preoperational Test (S-03BB05)

14.2.12.1.16.1 Objectives

a. To operate the reactor coolant system at full flow conditions for a minimum of 240 hours to provide the necessary vibration cycles on the vessel's internal components prior to their inspection at core loading.

b. To provide coordination and initial conditions necessary for the conduct of those preoperational tests to be performed during heatup, normal operating temperature and pressure, and cooldown of the reactor coolant system.

14.2.12.1.16.2 Prerequisites

a. The reactor coolant system cold hydrostatic test is complete.

b. The reactor vessel internals and head are installed, and the vessel is available to support this test.

c. All systems and components required to support heatup, operations at normal temperature and pressure, and cooldown of the reactor coolant system are available.

d. Required instrument calibration is complete.

e. The examination of the reactor internals in accordance with Section 3.9(N).2.4, is complete

14.2.12.1.16.3 Test Method

a. The reactor coolant system is operated at full flow conditions for a minimum of 240 hours.

b. Those preoperational tests required to be performed during heatup, normal operating temperature and pressure, and cooldown of the reactor coolant system are completed, as coordinated by this test.

14.2.12.1.16.4 Acceptance Criteria

The reactor coolant system has operated at full flow conditions for a minimum of 240 hours.

Notes: 1. The acceptance criteria for individual systems are a part of the individual test procedures sequenced by this procedure.

2. A post-hot functional examination of the reactor internals is performed as described in Section 3.9(N).2.4.

14.2.12.1.17 Thermal Expansion (S-03BB06)

14.2.12.1.17.1 Objectives

To verify that during heatup and cooldown of the reactor coolant system the associated components, piping, support, and restraint deflections are unobstructed and within design specifications.

14.2.12.1.17.2 Prerequisites

a. This test is conducted in conjunction with hot functional testing.

b. Supports, restraints, and hangers are installed and reference points and predicted movements established.

c. Required instrument calibration is complete.

14.2.12.1.17.3 Test Method

During the reactor coolant system heatup and cooldown, deflection data are recorded.

14.2.12.1.17.4 Acceptance Criteria

a. Unrestricted expansion and movements are verified to be within design specifications.

b. Components, piping, supports, and restraints return to their baseline cold position in accordance with system design.

14.2.12.1.18 Pressurizer Level Control Test (S-03BB07)

14.2.12.1.18.1 Objectives

To demonstrate the stability and response of the pressurizer level control system, including the verification of pressurizer level alarm and control functions.

14.2.12.1.18.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The letdown and charging portions of the chemical and volume control system are available to vary pressurizer level.

d. The plant is at normal operating temperature and pressure, and hot functional testing is in progress.

14.2.12.1.18.3 Test Method

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

b. Pressurizer level is varied, and pressurizer level control system alarm and control setpoints are verified.

14.2.12.1.18.4 Acceptance Criteria

a. The response and stability of the pressurizer level control system are within design specifications.

b. The pressurizer level control system alarm and control functions are within design specifications.

14.2.12.1.19 Pressurizer Heater and Spray Capability Test (SU3-BB08)

14.2.12.1.19.1 Objectives

To determine the electrical capacity of the pressurizer heaters, and the rate of pressure increase from the operation of all pressurizer heaters.

14.2.12.1.19.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The plant is at normal operating temperature and pressure with all reactor coolant pumps running, and hot functional testing is in progress.

14.2.12.1.19.3 Test Method

a. Pressurizer heaters are energized, and heater capacity is calculated.

b. With the pressurizer spray valves closed, all pressurizer heaters are energized, and the time to reach a 2,300 psig system pressure is measured and recorded.

14.2.12.1.19.4 Acceptance Criteria

a. The capacity of the pressurizer heaters is within design limits.

b. The pressurizer pressure response to the actuation of all pressurizer heaters is within design limits.

14.2.12.1.20 Reactor Coolant System Flow Measurement Test (SU3-BB09)

At WCGS, Test S-07BB03 (USAR Section 14.2.12.3.5) is used to satisfy the requirements for verification of design specifications.

14.2.12.1.21 Reactor Coolant System Flow Coastdown Test (SU3-BB10)

At WCGS, Test S-07BB04 (USAR Section 14.2.12.3.6) is used to satisfy the requirements for verification of design specifications.

14.2.12.1.22 Reactor Coolant System Hydrostatic Test (S-03BBll)

14.2.12.1.22.1 Objectives

To verify the integrity and leaktightness of the reactor coolant system and the high-pressure portions of associated systems.

14.2.12.1.22.2 Prerequisites

a. Required system flushing/cleaning are complete.

b. The reactor coolant pumps are available to support this test.

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

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

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

f. Required instrument calibration is complete.

14.2.12.1.22.3 Test Method

The minimum temperature for pressurizing the system is established. The reactor coolant pumps are operated as required to establish the required temperature. The system is then pressurized to test pressure, and system welds, flanges, piping, and components are monitored for leakage.

14.2.12.1.22.4 Acceptance Criteria

The reactor coolant system and associated high-pressure systems are verified leaktight in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section III, "Nuclear Components," through the Winter 1975 Addenda.

14.2.12.1.23 Pressurizer Continuous Spray Flow Verification Test (SU3-BB12)

At WCGS, Test S-07BB05 (USAR Section 14.2.12.3.7) was used to satisfy the requirements for verification of design specifications.

14.2.12.1.24 Pressurizer Relief Valve and PRT Hot Preoperational Test (S-03BB13)

14.2.12.1.24.1 Objectives

To demonstrate that the operating times of the pressurizer power- operated relief valves are within design specifications. The ability of the reactor coolant drain tank portion of the liquid radwaste system to cool down the pressurizer relief tank (PRT) at the design rate is also verified.

14.2.12.1.24.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The PRT is at a normal operating level and is aligned for normal operation.

d. The liquid radwaste system is available to cool down the PRT via the reactor coolant drain tank heat exchanger.

e. The plant is at normal operating temperature and pressure, and hot functional testing is in progress.

14.2.12.1.24.3 Test Method

a. Pressurizer power-operated relief valves are operated, and opening times recorded.

b. Following the operation of the pressurizer power-operated relief valves, the PRT is cooled down via the reactor coolant drain tank heat exchanger, and the cooldown rate is calculated and recorded.

14.2.12.1.24.4 Acceptance Criteria

a. Power-operated relief valve operating times are within design specifications.

b. The reactor coolant drain tank portion of the liquid radwaste system cools down the PRT at a rate within design specifications.

14.2.12.1.25 Reactor Coolant Loop Vibration Surveillance Test (S-03BB14)

14.2.12.1.25.1 Objectives

To verify that the dynamic effects experienced during reactor coolant loop steady flow and reactor coolant loop pump transients as measured during hot functional testing (HFT) do not exceed acceptance criteria for the primary loop piping and components.

14.2.12.1.25.2 Prerequisites

a. Hot functional testing is in progress.

b. Reference points for vibrational measurement of the reactor coolant piping and components are established.

c. All subject systems are available for the specified dynamic operation.

d. Required instrument calibration is complete.

14.2.12.1.25.3 Test Method

a. The systems are aligned for the specified dynamic operation.

b. The specified dynamic event is initiated and the reactor coolant piping and component responses are monitored.

14.2.12.1.25.4 Acceptance Criteria

The measured deflections for each of the test measurement points are within a specified percent of the calculated reference deflections.

14.2.12.1.26 Leak Detection System Preoperational Test (SU3-BB15A)

14.2.12.1.26.1 Objectives

a. To determine, during hot functional testing, the amount of identified and unidentified leakage from the reactor coolant system and verify that the leakage is within design limits.

b. To demonstrate the ability to detect an increase in reactor coolant system leakage.

14.2.12.1.26.2 Prerequisites

a. Required instrument calibration is complete.

b. Hot functional testing is in progress, and the reactor coolant system is at normal operating temperature and pressure.

c. The volume control tank contains an adequate supply of water to support this test.

d. The reactor coolant drain tank and associated pumps are available to support this test.

14.2.12.1.26.3 Test Method

a. The reactor coolant system identified and unidentified leakage rates are determined by monitoring the reactor coolant system water inventory.

b. A known leakage rate is initiated, and the ability to detect an increase in leakage is verified.

14.2.12.1.26.4 Acceptance Criteria

a. Reactor coolant system identified and unidentified leakage is within design limits.

b. The ability to detect an increase in reactor coolant system leakage is verified.

14.2.12.1.27 Leak Detection System Preoperational Test (SU3-BB15B)

14.2.12.1.27.1 Objectives

a. To demonstrate the operation of the leak detection system and to verify the ability of the system to detect leakage within the required time limit as specified by design.

b. The operation of the containment particulate and radioactive gas monitoring portions of the Leak Detection System are verified in SU4-SP01, Process Radiation Monitoring System Preoperational Test.

14.2.12.1.27.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. The containment normal sumps, instrument tunnel sump, floor drain tank, auxiliary building sump and associated pumps are available to support this test.

14.2.12.1.27.3 Test Method

a. A known simulated leakage is initiated, and the ability of the system to detect the leakage within the design time is verified.

14.2.12.1.27.4 Acceptance Criteria

a. The ability of the leak detection system to detect a leak within the design time is verified.

14.2.12.1.28 RTD/TC Cross Calibration (S-03BB16)

14.2.12.1.28.1 Objectives

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

14.2.12.1.28.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. Initial plant heatup, during hot functional testing, is in progress, and all reactor coolant pumps are operating.

14.2.12.1.28.3 Test Method

At various temperature plateaus, RTD and incore thermocouple data are recorded. Isothermal cross-calibration correction factors for individual thermocouples and the installation corrections for individual RTDs are determined.

14.2.12.1.28.4 Acceptance Criteria

a. Individual RTD readings are within the design specifications.

b. The installation corrections of the RTDs are within design specifications.

14.2.12.1.29 Chemical and Volume Control System Major Component Test (S-03BG01)

14.2.12.1.29.1 Objectives

To demonstrate the operation of the centrifugal charging pumps and associated minimum flow valves, including their response to safety signals.

14.2.12.1.29.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

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

d. The component cooling water system is available to provide cooling water to the centrifugal charging pump oil coolers.

14.2.12.1.29.3 Test Method

a. Centrifugal charging pumps are operated, and performance characteristics are verified.

b. Centrifugal charging pump and minimum flow valve control logics are verified, including their response to safety signals.

14.2.12.1.29.4 Acceptance Criteria

a. Centrifugal charging pump performance characteristics are within design specifications.

b. Each centrifugal charging pump receives a start signal from the load sequencer.

c. If a safety injection signal is present, a centrifugal charging pump minimum flow valve will open if the associated pump flow is low and will close if the associated pump flow is above the minimum flow requirement of the pump.

14.2.12.1.30 Seal Injection Preoperational Test (SU3-BG02)

14.2.12.1.30.1 Objective

To demonstrate the ability of the chemical and volume control system to supply adequate seal water injection flow to the reactor coolant pumps and verify the operation of the seal water return containment isolation valves, including their response to a CIS.

14.2.12.1.30.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The volume control tank contains an adequate supply of demineralized water for the performance of this test.

d. Cooling water is available to the charging pumps.

14.2.12.1.30.3 Test Method

a. With a charging pump in operation, seal water throttle valves are adjusted to maintain the required flow to each reactor coolant pump.

b. Seal water return containment isolation valves control logics are verified, including their response to a CIS.

14.2.12.1.30.4 Acceptance Criteria

a. Seal water injection flow to each reactor coolant pump is within design specifications.

b. Seal water return containment isolation valves close on receipt of a CIS. Valve closure times are within design specifications.

14.2.12.1.31 Charging System Preoperational Test (SU3-BG03)

14.2.12.1.31.1 Objective

To demonstrate positive displacement charging pump (replaced by the normal charging pump per DCP 04590) operating characteristics and to verify the operation of the regenerative heat exchanger inlet isolation valves and the letdown isolation valves, including their response to a safety injection signal (SIS).

14.2.12.1.31.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The volume control tank contains an adequate supply of demineralized water for the performance of this test.

d. Cooling water is available to the positive displacement charging pump (replaced by the normal charging pump per DCP 04590).

e. The reactor coolant system is available to receive charging system flow.

14.2.12.1.31.3 Test Method

a. The positive displacement charging pump (replaced by the normal charging pump per DCP 04590) is operated, and pump operating data are recorded.

b. Regenerative heat exchanger inlet isolation valve and letdown system isolation valve control circuits are verified, including valve response to safety injection signals.

14.2.12.1.31.4 Acceptance Criteria

a. Positive displacement charging pump (replaced by the normal charging pump per DCP 04590) operating characteristics are within design specifications.

b. Charging pump to regenerative heat exchanger inlet isolation valves close on receipt of an SIS. Valve closure times are within design specifications.

c. The letdown line containment isolation valves close on receipt of a containment isolation signal. Valve closure times are within design specifications.

14.2.12.1 32 Boron Thermal Regeneration System Preoperational Test (SU3-BG04)

14.2.12.1.32.1 Objective

To verify the operation of the boron thermal regeneration system, and associated control circuits. Performance characteristics of the chemical and volume control system chiller pumps are also verified.

14.2.12.1.32.2 Prerequisites

a. Required component testing, instrument calibration and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The volume control tank contains an adequate supply of demineralized water for the performance of this test.

d. The chemical and volume control system chiller surge tank contains an adequate supply of demineralized water for the performance of this test.

14.2.12.1.32.3 Test Method

a. The chemical and volume control system chiller pumps are operated and performance characteristics are verified.

b. Boron thermal regeneration system component control circuits are verified.

14.2.12.1.32.4 Acceptance Criteria

a. The chemical and volume control system chiller pumps' operating characteristics are within design specifications.

b. The chemical and volume control system chiller pumps start automatically when the boron thermal regeneration system is placed in the borate or dilute mode of operation.

14.2.12.1.33 Boric Acid Blending System Preoperational Test (SU3-BG05)

14.2.12.1.33.1 Objectives

a. To demonstrate the operating characteristics of boron injection makeup and boric acid transfer pumps and verify the ability of the boric acid blending system to make up at design flow rates to the chemical and volume control system (CVCS).

b. To verify the operation of system component control circuits in all modes of operation.

c. To demonstrate by flow test the ability of the reactor makeup water system to supply water to the boric acid blender.

d. To demonstrate by flow test the ability of the boric acid system to supply an emergency boration flow to the charging pump suction.

e. To verify the operation of volume control tank valves and associated control circuits, including valve response to safety signals.

14.2.12.1.33.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The reactor makeup water system is available to supply water to the boric acid blender and boric acid batching tank.

d. A charging pump is available to receive and discharge flow from the boric acid transfer pumps.

e. The volume control tank (VCT) contains an adequate supply of demineralized water for the performance of this test.

14.2.12.1.33.3 Test Method

a. The boron injection makeup and boric acid pumps are operated, performance data recorded, and the ability of the system to make up to the CVCS at design flow rates is verified.

b. System component control circuits are verified in all modes of operation.

c. With a reactor makeup water pump in operation, flow is verified to the boric acid blender and boric acid batching tank.

d. With both boric acid transfer pumps in operation and a charging pump taking a suction from the VCT and discharging to the reactor coolant loops, the emergency boration flow rate from the transfer pumps to the charging pump suction is recorded.

e. The emergency boration flow rate via gravity feed from the boric acid tanks to the charging pump suction is recorded.

f. Proper operation of the reactor makeup water system is verified when the reactor makeup control system (RMCS) is operated in the manual, dilute, alternate dilute, and automatic modes.

g. The operation of the VCT outlet valves control circuits is verified, including their response to a safety injection signal.

14.2.12.1.33.4 Acceptance Criteria

a. The boron injection makeup and boric acid transfer pump operating characteristics are within design specifications.

b. The flow rate to the boric acid blender from the reactor makeup water system is within design specifications.

c. The emergency boration flow rates to the charging pump suction are within design specifications.

d. The boric acid transfer pumps and the reactor makeup water pumps start automatically on a low level in the volume control tank when the RMCS is in the automatic mode.

e. VCT outlet valves close on receipt of a safety injection signal when the associated charging pump supply valve from the refueling water storage tank is open.

f. Refueling water storage tank to charging pump suction valves open on receipt of a safety injection signal.

g. The boric acid transfer pumps stop on receipt of a load shed signal.

h. The boric acid filter to charging pump valve supply breaker trips open on receipt of a load shed signal.

14.2.12.1.34 Chemical and Volume Control System Hot Preoperational Test (S-03BG06)

14.2.12.1.34.1 Objectives

a. To determine by flow test that all letdown and cleanup flow rates are within design specifications.

b. To determine, by comparison of boron concentrations, that boric acid addition to the reactor coolant system has occurred, using the normal and emergency flow paths.

c. To determine by flow test the ability of the chemical and volume control system (CVCS) to make up at design flow rates and boron concentrations to the reactor coolant system in all modes of operation.

d. To determine by operational test that the letdown containment isolation valve closure times are within design specifications.

e. To demonstrate the ability of the pump room coolers to maintain room temperatures within design limits.

14.2.12.1.34.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The plant is at normal operating temperature and pressure, and hot functional testing is in progress.

d. The CVCS pump rooms are closed, and their associated pump room coolers are operational.

14.2.12.1.34.3 Test Method

a. The letdown throttle valves are adjusted to establish letdown flow within design specifications.

b. Boric acid addition to the reactor coolant system is verified, using the normal and emergency flow paths, by comparing the change in boron concentrations.

c. With a charging pump in operation, the ability of the CVCS, in all modes of operation, to make up at design flow rates and boron concentrations to the reactor coolant system is verified.

d. With letdown flow established, the letdown containment isolation valves are operated, and operating times are recorded.

e. During CVCS pump operation, pump room temperature data are recorded.

14.2.12.1.34.4 Acceptance Criteria

a. All letdown and cleanup flow rates are within design specifications

b. The boric acid addition system is capable of adding boron to the reactor coolant system via both the normal and emergency flow paths.

c. The CVCS makeup flow rates and boron additions to the reactor coolant system are within design specifications in all modes of operation.

d. The letdown containment isolation valves' closure times are within design specifications.

e. The CVCS pump room coolers maintain the room temperature within design limits.

f. The boron thermal regeneration system (BTRS) can vary the reactor coolant boron concentration as required for daily load cycle at 85 percent core life.

14.2.12.1.35 Fuel Pool Cooling and Cleanup System Preoperational Test (SU3-EC01)

14.2.12.1.35.1 Objectives

a. To demonstrate the operating characteristics of the fuel pool cooling, fuel pool cleanup, and pool skimmer pumps and to verify that the associated instrumentation and controls are functioning properly.

b. To verify that the fuel pool cleanup pump refueling water storage tank (RWST) suction isolation valves close on receipt of a safety injection signal (SIS).

c. To verify that each fuel pool cooling pump room cooler starts when the associated fuel pool cooling pump starts.

14.2.12.1.35.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. Cooling water is available to the fuel pool cooling and cleanup system heat exchangers.

d. The liquid radwaste system is available to drain the refueling pool to the RWST.

e. The essential service water system is available to provide cooling water to the spent fuel pool pump room coolers.

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

14.2.12.1.35.3 Test Method

a. The fuel pool cooling, fuel pool cleanup, and pool skimmer pumps are operated in their various modes, and pump operating data are recorded.

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

c. The ability of each fuel pool cooling pump room cooler to start when the associated fuel pool cooling pump starts is verified.

14.2.12.1.35.4 Acceptance Criteria

a. The operating characteristics of the fuel pool cooling, fuel pool cleanup, and pool skimmer pumps are within design specifications.

b. The fuel pool cleanup pumps RWST suction isolation valves close on receipt of an SIS.

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

d. Each fuel pool cooling pump trips on receipt of a load shed signal.

e. Each fuel pool cooling pump room cooler starts when the associated fuel pool cooling pump starts.

14.2.12.1.36 Spent Fuel Pool Leak Test (S-03EC02)

14.2.12.1.36.1 Objectives

a. To demonstrate the integrity of the spent fuel pool, cask loading pit, and fuel transfer canal.

b. To demonstrate the leaktightness of the cask loading pit gate and the fuel transfer canal gate.

14.2.12.1.36.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The spent fuel pool is filled to the normal operating level.

d. The cask loading pit level is below the level of the fuel pool gate.

e. The fuel transfer canal level is below the level of the fuel pool gate.

f. The reactor makeup water system is available to provide demineralized water to the spent fuel pool.

g. A source of compressed air is available to pressurize the system standpipes.

14.2.12.1.36.3 Test Method

The cask loading pit gate and fuel transfer canal gate are visually inspected for leakage. A leak test is performed on the spent fuel pool, cask loading pit, and fuel transfer canal, using the associated leak chase standpipes.

14.2.12.1.36.4 Acceptance

No leakage is observed from the spent fuel pool, cask loading pit, fuel transfer canal, cask loading pit gate, and fuel transfer canal gate.

14.2.12.1.37 Essential Service Water System Preoperational Test (SU3-EF01)

Test SU3-EF02 combined with Test SU3-EF01, Essential Service Water System Preoperational Test.

14.2.12.1.37.1 Objectives

a. To demonstrate the capability of the essential service water system to provide cooling water flow during the LOCA mode of operation. The operation and response of system valves to align the system in the LOCA flow mode on safety injection signals, load sequence signals, and low suction pressure signals are also verified.

b. To demonstrate the operating characteristics of the essential service water (ESW) pumps and verify their response to safety signals.

c. To demonstrate the operability of the backpressure control valves, including their response to safety signals.

14.2.12.1.37.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The compressed air system is available to the system air-operated valves.

14.2.12.1.37.3 Test Method

a. System operating characteristics are verified in the LOCA mode of operation.

b. Safety signals are simulated, and the responses of the system valves and the ESW pumps are verified.

c. The ESW pumps are operated and pump operating data are recorded.

d. The operability of the backpressure control valves, including their response to safety signals is verified.

14.2.12.1.37.4 Acceptance Criteria

a. Components supplied by the essential service water system receive flows that are within design specifications in the LOCA mode of system operation.

b. System valve operation in response to safety signals is within design requirements.

c. System valve operating times are within design specifications.

d. The ESW pumps' operating characteristics are within design specifications.

e. Each ESW pump responds properly to load sequence and load shed signals.

f. The time required for each ESW pump to reach rated flow is within design specifications.

g. System backpressure valves close upon receipt of a LOCA sequencer or safety injection signal.

h. An auxiliary feedwater pump low suction pressure signal will close the ESW pump breakers if a zero sequencer signal is not present.

14.2.12.1.38 Component Cooling Water System Preoperational Test (S-03EG01)

14.2.12.1.38.1 Objectives

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

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

14.2.12.1.38.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

14 2.12.1.38.3 Test Method

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

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

14.2.12.1.38.4 Acceptance Criteria

a. The performance characteristics of each component cooling water pump are within design specifications.

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

c. Component cooling water pump and valve responses to load sequence, containment isolation, and safety injection signals are within design specifications.

d. Closure times for the component cooling water supply and return valves to the reactor coolant system are within design specifications.

e. Component cooling water pump response to centrifugal charging pump start signals is in accordance with system design.

14.2.12.1.39 Residual Heat Removal System Cold Preoperational Test (SU3-EJ01)

14.2.12.1.39.1 Objective

To demonstrate the operability of the Residual Heat Removal (RHR) pumps, demonstrate by flow test their ability to supply water at rated pressure and flow, and verify their response to safety signals. The operation of system motor-operated valves, including their response to safety signals, are also verified. The RWST control and alarm circuits are also verified.

14.2.12.1.39.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The reactor vessel head is removed and the water level is above the nozzles.

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

e. Cooling water is available to the RHR pumps and heat exchangers.

f. The instrument air system is available to supply air to system air-operated valves.

14.2.12.1.39.3 Test Method

a. Performance characteristics of the RHR pumps are verified during discharge to the reactor coolant hot and cold loops and test recirculation.

b. RWST and RHR system component control circuits are verified, including the operation of the RHR pumps and system valves on receipt of safety signals.

14.2.12.1.39.4 Acceptance Criteria

a. RHR pump performance characteristics are within design specifications.

b. RHR system components align or actuate in accordance with system design to safety injection, containment isolation, load sequencing, load shed, and tank level signals.

c. The time required for each RHR pump to reach rated speed is within design specifications.

d. RHR system motor-operated valve closure times are within design specifications.

14.2.12.1.40 Residual Heat Removal System Hot Preoperational Test (S-U3-EJ02)

14.2.12.1.40.1 Objectives

a. To demonstrate the ability of the residual heat removal (RHR) system to cool down the reactor coolant system (RCS) at its design rate.

b. To demonstrate the ability of the RHR pump room coolers to maintain room temperature within design limits.

14.2.12.1.40.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The component cooling water system is supplying water to each RHR heat exchanger.

d. The RCS is being cooled down during hot functional testing.

e. The RHR pump rooms are closed, and their associated pump room coolers are operational.

14.2.12.1.40.3 Test Method

a. While the RCS is being cooled down with the RHR system, the heat transfer is obtained by performing a heat balance across each RHR heat exchanger.

b. When RHR pump room temperatures have stabilized, room temperature data is recorded.

14.2.12.1.40.4 Acceptance Criteria

a. The RHR system is capable of cooling down the reactor coolant system at its design rate.

b. The RHR pump room coolers can maintain room temperature within design limits.

14.2.12.1.41 Safety Injection System Cold Preoperational Test (SU3-EM01)

14.2.12.1.41.1 Objectives

To demonstrate the response of the safety injection pumps and associated valves to safety signals.

14.2.12.1.41.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete

b. Required electrical power supplies and control circuits are operational.

14.2.12.1.41.3 Test Method

The response of the safety injection pumps and associated valves to safety signals is verified

14.2.12.1.41.4 Acceptance Criteria

a. The safety injection pumps and associated valves align or actuate in accordance with system design to containment isolation signals, load shedding signals, and load sequencing signals.

14.2.12.1.42 Safety Injection Flow Verification Test (SU3-EM02)

14.2.12.1.42.1 Objectives

a. To demonstrate the operating characteristics of the safety injection pumps and the centrifugal charging pumps.

b. To demonstrate the capability of the safety injection pumps to provide balanced flow to the reactor coolant system and prevent runout flow in the cold leg and hot leg injection modes.

c. To demonstrate the capability of the charging pumps to provide balanced flow to the reactor coolant system and prevent runout flow in the boron injection mode.

d. To demonstrate the capability of the residual heat removal pumps to provide required net positive suction head to the safety injection pumps and the centrifugal charging pumps.

e. To demonstrate that the safety injection and centrifugal charging pump room coolers maintain room temperature within design limits.

f. To demonstrate that associated system valve operating times are within specified limits.

14.2.12.1.42.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The CVCS is available to supply rated flow to the reactor coolant system via the boron injection path, while simultaneously supplying other required loads.

d. The residual heat removal system is available to supply adequate suction head to the safety injection and centrifugal charging pumps during required injection modes.

e. The borated refueling water storage tank contains an adequate supply of demineralized water for this test.

f. The reactor vessel is available to receive water, and the temporary reactor vessel pumpdown system is operational (if required).

g. The auxiliary building HVAC system is available to cool the pump rooms and verify associated pump interlocks.

h. The accumulator safety injection system piping from the safety injection system to the reactor coolant system is available, and an accumulator tank is capable of receiving water.

i. Cooling water is available to required pumps and heat exchangers.

j. The compressed air system is available to supply air to associated system valves.

k. The residual heat removal system hot leg and cold leg flow orifices have been sized for required flow.

14.2.12.1.42.3 Test Method

a. The safety injection pumps are operated in the cold leg flow mode to verify pump performance characteristics and to identify the weaker pump.

b. The safety injection cold leg branch lines are balanced using the weaker safety injection pump and the balance checked with the stronger pump. The balance is performed so that injection flow is maximized while preventing pump runout.

c. The safety injection hot leg branch lines are balanced, using their respective safety injection pump. The balance is performed so that injection flow is maximized while preventing pump runout.

d. The centrifugal charging pumps are operated in the boron injection mode to determine pump performance characteristics and to identify the weaker pump.

e. The boron injection branch lines are balanced, using the weaker centrifugal charging pump and the balance checked with the stronger pump. The balance is performed such that injection flow is maximized while preventing pump runout.

f. Each residual heat removal pump is operated in series with the centrifugal charging pumps and safety injection pumps to verify that the residual heat removal pumps can supply adequate suction head.

g. With each centrifugal charging pump and safety injection pump operating, pump room temperatures are allowed to stabilize, and room temperature data are recorded.

14.2.12.1.42.4 Acceptance Criteria

a. The safety injection and centrifugal charging pump response times and valve operating times are within design specifications.

b. The safety injection pump room coolers start with their respective pump.

c. The NPSH provided by the residual heat removal pumps to the centrifugal charging pumps and safety injection pumps is within system design specifications.

d. Safety injection cold leg, hot leg, and safety injection pump flows are within design specifications.

e. Boron injection and centrifugal charging pump flows are within design specifications.

f. The safety injection and centrifugal charging pump room coolers can maintain room temperature within design limits.

14.2.12.1.43 Safety Injection Check Valve Test (SU3-EM03)

14.2.12.1.43.1 Objectives

To demonstrate the integrity of accumulator outlet line and loop safety injection line check valves and backup check valves by performing backleakage tests. The operability of the various safety injection line check valves under their design pressure conditions is also verified.

14.2.12.1.43.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The reactor coolant system is at normal operating pressure.

14.2.12.1.43.3 Test Method

a. Check valve leak testing is performed with the reactor coolant system at normal operating pressure.

b. Check valve operability is performed by verifying flow through the check valves at reduced reactor coolant pressure.

14.2.12.1.43.4 Acceptance Criteria

a. Check valve leakage rates are within limits established by Technical Specifications Section 3.4.6.2f.

b. Injection line check valve operability is demonstrated by verification of flow through the check valves in each of the safety injection lines to the reactor coolant system.

14.2.12.1.44 Boron Injection Tank and Recirculation Pump Test (SU3-EM04)

This test has been deleted at Wolf Creek since the boron injection requirements have been eliminated due to the decrease in required boron concentration.

14.2.12.1.45 Containment Spray System Nozzle Air Test (S-03EN01)

14.2.12.1.45.1 Objectives

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

14.2.12.1.45.2 Prerequisites

A source of compressed air is available to pressurize the spray headers.

14.2.12.1.45.3 Test Method

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

14.2.12.1.45.4 Acceptance Criteria

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

14.2.12.1.46 Containment Spray System Preoperational Test (SU3-EN02)

14.2.12.1.46.1 Objectives

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

b. To demonstrate the ability of the pump room coolers to maintain room temperatures within design limits.

14.2.12.1.46.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

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

d. The auxiliary building HVAC system is available to cool the pump rooms and verify associated pump interlocks.

e. The containment spray pump rooms are closed.

14.2.12.1.46.3 Test Method

a. Performance characteristics of the containment spray pumps are verified in the test mode, recirculating to the refueling water storage tank, and in the simulated accident mode.

b. System component control circuits are verified, including the operation of system pumps and valves on receipt of load sequence/shedder and CSAS/CIS signals, respectively.

c. During system operations, spray additive eductor operating characteristics are verified.

d. During containment spray pump operation, pump room temperature data are recorded.

14.2.12.1.46.4 Acceptance Criteria

a. Containment spray pump performance characteristics are within design specifications for the tested modes of operation.

b. Containment spray pump and valve response to load sequence/shedder and CSAS/CIS is verified, and the associated response times are within design specifications.

c. Spray additive eductor operating characteristics are within design specifications.

d. The containment spray pump room coolers maintain the room temperature within design limits.

14.2.12.1.47 Accumulator Testing (S-03EP01)

14.2.12.1.47.1 Objectives

To determine the operability of each safety injection accumulator and obtain, by flow test, each accumulator's discharge line resistance to flow. The ability of the accumulator discharge line isolation valves to open under maximum differential pressure conditions is verified, as is the response of accumulator system valves to safety signals.

14.2.12.1.47.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The reactor vessel head and reactor internals are not installed, and the vessel is available to receive water.

d. A source of compressed air and nitrogen is available.

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

14.2.12.1.47.3 Test Method

a. Each accumulator is filled and partially pressurized with the discharge valves closed. The discharge valves are opened, discharging the accumulators to the reactor vessel, and performance data are recorded.

b. Each accumulator discharge line isolation valve is operated under maximum differential pressure conditions of normal accumulator precharge pressure and zero reactor coolant pressure, and the valve operating times are recorded.

c. Accumulator system valve control circuits are verified, including their response to safety injection and containment isolation signals.

14.2.12.1.47.4 Acceptance Criteria

a. Each accumulator’s discharge line resistance to flow (L/D) is in accordance with design specifications.

b. Each accumulator’s discharge line isolation valve opening time under maximum differential pressure conditions is within design specifications.

c. The accumulator system nitrogen supply containment isolation valve closes on receipt of a containment isolation signal. Valve closure time is within design specifications.

d. Each accumulator discharge isolation valve opens on receipt of a safety injection signal.

14.2.12.1.48 Auxiliary Feedwater Pump Turbine Preoperational Test (SU3-FC01)

14.2.12.1.48.1 Objectives

a. To demonstrate the operation of the auxiliary feedwater pump (AFWP) turbine and its support equipment, while uncoupled from the pump.

b. To demonstrate control of the AFWP turbine from the control room as well as the auxiliary shutdown panel.

14.2.12.1.48.2 Prerequisites

a. Required component testing, instrument calibration and system flushing/cleaning are complete.

b. Steam is available to the AFWP turbine.

14.2.12.1.48.3 Test Method

a. AFWP turbine system valves are operated and required response to various signals is verified.

b. The turbine is operated and proper control is verified from the control room as well as the auxiliary shutdown panel, and operating data are recorded.

c. The turbine is brought to high speed at which time the mechanical and electronic overspeed trips are verified.

14.2.12.1.48.4 Acceptance Criteria

a. The AFWP turbine can be controlled from the control room panel and the auxiliary shutdown panel.

b. The mechanical and electronic overspeed trips actuate to shut down the turbine in accordance with the design.

14.2.12.1.49 Essential Service Water Pumphouse HVAC Preoperational Test (SU3-GD01)

14.2.12.1.49.1 Objectives

a. To demonstrate the capacity of the essential service water (ESW) pumproom supply fans.

b. To demonstrate ESW pumproom unit heater response to a load shed signal.

14.2.12.1.49.2 Prerequisites

a. Required component testing and instrument calibration are completed.

b. Required electrical power supplies and control circuits are operational.

c. The ESW pumphouse HVAC system is air balanced.

14.2.12.1.49.3 Test Methods

a. The ESW pumphouse supply fans are operated and flow data are recorded.

b. Response of the ESW pumproom unit heaters to load shed signal is verified.

14.2.12.1.49.4 Acceptance Criteria

a. The ESW pumphouse supply fan capacities are within design specification.

b. A load shed signal will trip the ESW pumproom unit heaters' circuit breaker.

14.2.12.1.50 Miscellaneous Building HVAC System Preoperational Tests (SU3-GF01, SU3-GF02, SU3-GF03)

14.2.12.1.50.1 Objectives

To demonstrate the capacity of; 1) the auxiliary feedwater pump room cooler fans, 2) the main steam enclosure building supply and exhaust fans and 3) the tendon access gallery transfer fans and to verify that the associated instrumentation and controls are functioning properly. The responses of the main steam enclosure building dampers and tendon access gallery dampers to safety signals are also verified.

(At Wolf Creek Generating Station, this test was performed in three independent parts. In addition, the auxiliary boiler room fan was treated as part of preoperational test SU4-GF01.)

14.2.12.1.50.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The miscellaneous building HVAC system is air balanced.

14.2.12.1.50.3 Test Method

a. Flow data are recorded while the fans are operating.

b. The response of system dampers to a safety injection signal (SIS) is verified.

14.2.12.1.50.4 Acceptance Criteria

a. System fan capacities are within design specifications.

b. The main steam enclosure building and tendon access gallery dampers close on receipt of a SIS.

14.2.12.1.51 Fuel Building HVAC System Preoperational Test (S-03GG01)

14.2.12.1.51.1 Objectives

To demonstrate that the emergency exhaust fans are capable of maintaining a negative pressure in the fuel building or the auxiliary building during accident conditions with the buildings isolated. To demonstrate the capacities of the fuel building supply unit fans, emergency exhaust fans, and the spent fuel pool pump room cooler fans. The operability of system instrumentation and controls, including the components' response to safety signals, is also verified.

14.2.12.1.51.2 Prerequisites

a. Required component testing, instrument calibration, and system air balancing are complete.

b. Required electrical power supplies and control circuits are operational.

c. The compressed air system is available to supply the air-operated dampers in the fuel building.

d. Required portions of the auxiliary building HVAC system have been air balanced and are available to support this test.

14.2.12.1.51.3 Test Method

a. With the fuel building closed, the system is operated in its normal configuration, and the fuel building supply unit fan and spent fuel pool pump room cooler fan capacities are verified.

b. With a fuel building isolation signal (FBIS) present, the emergency exhaust fan capacities and negative fuel building pressures are verified.

c. With a safety injection signal (SIS) present and the auxiliary building isolated, the emergency exhaust fan capacities and negative auxiliary building pressures are verified.

14.2.12.1.51.4 Acceptance Criteria

a. The auxiliary building and fuel building pressures maintained by the emergency exhaust fans are within design specifications.

b. The fuel building supply fans, emergency exhaust fans, and spent fuel pool pump room cooler fans’ capacities are within design specifications.

c. The fuel building ventilation system fans and dampers properly respond to FBIS and SIS, in accordance with system design.

14.2.12.1.52 Control Building HVAC System Preoperational Test (SU3-GK01)

14.2.12.1.52.1 Objectives

To demonstrate the capacities of the control building supply air unit, control building exhaust fans, access control exhaust fans, control room pressurization fans, control room filtration fans, control room air conditioning units, access control fan coil units, counting room fan coil unit, and Class IE electrical equipment ac units. To demonstrate that the control room pressurization fans are capable of maintaining a positive pressure in the control room following a control room ventilation isolation signal (CRVIS). The system instrumentation and controls, including the components’ responses to safety signals, are also verified. To demonstrate that the ventilation to battery rooms 1 through 4 is in accordance with system design.

14.2.12.1.52.2 Prerequisites

a. Required component testing, instrument calibration, and system air balancing are complete.

b. Required electrical power supplies and control circuits are operational.

c. The compressed air system is available to supply air to system air-operated dampers.

14.2.12.1.52.3 Test Method

a. The control building system fans are operated, and fan capacities are verified.

b. Proper response of system components to control room ventilation isolation signals (CRVIS) and safety injection signals (SIS) is verified.

c. With a CRVIS present, the ability of each control room pressurization fan to maintain the control room at a positive pressure is verified.

d. The air flow to battery rooms 1 through 4 is verified.

14.2.12.1.52.4 Acceptance Criteria

a. The control building HVAC system fan capacities are within design specifications.

b. The control building HVAC system fans and dampers properly respond to CRVIS and SIS in accordance with system design.

c. The control room pressure maintained by the control room pressurization fans is within design specification.

d. The air flow to battery rooms 1 through 4 is in accordance with system design.

14.2.12.1.53 Auxiliary Building HVAC System Preoperational Test (SU3-GL01)

14.2.12.1.53.1 Objectives

To demonstrate the capacities of the auxiliary building supply unit fans, auxiliary/fuel building normal exhaust fans, the auxiliary building fan coil units, pump room coolers, penetration room coolers, decon tank exhaust scrubber fans, access tunnel transfer fan, and penetration cooling fan. The system instrumentation and controls, including components' response to safety and fire signals, are also verified.

14.2.12.1.53.2 Prerequisites

a. Required component testing, instrument calibration, and system air balancing are complete.

b. Required electrical power supplies and control circuits are operational.

c. The compressed air system is available to supply the air-operated dampers in the auxiliary building.

d. The fuel building HVAC system has been air balanced, and is available to support this test.

14.2.12.1.53.3 Test Method

a. The system is operated in its normal configuration, and the system fan capacities are verified.

b. Proper responses of system components to safety injection and fire signals are verified.

14.2.12.1.53.4 Acceptance Criteria

a. The auxiliary building fan capacities are within design specifications.

b. The auxiliary building fans and dampers properly respond to safety injection and fire signals, in accordance with system design.

14.2.12.1.54 Diesel Generator Building HVAC Preoperational Test (S-03GM01)

14.2.12.1.54.1 Objectives

To demonstrate the capacities of the diesel generator room supply fans and to verify that the system instrumentation and controls function properly, including the response of fans and associated dampers to a diesel generator run signal and room temperature signals.

14.2.12.1.54.2 Prerequisites

a. Required component testing and instrument calibration are completed.

b. Required electrical power supplies and control circuits are operational.

c. The diesel generator building HVAC system is air balanced.

d. The respective diesel generator is not operating while the room is under test.

14.2.12.1.54.3 Test Method

a. Flow data are recorded, while the diesel generator room supply fans are operating.

b. The responses of the diesel generator room supply fans and exhaust dampers to a diesel generator run signal and to room temperature signals are verified.

14.2.12.1.54.4 Acceptance Criteria

a. The capacities of the diesel generator room supply fans are within design specifications.

b. The diesel generator room exhaust dampers open on receipt of a diesel generator run signal.

c. The diesel generator room supply fans start on a high room temperature signal and stop on a low room temperature signal.

14.2.12.1.55 Containment Cooling System Preoperational Test (SU3-GN01)

14.2.12.1.55.1 Objectives

To demonstrate the capacities of the hydrogen mixing, containment cooling, and pressurizer cooling fans and verify their associated instrumentation and controls function properly, including fan response to safety signals.

14.2.12.1.55.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The essential service water system is available to supply water to the containment coolers.

d. The containment cooling system has been air balanced.

14.2.12.1.55.3 Test Method

a. The hydrogen mixing, containment cooling, and pressurizer cooling fans are operated, flow data recorded, and fan capacities calculated.

b. The response of the hydrogen mixing and containment cooling fans to safety signals is verified.

14.2.12.1.55.4 Acceptance Criteria

a. The capacities of the hydrogen mixing, containment cooling, and pressurizer cooling fans are within design specifications.

b. The hydrogen mixing and containment cooling fans align or actuate in response to safety injection, shutdown sequencer, and LOCA sequencer signals, in accordance with system design.

14.2.12.1.56 CRDM Cooling Preoperational Test (S-03GN02)

14.2.12.1.56.1 Objectives

To demonstrate the operating characteristics of the cavity cooling, control rod drive mechanism (CRDM), and the elevator machine room exhaust fans and verify their associated instrumentation and controls, including their response to safety signals.

14.2.12.1.56.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The CRDM and cavity cooling portions of the containment cooling system are air balanced.

14.2.12.1.56.3 Test Method

a. The cavity cooling, elevator machine room exhaust, and CRDM fans are operated, flow data recorded, and fan capacities calculated.

b. The response of the CRDM fans to a safety injection signal is verified.

14.2.12.1.56.4 Acceptance Criteria

a. The capacities of the cavity cooling, elevator machine room exhaust, and CRDM fans are within design specifications.

b. The appropriate CRDM fans supply breakers open on receipt of a safety injection signal.

14.2.12.1.57 Integrated Containment Leak Rate Test (SU3-GP01)

14.2.12.1.57.1 Objective

To demonstrate that the total leakage from the containment does not exceed the maximum allowable leakage rate at the calculated peak containment internal pressure. The operability of the containment cooling fans at design accident pressure is also verified.

14.2.12.1.57.2 Prerequisites

a. The containment penetration leakage rate tests (type B tests) and containment isolation valve leakage tests (type C tests) are complete and the containment has been pressurized to 115 percent of the design pressure.

b. All containment isolation valves are closed by normal actuation methods.

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

d. Portions of fluid systems that are part of the containment boundary, that may be opened directly to the containment or outside atmosphere under post-accident conditions, are opened or vented to the appropriate atmosphere to place the containment in as close to post-accident conditions as possible.

e. Required instrument calibration is complete.

14.2.12.1.57.3 Test Method

a. The integrated containment leak rate test (type A test) is conducted, using the absolute method, described in the ANSI/ANS 56.8-1981 Containment System Leakage Testing Requirements. Measurements of containment atmosphere dry-bulb temperature, dew point and pressure are taken to calculate the leakage rate. A standard statistical analysis of data is conducted, using a linear least squares fit regression analysis to calculate the leakage rate.

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

c. While at the design accident pressure, data is recorded for the containment cooling fans.

14.2.12.1.57.4 Acceptance Criteria

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

The containment cooling fan operation at design accident pressure is in accordance with design.

14.2.12.1.58 Reactor Containment Structural Integrity Acceptance Test (SU3-GP02)

14.2.12.1.58.1 Objectives

To demonstrate the structural integrity of the reactor containment building.

14.2.12.1.58.2 Prerequisites

a. Containment penetrations are installed, and penetration leak tests are completed.

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

c. Required instrument calibration is complete.

14.2.12.1.58.3 Test Method

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

14.2.12.1.58.4 Acceptance Criteria

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

14.2.12.1.59 Post-Accident Hydrogen Removal System Preoperational Test (S-03GS01)

14.2.12.1.59.1 Objectives

a. To demonstrate that the hydrogen recombiner performance characteristics are within design specifications.

b. To determine the operation of system dampers and valves, including the response of hydrogen purge and hydrogen monitoring containment isolation valves to a CIS.

c. To demonstrate the operability of the hydrogen analyzers and their ability to sample the containment atmosphere.

14.2.12.1.59.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.1.59.3 Test Method

a. Performance characteristics are recorded, while the hydrogen recombiners are operating.

b. System valve and damper control circuits are verified, including the response of hydrogen purge and hydrogen monitoring containment isolation valves to a CIS.

c. The hydrogen analyzers are operated, and performance data recorded.

14.2.12.1.59.4 Acceptance Criteria

a. Hydrogen recombiner performance characteristics are within design specifications.

b. Hydrogen purge and hydrogen monitoring containment isolation valves close on receipt of a CIS. Valve closure times are within design specifications.

14.2.12.1.60 Containment Purge System HVAC Preoperational Test (S-03GT01)

14.2.12.1.60.1 Objectives

To demonstrate the capacities of the containment minipurge supply and exhaust, shutdown purge supply and exhaust, and containment atmospheric control fans. The operation of system instrumentation and controls, including the response of system fans and dampers to safety signals, is also verified.

14.2.12.1.60.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The containment purge HVAC system has been air balanced.

d. The compressed air system is available to supply air to system valves and dampers.

14.2.12.1.60.3 Test Method

a. The containment minipurge supply and exhaust, shutdown purge supply and exhaust, and containment atmospheric control fans are operated, flow data recorded, and fan capacities calculated.

b. The response of system fans and dampers to safety signals is verified.

14.2.12.1.60.4 Acceptance Criteria

a. The capacities of the containment minipurge supply and exhaust, shutdown purge supply and exhaust, and containment atmospheric control fans are within design specifications.

b. System fans and dampers align or actuate in response to containment purge isolation and safety injection signals, in accordance with system design. Damper closure times are within design specifications.

14.2.12.1.61 Gaseous Radwaste System Preoperational Test (S-03HA01)

14.2.12.1.61.1 Objectives

a. To demonstrate the performance characteristics of the gas decay tank drain pump, waste gas compressors, and catalytic hydrogen recombiners, including their response to safety signals.

b. To verify the operability of system valves, including the response of the waste gas discharge valve to a high-radiation signal.

c. To verify that system instrumentation and controls function properly.

14.2.12.1.61.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The component cooling water system is available to supply cooling water to the waste gas compressors and catalytic hydrogen recombiners.

d. The service gas system is available to provide nitrogen, hydrogen, and oxygen to the catalytic hydrogen recombiners.

e. The reactor makeup water system is available to provide water to the waste gas compressors, catalytic hydrogen recombiners, and the waste gas decay tank drain header.

14.2.12.1.61.3 Test Method

a. Performance characteristics of the gas decay tank drain pump, and waste gas compressors are verified.

b. Hydrogen is introduced to the system and the catalytic hydrogen recombiners performance are verified.

c. System component control circuits are verified, including component response to safety signals.

14.2.12.1.61.4 Acceptance Criteria

a. Performance characteristics of the gas decay tank drain pump, waste gas compressors, and catalytic hydrogen recombiners are within design specifications.

b. The waste gas discharge valve automatically closes on a high-radiation signal.

c. The waste gas compressors trip on a high-high or low-low moisture separator level, high or low moisture separator pressure, low compressor suction pressure, or low component cooling water flow.

d. The hydrogen recombiner oxygen feed valve closes on high-high hydrogen concentration in the recombiner feed, high-high oxygen concentration in the recombiner discharge, high cooler-condenser discharge temperature, high-high recombiner discharge temperature, low-low recombiner flow, and high-high recombiner reactor inlet temperature.

e. The hydrogen recombiner oxygen feed valve signal is blocked on high oxygen concentration in the recombiner feed and high catalyst bed temperature.

f. The volume control tank vent valve closes on a hydrogen recombiner trip, low volume control tank pressure, and low waste gas compressor suction pressure.

14.2.12.1.62 Emergency Fuel Oil System Preoperational Test (S-03JE01)

14.2.12.1.62.1 Objectives

To demonstrate the capability of the system to provide an adequate fuel supply to the emergency diesel generator fuel oil day tanks and verify that the associated instrumentation and controls are functioning properly.

14.2.12.1.62.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.1.62.3 Test Method

a. Fuel oil is transferred from the fuel oil storage tank to the fuel oil day tanks by means of the transfer pumps. Flow and pressure characteristics are recorded.

b. Fuel oil day tank levels are varied to verify the transfer pump automatic operations.

c. Response to fire and emergency diesel generator start signals are verified.

14.2.12.1.62.4 Acceptance Criteria

a. The transfer pump flow capacity is verified for later comparison to the fuel consumption rate (S-03NF02).

b. Control circuit automatic operation from fuel oil day tank levels, fire signals, and diesel generator start signals is within design specifications.

14.2.12.1.63 Spent Fuel Pool Crane Preoperational Test (SU3-KE01)

14.2.12.1.63.l Objectives

a. To demonstrate proper operation of the spent fuel pool bridge crane control circuits and associated interlocks.

b. To document the data obtained during testing of the spent fuel pool bridge crane at 125 percent of rated load.

c. To verify the ability of the spent fuel pool bridge crane and associated fuel handling tools to transfer a dummy fuel assembly.

14.2.12.1.63.2 Prerequisites

a. Required component testing and instrument calibration are completed.

b. Required electrical power supplies and control circuits are operational.

c. A dummy fuel assembly is available.

14.2.12.1.63.3 Test Method

a. Operability of the spent fuel pool bridge crane control circuits and associated interlocks is verified.

b. Ability of the spent fuel pool bridge crane and associated fuel handling tools to transfer a dummy fuel assembly is verified.

14.2.12.1.63.4 Acceptance Criteria

a. The spent fuel pool bridge crane electric and manual hoists support 125 percent of their rated load.

b. The spent fuel pool bridge crane monorail center span deflection at rated load is within design specifications.

c. The spent fuel pool crane bridge, trolley and hoist speeds at rated loads are within design specifications.

d. All control circuits and interlocks associated with the spent fuel pool bridge crane operate in accordance with system design.

e. While transferring a dummy fuel assembly, the spent fuel pool bridge crane and associated fuel handling tools operate in accordance with system design.

14.2.12.1.64 New Fuel Elevator Preoperational Test (SU3-KE02)

14.2.12.1.64.1 Objectives

a. To demonstrate proper operation of the new fuel elevator control circuits and associated interlocks.

b. To verify the ability of the new fuel elevator to raise and lower a dummy fuel assembly.

14.2.12.1.64.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. A dummy fuel assembly is available.

14.2.12.1.64.3 Test Method

Operability of the new fuel elevator including control circuits and associated interlocks is verified.

14.2.12.1.64.4 Acceptance Criteria

a. All control circuits and interlocks associated with the new fuel elevator operate in accordance with system design.

b. While raising and lowering a dummy fuel assembly, the new fuel elevator operates in accordance with system design.

14.2.12.1.65 Fuel Handling and Storage Preoperational Test (SU3-KE03)

14.2.12.1.65.1 Objectives

a. To verify the ability of the spent fuel cask handling crane, and associated fuel handling tools to transfer a dummy fuel assembly.

b. To demonstrate proper operation of the spent fuel cask handling crane control circuits and associated interlocks.

c. To document the data obtained during testing of the spent fuel cask handling crane at 125 percent of rated load.

14.2.12.1.65.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. A dummy fuel assembly is available.

14.2.12.1.65.3 Test Method

a. During the transfer of a dummy fuel assembly, the operability of the spent fuel cask handling crane and associated fuel handling tools is verified.

b. Operability of the spent fuel cask handling crane control circuits and associated interlocks is verified.

14.2.12.1.65.4 Acceptance Criteria

a. While transferring a dummy fuel assembly, the spent fuel cask handling crane and associated fuel handling tools operate in accordance with system design.

b. All control circuits and interlocks associated with the spent fuel cask handling crane operate in accordance with system design.

c. The spent fuel cask handling crane hoist supports 125 percent of rated load.

d. The spent fuel cask handling crane bridge center span deflection at rated load is within design specifications.

e. The spent fuel cask handling crane bridge, trolley and hoist speeds at rated loads are within design specifications.

14.2.12.1.66 Fuel Transfer System Preoperational Test (SU3-KE04)

14.2.12.1.66.l Objectives

a. To demonstrate proper operation of the fuel transfer system control circuits and associated interlocks.

b. To verify the ability of the fuel transfer system and associated handling tools to transfer a dummy fuel assembly.

14.2.12.1.66.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. A dummy fuel assembly is available.

14.2.12.1.66.3 Test Method

a. Operability of the fuel transfer system control circuits and associated interlocks is verified.

b. During the transfer of a dummy fuel assembly, the operability of the fuel transfer system and associated handling tools is verified.

14.2.12.1.66.4 Acceptance Criteria

a. All control circuits and interlocks associated with the fuel transfer system operate in accordance with system design.

b. While transferring a dummy fuel assembly, the fuel transfer system and associated handling tools operate in accordance with system design.

14.2.12.1.67 Refueling Machine and RCC Change Fixture Preoperational Test (SU3-KE05)

14.2.12.1.67.1 Objectives

a. To demonstrate proper operation of the refueling machine, rod cluster control change fixture and containment building polar crane control circuits and associated interlocks.

b. To document the data obtained during testing of the containment building polar crane at 125 percent of rated load.

c. To verify the ability of the refueling machine to transfer a dummy fuel assembly.

14.2.12.1.67.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. A dummy fuel assembly is available.

d. A dummy control rod assembly is available.

14.2.12.1.67.3 Test Method

a. Operability of the refueling machine and rod cluster control change fixture control circuits and associated bridge, trolley, hoist and gripper interlocks is verified.

b. Operability of the containment building polar crane control circuits and associated interlocks is verified.

14.2.12.1.67.4 Acceptance Criteria

a. All control circuits and interlocks associated with the refueling machine and rod cluster control change fixture operate in accordance with system design.

b. The control circuits and interlocks associated with the containment building polar crane operate in accordance with system design.

c. The containment polar crane main and auxiliary hoists support 125 percent of their rated load.

d. The containment polar crane bridge center span deflection at rated load is within design specifications.

e. The containment polar crane bridge, trolley, and hoist speeds at rated loads are within design specifications.

f. While transferring a dummy fuel assembly, the refueling machine operates in accordance with system design.

14.2.12.1.68 Refueling Machine Indexing Test (S-03KE06)

14.2.12.1.68.1 Objectives

a. To verify the indexing of the refueling machine and establish bridge rail reference points for future operations.

b. To demonstrate the ability to transfer the dummy fuel assembly to the reactor vessel.

14.2.12.1.68.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. A dummy fuel assembly is available.

14.2.12.1.68.3 Test Method

a. While transferring a dummy fuel assembly with the refueling machine, the bridge rail is marked at key transfer points.

14.2.12.1.68.4 Acceptance Criteria

a. The refueling machine can load a dummy fuel assembly in each of the reactor vessel fuel loading locations.

14.2.12.1.69 Fuel Handling System Integrated Preoperational Test (SU3-KE07)

14.2.12.1.69.1 Objective

To verify the ability of the refueling machine, new fuel elevator, fuel transfer system, spent fuel bridge crane, spent fuel cask handling crane and associated fuel handling tools to transfer a dummy fuel assembly.

14.2.12.1.69.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The reactor vessel, refueling pool, refueling canal and spent fuel pool are filled with demineralized water.

d. A dummy fuel assembly is available.

14.2.12.1.69.3 Test Method

During the transfer of a dummy fuel assembly, the operability of the refueling machine, new fuel elevator, fuel transfer system, spent fuel bridge crane, spent fuel cask handling crane and associated fuel handling tools is verified.

14.2.12.1.69.4 Acceptance Criteria

While transferring a dummy fuel assembly, the refueling machine, new fuel elevator, fuel transfer system, spent fuel bridge crane, spent fuel cask handling crane and associated fuel handling tools operate in accordance with system design.

14.2.12.1.70 Diesel Generator Mechanical Preoperational Test (S-03KJ01)

14.2.12.1.70.1 Objectives

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

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

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

14.2.12.1.70.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The essential service water system is available to provide cooling water to the diesel engine intercooler heat exchanger.

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

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

14.2.12.1.70.3 Test Method

a. The diesel generators are started, and the time required to reach rated speed is recorded.

b. With the diesel generators and associated auxiliaries operating, performance characteristics are verified.

c. The operability of all control circuits associated with the diesel generator and diesel auxiliaries, including the control circuits' response to safety signals, is verified.

d. The ability of each air storage tank to provide five diesel cranking cycles, without being recharged, is verified.

14.2.12.1.70.4 Acceptance Criteria

a. The time required for each diesel generator to reach rated speed is within design specifications.

b. The performance characteristics of the diesel generators and associated auxiliaries are within design specifications.

c. Each diesel generator starts automatically on receipt of a safety injection signal or a bus under-voltage signal.

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

Lube oil pressure low
Jacket coolant temperature high
Crankcase pressure high
Start failure
Engine overspeed
Diesel generator ground overcurrent
Diesel generator differential current

e. The diesel generator neutral ground overcurrent trip signal is bypassed when the diesel generator is operating in the emergency mode.

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

g. Each starting air compressor has the ability to charge its respective air tank from minimum to normal pressure within the required time.

14.2.12.1.71 4160-V (Class IE) System Preoperational Test (S-03NB01)

14.2.12.1.71.1 Objectives

a. To demonstrate that the 4,160-V Class IE busses can be energized from their normal and alternate sources.

b. To verify that a 4,160-V Class IE bus digital undervoltage signal trips the associated incoming feeder breakers.

c. To verify that a degraded bus voltage condition will trip the associated incoming feeder breakers.

d. To verify proper operation of system instrumentation and alarms.

14.2.12.1.71.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.1.71.3 Test Method

a. The 4,160-V Class IE busses are energized from their normal source, and bus voltages are recorded.

b. The 4,160-V Class IE busses are energized from their alternate source, and bus voltages are recorded.

c. 4,160-V Class IE bus undervoltage signals are simulated, and proper operation of the 4,160-V Class IE feeder breakers is verified.

14.2.12.1.71.4 Acceptance Criteria

a. The voltage of each 4,160-V Class IE bus, when supplied from its normal source, is within design specifications.

b. The voltage of each 4,160-V Class IE bus, when supplied from its alternate source, is within design specifications.

c. A 4,160-V Class IE bus digital undervoltage signal will trip the appropriate bus incoming feeder breakers.

d. A degraded voltage condition on either 4,160-V Class IE bus will cause an alarm and, if it continues, trip the appropriate bus incoming feeder breakers.

e. A degraded voltage condition on either 4,160-V Class IE bus coincident with a safety injection actuation signal will immediately trip the bus incoming feeder breakers.

14.2.12.1.72 Diesel Generator Electric Preoperational Test (S-03NE01)

14.2.12.1.72.1 Objectives

a. To demonstrate that each diesel generator is capable of 35 consecutive valid starts with no failure.

b. To demonstrate the ability of each diesel generator to carry the design load for the time required to reach equilibrium temperature plus 1 hour, without exceeding design limits.

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

d. To demonstrate the capability of each diesel generator to withstand a full-load rejection without exceeding speeds or voltages that cause tripping or damage.

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

f. To demonstrate the ability of the diesel cooling water system to maintain the diesel temperature within design specifications, while the diesel generators are operating at full load.

g. To demonstrate the ability of each diesel generator to start and shed the largest single motor while supplying all other sequenced loads, maintaining voltage and frequency within design limits.

14.2.12.l.72.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The essential service water system is available to provide cooling water to the diesel generator intercooler heat exchanger.

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

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

f. The 4.16-kV busses are available for loading to support this test.

14.2.12.1.72.3 Test Method

a. The ability of each diesel generator to undergo 35 consecutive starts with no failure is verified.

b. The ability of each diesel generator to carry the design load for the time required to reach equilibrium temperature, plus 1 hour, without exceeding design limits, is verified.

c. The ability of each diesel generator to attain and stabilize frequency and voltage within the design limits and time is verified.

d. The ability of each diesel generator to withstand a full-load rejection, without exceeding speeds or voltages that cause tripping, is verified.

e. The operability of each diesel generator feeder breaker and associated interlocks is verified.

f. While operating each diesel generator at full-load conditions, the ability of the diesel cooling water system to maintain diesel temperatures within design specifications is verified.

g. The ability of each diesel generator to start and shed the largest fully loaded single motor while supplying all other sequenced loads and maintain voltage and frequency within design limits is verified.

14.2.12.1.72.4 Acceptance Criteria

a. Each diesel generator is capable of carrying the design load for the time required to reach equilibrium temperature, plus 1 hour, without exceeding design limits.

b. Each diesel generator can attain and stabilize frequency and voltage within design limits and time.

c. Each diesel generator is capable of withstanding a full-load rejection without exceeding speeds or voltages that cause tripping.

d. When a diesel generator is operating in the nonemergency (test) mode, the associated diesel generator feeder breaker trips on receipt of any of the following signals:

Generator overcurrent
Reverse power
Loss of field
Underfrequency

e. The diesel generator stops and the associated diesel generator feeder breaker trips on receipt of any of the following signals:

Generator differential current
Neutral ground overcurrent

f. When a diesel generator is operating in the emergency mode, the following trip signals are bypassed:

Neutral ground overcurrent
Generator overcurrent
Reverse power
Loss of field
Underfrequency

g. Each diesel generator cooling water system, with the diesel generators operating at full-load, maintains the diesel temperatures within design specifications.

h. Each diesel generator has the capability of starting and shedding the largest fully loaded single motor while supplying all other sequenced loads, maintaining voltage and frequency within design limits.

i. Diesel generators are capable of 35 consecutive valid starts with no failure.

14.2.12.1.73 Integrated Control Logic Test (SU3-NF01)

14.2.12.1.73.1 Objectives

a. To demonstrate that the actuation of the LOCA sequencer, shutdown sequencer, safety-related load shed, and nonsafety-related load shed circuits on receipt of the appropriate undervoltage, safety injection, containment spray actuation, diesel generator breaker position, and normal and alternate 4,160-V feeder breaker position signals is in accordance with system design.

b. To demonstrate that the LOCA sequencer, shutdown sequencer, safety-related load shed, and nonsafety-related load shed circuits shed and sequence loads in accordance with system design.

14.2.12.1.73.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.1.73.3 Test Method

a. Undervoltage, safety injection, containment spray actuation, diesel generator breaker position, and normal and alternate 4,160-V feeder breaker position signals are initiated, and the actuation of the LOCA sequencer, shutdown sequencer, safety-related load shed, and nonsafety-related load shed circuits is verified.

b. Signals are initiated to actuate the LOCA sequencer, shutdown sequencer, safety-related load shed, and nonsafety-related load shed circuits, and proper load shed and load sequencing are verified.

14.2.12.1.73.4 Acceptance Criteria

a. Actuation of the LOCA sequencer, shutdown sequencer, safety-related load shed, and nonsafety-related load shed circuits on receipt of under-voltage, safety injection, containment spray actuation, diesel generator breaker position, and normal and alternate 4,160-V feeder breaker position signals is in accordance with system design.

b. The LOCA sequencer, shutdown sequencer, safety-related load shed, and nonsafety-related load shed circuits shed and sequence loads in accordance with system design.

14.2.12.1.74 LOCA Sequencer Preoperational Test (S-03NF02)

14.2.12.1.74.1 Objectives

a. To demonstrate that initiation of a safety injection signal (SIS) will shed the nonsafety-related loads, start the diesel generator, and sequence the associated equipment. The ability of each 4,160-V Class IE load group to supply the sequenced loads while maintaining voltage within design specifications is also verified.

b. To demonstrate that a loss of offsite power concurrent with SIS will shed the safety-related loads, start the diesel generator, close the diesel generator feeder breaker, and sequence the associated equipment. The ability of each diesel generator to supply the sequenced loads while maintaining voltage and frequency within design specifications is also verified.

c. To demonstrate the ability of each diesel generator to carry the short-time rating load for 2 hours and the continuous rated load for 22 hours, without exceeding design limits.

d. To demonstrate that each diesel generator, following operation for 2 hours at the short-time rated load and

22 hours at the continuous rated load, will start automatically on a loss of ac voltage concurrent with an SIS, attain voltage and frequency within design limits and time, and accept the LOCA sequenced loads, while maintaining voltage and frequency within design limits.

c. To demonstrate the ability of the diesel cooling water system to maintain the diesel temperature within design specifications, while the diesel generators are operating for 2 hours at the short-time rating load and 22 hours at the continuous rating load.

f. To determine the fuel oil consumption of each diesel, while operating for 22 hours at the continuous rating load.

g. To demonstrate the ability of the 125 V dc system to perform its design functions while at minimum voltage.

h. To demonstrate the independence between the redundant on ac and dc power sources.

14.2.12.1.74.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Each diesel generator and its associated auxiliaries are available.

c. All components actuated by the LOCA sequencer and safety-related and nonsafety-related load shed circuits are available.

14.2.12.1.74.3 Test Method

a. A train A SIS is initiated, and the following are verified:

   1. Group l nonsafety-related loads are shed.

   2. Group 1 diesel generator starts.

   3. Group 1 LOCA sequencer is actuated, and associated components are sequenced. The times for sequenced pumps to reach full flow are verified.

   4. With bus NB01 supplying the sequenced loads from its normal source, bus voltage is recorded.

b. With group 2 dc load group isolated from its power source and group 1 dc load group voltage set to minimum, a loss of offsite power is initiated concurrent with a train A SIS, and the following are verified:

   1. Safety-related group 1 loads are shed.

   2. Group 1 diesel generator starts, and its feeder breaker closes.

   3. Group 1 LOCA sequencer is actuated, and associated components are sequenced. The times for sequenced pumps to reach full flow are verified.

   4. With the group 1 diesel generator supplying the sequenced loads, bus voltage and frequency are recorded.

   5. The group 2 ac and dc busses are monitored to verify the absence of voltage on these busses and loads, indicating no interconnection at load groups.

c. The ability of the group 1 diesel generator to carry the short-time rating load for 2 hours without exceeding design limits is verified.

d. The ability of the group 1 diesel generator to carry the continuous rated load for 22 hours without exceeding design limits is verified. Group l diesel fuel oil consumption is also determined.

e. Following group 1 diesel generator operation for 2 hours at the short-time rated load and 22 hours at the continuous rated load, the group 1 diesel generator is shutdown, a loss of group 1 ac voltage is initiated concurrent with a train A SIS, and the ability of the group l diesel generator to start, attain voltage and frequency within design limits and time, and accept the loads resulting from the design accident loading sequence while maintaining voltage and frequency within design limits is verified. If this test is not satisfactorily completed, it is not necessary to repeat the tests of items c and d prior to rerunning this test. Instead, prior to rerunning this test, the diesel generator may be operated at the continuous rated load for l hour or until operating temperature has stabilized.

f. A train B SIS is initiated, and the following are verified:

   1. Group 2 nonsafety-related loads are shed.

   2. Group 2 diesel generator starts.

   3. Group 2 LOCA sequencer is actuated, and associated components are sequenced. The times for sequenced pumps to reach full flow are verified.

   4. With Bus NB02 supplying the sequenced loads from its normal source, bus voltage is recorded.

g. With group 1 dc load group isolated from its power source and group 2 dc load group voltage set to minimum, a loss of offsite power is initiated concurrent with a train B SIS, and the following are verified:

   1. Safety-related group 2 loads are shed.

   2. Group 2 diesel generator starts, and its feeder breaker closes.

   3. Group 2 LOCA sequencer is actuated, and associated components are sequenced. The times for sequenced pumps to reach full flow are verified.

   4. With the group 2 diesel generator supplying the sequenced loads, bus voltage and frequency are recorded.

   5. The group 1 ac and dc busses are monitored to verify the absence of voltage on these busses and loads, indicating no interconnection of load groups.

h. The ability of the group 2 diesel generator to carry the short-time rating load for 2 hours without exceeding design limits is verified.

i. The ability of the group 2 diesel generator to carry the continuous rated load for 22 hours without exceeding design limits is verified. Group 2 diesel fuel oil consumption is also determined.

j. Following group 2 diesel generator operation for 2 hours at the short-time rated load and 22 hours at the continuous rated load, the group 2 diesel generator is shutdown, a loss of group 2 ac voltage is initiated concurrent with a train B SIS, and the ability of the group 2 diesel generator to start, attain voltage and frequency within design limits and time, and accept the LOCA sequenced loads, while maintaining voltage and frequency within design limits, is verified. If this test is not satisfactorily completed, it is not necessary to repeat the tests of items h and i prior to rerunning this test. Instead, prior to rerunning this test, the diesel generator may be operated at the continuous rated load for 1 hour or until operating temperature has stabilized.

k. The ability of the diesel cooling water system to maintain the diesel temperature within design specifications, while the diesel generators are operating for 2 hours at the short-time rating load and 22 hours at the continuous rating load, is verified.

14.2.12.1.74.4 Acceptance Criteria

a. A train A SIS initiates the following, in accordance with system design:

   1. Group 1 nonsafety-related loads are shed.

   2. Group 1 diesel generator starts.

   3. Group 1 LOCA sequencer actuates, and the associated components are sequenced. Sequenced pumps reach full flow within the required times.

b. Bus NB01, while powered from its normal source, supplies the sequenced loads while maintaining voltage within design specifications.

c. With the group 2 dc load group isolated from its power source and the group 1 dc load group voltage at minimum, a loss of offsite power concurrent with a train A SIS initiates the following, in accordance with system design:

   1. Safety-related group 1 loads are shed.

   2. Group 1 diesel generator starts, and its feeder breaker closes.

3. Group l LOCA sequencer actuates, and the associated components are sequenced. Sequenced pumps reach full flow within design times.

d. Group l diesel generator supplies the sequenced loads, while maintaining voltage and frequency within design specifications.

e. With load group 1 supplying loads following a loss of offsite power concurrent with a train A SIS, the group 2 ac and dc busses are verified de-energized, indicating no interconnection of load groups.

f. Following group 1 diesel generator operation for 2 hours at the short-time rated load and 22 hours at the continuous rated load, the group 1 diesel generator starts, attains voltage and frequency within design limits and time, and accepts the LOCA sequenced loads while maintaining voltage and frequency within design limits, on loss of group 1 ac voltage concurrent with a train A SIS.

g. A train B SIS initiates the following, in accordance with the system design:

1. Group 2 nonsafety-related loads are shed.

2. Group 2 diesel generator starts.

3. Group 2 LOCA sequencer actuates, and the associated components are sequenced. Sequenced pumps reach full flow within design times.

h. Bus NB02, while powered from its normal source, supplies the required loads while maintaining the voltage within design specifications.

i. With the group 1 dc load group isolated from its power source and the group 2 dc load group voltage at minimum, a loss of offsite power concurrent with a train B SIS initiates the following, in accordance with system design:

1. Safety-related group 2 loads are shed.

2. Group 2 diesel generator starts, and its feeder breaker closes.

3. Group 2 LOCA sequencer actuates, and the associated components are sequenced. Sequenced pumps reach full flow within design times.

j. Group 2 diesel generator supplies the required loads, while maintaining voltage and frequency within design specifications.

k. With load group 2 supplying loads following a loss of offsite power concurrent with a train B SIS, the group 1 ac and dc busses are verified de-energized, indicating no interconnection of load groups.

l. Following group 2 diesel generator operation for 2 hours at the short-time rated load and 22 hours at continuous rated load, group 2 diesel generator starts, attains voltage and frequency within design limits and time, and accepts the LOCA sequenced loads while maintaining voltage and frequency within design limits, on loss of group 2 ac voltage concurrent with a train B SIS.

m. Each diesel generator is capable of carrying the short-time rating load for 2 hours and the continuous rated load for 22 hours, without exceeding design limits.

n. Fuel oil consumption of each diesel, while operating at the continuous rated load, is within design specifications.

o. Each diesel generator cooling water system, with the diesel generators operating for 2 hours at the short-time rating load and 22 hours at the continuous rating load, maintains the diesel temperatures within design specifications.

p. The controls required for the loss of offsite power concurrent with a SIS (shedding, sequencing, etc.) function with minimum dc voltage available.

14.2.12.1.75 Shutdown Sequencer Preoperational Test (S-03NF03)

14.2.12.1.75.1 Objectives

a. To demonstrate that de-energization of either 4,160-V Class IE load group will start the associated diesel generator, close the diesel generator feeder breaker, actuate the associated group load shed, and actuate the shutdown sequencer. All sequenced components are verified to start within required design times.

b. To demonstrate that each diesel generator will maintain voltage and frequency within design specifications while supplying the design shutdown loads.

c. To demonstrate the ability of the emergency 4.16-kV loads to start at maximum and minimum design voltages.

14.2.12.1.75.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. Each diesel generator and its associated auxiliaries are available.

d. All components actuated by the shutdown sequencer are available.

14.2.12.1.75.3 Test Method

a. Class IE 4,160-V load group 1 is de-energized and the following are verified:

    1. Group 1 load shedder actuates.

    2. Group 1 diesel generator starts, and its feeder breaker closes.

    3. Group 1 shutdown sequencer is actuated, and associated components are sequenced. Components are verified to actuate within the required design times.

b. Class IE 4,160-V load group 2 is de-energized and the following are verified:

    1. Group 2 load shedder actuates.

    2. Group 2 diesel generator starts, and its feeder breaker closes.

    3. Group 2 shutdown sequencer is actuated, and associated components are sequenced. Components are verified to actuate within the required design times.

c. Emergency 4.16-kV loads are started while their respective diesel generators are supplying:

1. Minimum rated voltage

2. Maximum rated voltage

d. The ability of each diesel generator to maintain voltage and frequency within the design specifications while supplying the design shutdown loads is verified.

14.2.12.1.75.4 Acceptance Criteria

a. De-energization of Class IE 4,160-V load group 1 initiates the following, in accordance with system design:

1. Group 1 diesel generator starts, and its feeder breaker closes.

2. Group 1 shutdown sequencer actuates, and associated components are sequenced. Components actuate within required design times.

3. Group 1 load shedder actuates.

b. De-energization of Class IE 4,160-V load group 2 initiates the following, in accordance with system design:

1. Group 2 diesel generator starts, and its feeder breaker closes.

2. Group 2 shutdown sequencer actuates, and associated components are sequenced. Components actuate within required design times.

3. Group 2 load shedder actuates.

c. The emergency 4.16-kV loads start and reach rated speed within design times, with minimum and maximum design voltage.

d. Each diesel generator maintains voltage and frequency within design specifications, while supplying the design shutdown loads.

14.2.12.1.76 480-V (Class IE) System Preoperational Test (S-03NG01)

14.2.12.1.76.1 Objectives

To demonstrate that the 480-V Class IE load centers can be energized from their normal and alternate sources and verify the operability of system breaker protective interlocks. Proper operation of system instrumentation and controls is also verified.

14.2.12.1.76.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.1.76.3 Test Method

a. The 480-V Class IE load centers are energized from their normal source, and voltages are recorded.

b. The 480-V Class IE load centers are energized from their alternate source, and voltages are recorded.

c. System breakers are operated, and breaker interlocks verified.

14.2.12.1.76.4 Acceptance Criteria

a. The voltage for each 480-V Class IE load center, when supplied from its normal source, is within design specifications.

b. The voltage for each 480-V Class IE load center, when supplied from its alternate source, is within design specifications.

c. System breaker interlocks operate in accordance with the system design.

14.2.12.1.77 480-V Class IE System (ESW) Preoperational Test (SU3-NG02).

14.2.12.1.77.1 Objectives

To demonstrate that the nonpower block 480-V Class IE MCC can be energized from their normal source and to verify their bus voltage phase sequence. Proper operation of system instrumentation and controls is also verified.

14.2.12.1.77.2 Prerequisites

a. Required component testing and instrument calibration are completed.

b. Required electrical power supplies and control circuits are operational.

14.2.12.1.77.3 Test Method

The nonpower block 480-V Class IE MCC are energized, voltages are recorded, and phase sequence is verified.

14.2.12.1.77.4 Acceptance Criteria

a. The voltage for each nonpower block 480-V Class IE MCC is within design specification.

b. The bus voltage phase sequence of the nonpower block 480-V Class IE MCC is in accordance with design.

14.2.12.1.78 125-V (Class IE) DC System Preoperational Test (S-03NK01)

14.2.12.1.78.1 Objectives

To demonstrate the ability of the batteries and chargers to provide power during normal operations and the battery to provide power during abnormal conditions. The battery chargers' ability to recharge their respective battery is also demonstrated. Proper operation of the system instrumentation and controls is also verified.

14.2.12.1.78.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. Ventilation for the battery rooms is available.

14.2.12.1.78.3 Test Method

a. Each battery is discharged, using a test load at the design duty cycle discharge rate.

b. Each battery is fully discharged to determine its capacity factor.

c. Each battery charger will charge its respective battery to normal conditions, after the battery has undergone a design duty cycle, while simultaneously supplying power at a rate equivalent to the design emergency loading.

14.2.12.1.78.4 Acceptance Criteria

a. Each battery is capable of maintaining output voltage above the design minimum, during a design duty cycle.

b. Each battery has a capacity factor greater than or equal to design.

c. The battery chargers are able to recharge the batteries to normal conditions, after the battery has undergone a design duty cycle, while simultaneously supplying power at a rate equivalent to the design emergency loading.

14.2.12.1.79 Instrument AC System (Class IE) Preoperational Test (S-03NN01)

14.2.12.1.79.1 Objectives

To demonstrate that the 120-V Class IE ac distribution panel- boards can be fed from their normal source inverters and from their backup source transformers by manual transfer. The operability of system instrumentation and controls, including breaker protective interlocks, is also verified.

14.2.12.1.79.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.1.79.3 Test Method

a. The 120-V Class IE ac distribution panelboards are energized from their normal source inverters, and panelboard voltages are recorded.

b. The 120-V Class IE ac distribution panelboards are energized from their backup source transformers by manual transfer, and panelboard voltages are recorded.

c. The system breakers are operated, and breaker interlocks are verified.

14.2.12.1.79.4 Acceptance Criteria

a. Each 120-V Class IE ac distribution panelboard voltage, when supplied from the normal source inverters of the panelboards, is within design specifications.

b. Each 120-V Class IE ac distribution panelboard voltage, when supplied from the backup source transformers, is within design specifications.

c. System breaker interlocks operate in accordance with system design.

14.2.12.1.80 Engineered Safeguards (NSSS) Preoperational Test (SU3-SA01)

14.2.12.1.80.1 Objectives

a. To demonstrate the ability of the NSSS to initiate safety injection, containment isolation, containment spray actuation, main feedwater isolation, and steam line isolation signals on receipt of the associated input signals.

b. To verify NSSS ESFAS loop response times.

c. To demonstrate the ability of each solid-state protection system test panel to adequately test the associated NSSS ESFAS and reactor protection logic trains.

d. To demonstrate the coincidence and redundancy of the NSSS ESFAS.

e. To verify the operability of ESFAS block and permissive interlocks.

14.2.12.1.80.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies are operational.

14.2.12.1.80.3 Test Method

a. The ability of the NSSS ESFAS to actuate safety injection, containment isolation, containment spray actuation, main feedwater isolation, and steam line isolation signals on receipt of the required coincidence of the following input signals for each redundant channel is verified:

- High steam line pressure rate
- Low steam line pressure
- Low pressurizer pressure

- High containment pressure (Hi-1, Hi-2, and Hi-3)
- High-high steam generator level
- Low Tavg
- Low-low steam generator water level

b. Input signals are initiated, and loop response times are verified.

c. The ability of each solid-state protection system test panel to test the NSSS ESFAS logic trains is verified.

d. ESFAS block and permissive interlocks are verified.

14.2.12.1.80.4 Acceptance Criteria

a. The NSSS ESFAS actuates safety injection, containment isolation, containment spray actuation, main feedwater isolation, and steam line isolation signals when their associated input signals are received from the following signals for each applicable channel:

- High steam line pressure rate
- Low steam line pressure
- Low pressurizer pressure
- High containment pressure (Hi-1, Hi-2, and Hi-3)
- High-high steam generator level
- Low Tavg
- Low-low steam generator water level

b. NSSS ESFAS loop response times are within design specifications.

c. ESFAS block and permissive interlocks operate in accordance with system design.

14.2.12.1.81 Engineered Safeguards (BOP) Preoperational Test (SU3-SA02)

14.2.12.1.81.1 Objectives

a. To demonstrate the operability of the BOP ESFAS to initiate containment purge isolation, control room ventilation isolation, fuel building ventilation isolation, auxiliary feedwater pump actuation, auxiliary feedwater suction valve switchover to essential service water (ESW), and steam generator blowdown and sample isolation signals on receipt of the associated input signals.

b. To verify BOP ESFAS loop response times.

c. To demonstrate the ability of the BOP ESFAS test panel to adequately test the associated BOP ESFAS logic trains.

d. To demonstrate the coincidence and redundancy of the BOP ESFAS.

14.2.12.1.81.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies are operational.

14.2.12.1.81.3 Test Method

a. The ability of the BOP ESFAS to actuate containment purge isolation, control room ventilation isolation, fuel building ventilation isolation, auxiliary feedwater pump actuation, auxiliary feedwater suction valve switchover to ESW, and steam generator blowdown and sample isolation signals on receipt of the required coincidence of the following input signals for each redundant channel is verified.

   - Containment isolation (phase A)
   - High atmospheric radiation
   - High chlorine concentration
   - Loss of main feedwater flow
   - Low-low steam generator level
   - Loss of offsite power
   - Low feedwater pump suction pressure
   - Safety injection

b. Input signals are initiated, and loop response times are verified.

c. The ability of the BOP ESFAS test panel to test the BOP ESFAS logic trains is verified.

14.2.12.1.81.4 Acceptance Criteria

a. The BOP ESFAS actuates containment purge isolation, control room ventilation isolation, fuel building ventilation isolation, auxiliary feedwater pump actuation, auxiliary feedwater suction valve switchover to ESW, and steam generator blowdown and sample isolation signals when their associated input signals are received from the following signals for each applicable channel:

- o Containment isolation (phase A)
- o High atmospheric radiation
- o High chlorine concentration
- o Loss of main feedwater flow
- o Low-low steam generator level
- o Loss of offsite power
- o Low feedwater pump suction pressure
- o Safety injection

b. BOP ESFAS loop response times are within design specifications.

14.2.12.1.82 Engineered Safeguards Verification Test (SU3-SA03)

14.2.12.1.82.1 Objectives

To demonstrate the proper response of actuated components resulting from the following safety signals: Safety injection, containment spray actuation, main feedwater isolation, steam line isolation, containment isolation, containment purge isolation, control room ventilation isolation, fuel building ventilation isolation, auxiliary feedwater pump actuation, auxiliary feedwater suction valve switch over to ESW, and steam generator blowdown and sample isolation.

14.2.12.1.82.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power sources and control circuits are operational.

c. Components actuated by the NSSS and BOP ESFAS are available.

14.2.12.1.82.3 Test Method

NSSS and BOP ESFAS signals are initiated manually and the proper response and response times of the actuated components are verified.

14.2.12.1.82.4 Acceptance Criteria

Components required to actuate on receipt of safety signals respond properly in accordance with design specifications and within the times specified by design requirements.

14.2.12.1.83 Reactor Protection System Logic Test (S-03SB01)

14.2.12.1.83.1 Objectives

a. To demonstrate the ability of the reactor protection system to initiate a reactor trip on input of the associated input signals.

b. To verify reactor protection loop response times.

c. To verify the operability of the reactor protection system block and permissive interlocks.

d. To demonstrate the coincidence, redundancy, and fail safe (power loss) design of the reactor protection system.

14.2.12.1.83.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.1.83.3 Test Method

a. The ability of the reactor protection system to initiate a reactor trip on receipt of the proper coincidence of the following trip signals for each redundant channel is verified:

   - Source range high neutron flux
   - Intermediate range high neutron flux
   - Power range high neutron flux (low setpoint and high setpoint)
   - Power range high positive neutron flux rate
   - Power range high negative neutron flux rate
   - Overtemperature ΔT
   - Overpower ΔT
   - Low primary coolant flow
   - Reactor coolant pump bus undervoltage
   - Reactor coolant pump bus underfrequency

- o High pressurizer pressure
- o Low pressurizer pressure
- o High pressurizer level
- o Safety injection signal
- o Turbine trip signal

b. Loop response times are measured for the above listed trip signals.

c. Reactor protection system block and permissive interlocks are verified.

d. Power is isolated from the system, and the safe failure of the system is verified.

14.2.12.1.83.4 Acceptance Criteria

a. The reactor protection system initiates a reactor trip on receipt of the proper coincidence of the following signals for each applicable channel:

- o Source range high neutron flux
- o Intermediate range high neutron flux
- o Power range high neutron flux (low setpoint and high setpoint)
- o Power range high positive neutron flux rate
- o Power range high negative neutron flux rate
- o Overtemperature ΔT
- o Overpower ΔT
- o Low primary coolant flow
- o Reactor coolant pump bus undervoltage
- o Reactor coolant pump bus underfrequency
- o High pressurizer pressure
- o Low pressurizer pressure
- o High pressurizer level
- o Safety injection signal
- o Turbine trip signal

b. Loop response times for the following trip signals are within design limits.

- o Power range high neutron flux (low setpoint and high setpoint)
- o Power range high negative neutron flux rate
- o Overtemperature ΔT
- o Overpower ΔT
- o Low primary coolant flow
- o Reactor coolant pump bus undervoltage
- o Reactor coolant pump bus underfrequency

- o High pressurizer pressure
- o Low pressurizer pressure

c. Reactor protection system block and permissive interlocks operate in accordance with system design.

d. The reactor protection system functions in accordance with system design on a loss of power.

14.2.12.1.84 Primary Sampling System Preoperational Test (S-03SJ01)

14.2.12.1.84.1 Objectives

a. To set sample panels' flow rates and to verify the operability of the sample system containment isolation valves. Proper operation of system instrumentation and controls is also verified.

b. To verify that the post-accident sampling system (PASS) containment isolation valves operate properly.

14.2.12.1.84.2 Prerequisites

a. Required component testing instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operable.

c. Plant conditions are established, and systems are available, as necessary, to facilitate drawing samples from the sample points.

d. The component cooling water system is available to provide cooling water to the auxiliary building sample station.

e. The chemical and volume control system is available to receive discharge from the nuclear sampling station.

f. The chemical and detergent waste system is available to receive discharge from the nuclear sampling station.

14.2.12.1.84.3 Test Method

a. Sample panel flows are adjusted, and flow data are recorded.

b. Operability of the sample containment isolation valves is verified, including their response to an isolation signal. Valve operating times are recorded.

14.2.12.1.84.4 Acceptance Criteria

a. The sample containment isolation valves close on receipt of an isolation signal.

b. The sample containment isolation valves' closure times are within design specifications.

14.2.12.1.85 Process Radiation Monitoring System Preoperational Test (S-03SP01)

14.2.12.1.85.1 Objectives

To demonstrate the operation of the process radiation monitors and to verify the ability of the process radiation monitoring system to provide alarm and isolation signals, as applicable, upon receipt of high radiation signals. Operability of the radioactivity monitoring control room microprocessor is also verified.

14.2.12.1.85.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operable.

14.2.12.1.85.3 Test Method

a. The check source for each monitor is remotely positioned, and the actuation of each monitor and the operability of its associated alarms and isolation signals are verified.

b. Operability of the radioactivity monitoring control room microprocessor is verified.

14.2.12.1.85.4 Acceptance Criteria

The process radiation monitoring system provides alarm and isolation signals, in accordance with system design specifications.

14.2.12.1.86 Power Conversion and ECCS Thermal Expansion Test (SU3-0004)

14.2.12.1.86.1 Objective

To demonstrate snubber operability on all safety-related systems whose operating temperature exceeds 250°F.

14.2.12.1.86.2 Prerequisites

a. Preservice examinations as specified in the Tedesco letter to KG&E dated 2/10/81 have been completed on the systems being checked within the last 6 months.

b. Other required component testing and instrument calibration are completed.

c. Required electrical power supplies and control circuits are operational.

d. Preoperational testing is in progress.

14.2.12.1.86.3 Test Method

a. During initial system heatup and cooldown, at specified temperature intervals, verify the expected snubber movement for any system which attains operating temperature.

b. For those systems which do not attain operating temperature, verify by observation and/or calculation that the snubber will accommodate the projected thermal movement.

c. Observe snubber swing clearances at specified heat-up and cooldown intervals.

14.2.12.1.86.4 Acceptance Criteria

a. The expected snubber movement for any system that attains operating temperature is within design specifications.

b. The expected snubber movement determined by observation and/or calculation for any system that does not attain operating temperature is within design specifications.

c. Snubber swing clearance observed at specified heatup and cooldown intervals is within design specifications.

14.2.12.1.87 Power Conversion and ECCS Systems Dynamic Test (S-030005)

14.2.12.1.87.1 Objectives

To demonstrate during specified transients that the systems' monitored points respond in accordance with design.

14.2.12.1.87.2 Prerequisites

a. Reference points for measurement of the systems are established.

b. Hot functional testing is in progress.

c. All subject systems are available for the specified dynamic operations.

d. Required instrument calibration is complete.

14.2.12.1.87.3 Test Method

a. The systems are aligned for the specified dynamic operation.

b. The specified dynamic event of pump operation, valve operation, etc., is initiated, and the system is monitored for response.

14.2.12.1.87.4 Acceptance Criteria

a. The total stress shall not exceed applicable code limits.

14.2.12.1.88 HEPA Filter Test (SU3-0006).

14.2.12.1.88.1 Objectives

To demonstrate the leaktightness and particulate removal efficiency of all HEPA filters and to verify the leaktightness of their associated charcoal adsorbers.

14.2.12.1.88.2 Prerequisites

a. The ventilation systems containing HEPA filters and charcoal adsorbers have been air balanced and are operational and available to support this test.

b. Required electrical power supplies and control circuits are operational.

c. Required instrument calibration is complete.

14.2.12.1.88.3 Test Method

a. HEPA filters are inplace tested with cold poly-dispersed DOP, in accordance with the procedures set forth in ANSI N510.

b. Charcoal adsorbers are inplace tested with a suitable refrigerant, in accordance with the procedures set forth in ANSI N510.

14.2.12.1.88.4 Acceptance Criteria

a. The airflow of each filter adsorber unit is equal to the design flow.

b. Air flow distribution downstream of each HEPA filter is within 20 percent of the average velocity through the unit.

c. HEPA DOP penetration is less than one percent at the design air flow.

d. Charcoal adsorber bypass leakage is less than .05 percent at the design air flow.

14.2.12.1.89 Cooldown from Hot Standby External to the Control Room (S-030008)

14.2.12.1.89.1 Objectives

To demonstrate, using a plant procedure, the potential capability to cooldown the plant from the hot standby to the cold shutdown condition, using instrumentation and controls external to the control room verifying that:

a. The reactor coolant temperature and pressure can be lowered to permit the operation of the residual heat removal (RHR) system.

b. The RHR system can be operated and controlled.

c. The reactor coolant temperature can be reduced ≥50° F, using the RHR system, without exceeding technical specification limits.

14.2.12.1.89.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The plant is in a hot standby condition.

d. The authority and responsibility of the control room observers has been established and is specified in this procedure.

14.2.12.1.89.3 Test Method

a. The plant is cooled from hot standby, RHR is initiated, and a $\geq$50°F cooldown is performed with the RHR system transferring heat to the ultimate heat sink, using instrumentation and controls external to the control room.

b. All actions performed by the control room observers are documented within this procedure for use in evaluating their impact on the test results.

14.2.12.1.89.4 Acceptance Criteria

The following actions are capable of being performed, external to the control room:

a. The reactor coolant temperature and pressure can be lowered to permit the operation of the RHR system.

b. The reactor coolant temperature can be reduced $\geq$50° F, using the RHR system, without exceeding technical specification limits.

14.2.12.1.90 Compressed Gas Accumulator Testing (S-030009)

14.2.12.1.90.1 Objectives

To demonstrate the ability of the auxiliary feedwater control valve/mainsteam atmospheric relief valve and main feedwater control valve accumulators to provide the design backup supply of compressed gas for continued design valve operation following a loss of the normal motive source.

14.2.12.1.90.2 Prerequisites

Required component testing, instrument calibration and system flushing/cleaning are complete.

14.2.12.1.90.3 Test Method

The accumulators are isolated from the compressed gas supply header and the associated valves are operated to demonstrate the ability of the accumulators to provide design motive force for the required valve cycles.

14.2.12.1.90.4 Acceptance Criteria

The auxiliary feedwater control valve/mainsteam atmospheric relief valve, and main feedwater control valve accumulators provide the design backup supply of compressed gas to their associated valves.

14.2.12.2 Nonsafety-Related Preoperational Test Procedures

The following sections are the test abstract for each nonsafety- related preoperational test. Table 14.2-2 provides an index of these tests.

14.2.12.2.1 Turbine Trip Test (S-04AC02)

14.2.12.2.1.1 Objectives

a. To demonstrate the ability of the turbine trip and monitoring system to initiate a turbine trip on input of the associated input signals.

b. To demonstrate the response of the moisture separator reheater drain valves, feedwater heater extraction check valves, turbine main stop valves, turbine main stop valve above seat drain valves, turbine control valves, turbine control valve above seat drain valves, intermediate stop valves, main steamline drain valves, startup drain valves, and intercept valves to a turbine trip signal.

c. To demonstrate that a turbine trip signal initiates a reactor trip signal.

d. To demonstrate that the turbine main stop valves operating times are within design specifications.

14.2.12.2.1.2 Prerequisites

a. Required component testing and instrument calibration is complete.

b. Required electrical power supplies and control circuits are operational.

c. The main turbine control oil and lube oil systems are available to provide oil to the turbine auxiliaries.

d. The compressed air system is available to provide air to system air-operated valves.

14.2.12.2.1.3 Test Method

a. The ability of the turbine trip and monitoring system to initiate a turbine trip signal on receipt of each of the following input signals is verified:

- Manual trip pushbutton depressed
- Manual trip handle pulled
- Generator trip (EHC vital trip)
- Generator trip (unit trip)
- Reactor trip
- Loss of stator coolant
- Low lube oil pressure
- Loss of EHC 125 V dc power with turbine speed below 75 percent
- High turbine vibration
- High exhaust hood temperature
- Low hydraulic fluid pressure
- Moisture separator high level
- Low bearing oil pressure
- Low condenser vacuum
- Excessive thrust bearing wear
- Backup overspeed (Electrical)
- Loss of EHC 24-volt dc power

b. A turbine trip signal is initiated, and the response of the following valves is verified:

- Moisture separator reheater drain valves
- Feedwater heater extraction check valves
- Turbine main stop valves
- Turbine control valves
- Intermediate stop valves
- Turbine intercept valves
- Startup drain valves
- Main steam line drain valves

- o Turbine main stop valve above seat drain valves
- o Turbine control valve above seat drain valves

c. A turbine trip signal is initiated, and a reactor trip input signal is verified.

14.2.12.2.1.4 Acceptance Criteria

a. The turbine trip and monitoring system initiates a turbine trip on receipt of each of the following signals:

- o Manual trip pushbutton depressed
- o Manual trip handle pulled
- o Generator trip (EHC vital trip)
- o Generator trip (unit trip)
- o Reactor trip
- o Loss of stator coolant
- o Low lube oil pressure
- o Loss of EHC 125 V dc power with turbine speed below 75 percent
- o High turbine vibration
- o High exhaust hood temperature
- o Low hydraulic fluid pressure
- o Moisture separator high level
- o Low bearing oil pressure
- o Low condenser vacuum
- o Excessive thrust bearing wear
- o Backup overspeed (electrical)
- o Loss of EHC 24-volt dc power

b. The following valves open on receipt of a turbine trip signal:

- o Turbine main stop valve above seat drain valves
- o Turbine control valve above seat drain valves
- o Main steam line drain valves
- o Moisture separator reheater drain valves
- o Startup drain valves

c. The following valves close on receipt of a turbine trip signal:

- o Low pressure heater extraction check valves
- o Main stop valves
- o Turbine control valves
- o Intercept valves
- o Intermediate stop valves

d. A turbine trip signal initiates a reactor trip signal.

e. The turbine main stop valves operating times are within design specifications.

14.2.12.2.2 Turbine System Cold Test (S-04AC03)

14.2.12.2.2.1 Objectives

a. To demonstrate the operability of the turning gear and associated control circuits.

b. To demonstrate the operability of the electro-hydraulic control system.

14.2.12.2.2.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The main turbine control oil and lube oil systems are available to supply the turbine auxiliaries.

14.2.12.2.2.3 Test Method

a. The operability of the turning gear and associated control circuits is verified.

b. A turbine simulator is utilized to verify the ability of the electro-hydraulic control system to perform its control functions.

14.2.12.2.2.4 Acceptance Criteria

a. The turning gear motor trips on loss of bearing oil pressure, loss of all bearing lift pumps, or closure of the main transformer switchyard breaker.

b. The turbine control and intercept valves close on a power load unbalance signal.

c. The turbine load set is run back on a reactor overtemperature ΔT signal when in the manual mode.

d. The turbine load set is run back on a reactor overpower ΔT signal when in the manual mode.

e. The turbine load is set back on a loss of circulating water pump signal.

f. Turbine loading is inhibited on a C-16 control interlock signal.

14.2.12.2.3 Condensate System Preoperational Test (S-04AD01)

14.2.12.2.3.1 Objectives

To demonstrate the condensate pumps' operating characteristics and verify the operation of system valves and associated control circuits. The operability of the condensate storage and transfer system and associated components is also verified.

14.2.12.2.3.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

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

d. The demineralized water system is available to provide water to the condensate pump seals and a source of makeup to the condensate storage tank.

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

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

14.2.12.2.3.3 Test Method

a. Condensate pumps are operated, and performance characteristics are verified.

b. The response of each condensate pump to a condenser low-low level trip signal is verified.

c. The operability of the condensate pump recirculation valves is verified.

14.2.12.2.3.4 Acceptance Criteria

a. The operating characteristics of the condensate pumps are within design specifications.

b. Each condensate pump will receive a trip signal on a 2/3 condenser low-low level signal.

c. Each condensate pump recirculation valve operates in accordance with design specifications.

14.2.12.2.4 Secondary Vent and Drain System Preoperational Test (S-04AF01)

14.2.12.2.4.1 Objectives

a. To demonstrate the operating characteristics of the heater drain pumps.

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

14.2.12.2.4.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The compressed air system is available to the system air-operated valves.

d. The closed cooling water system is available to supply cooling water to the heater drain pumps.

14.2.12.2.4.3 Test Method

a. The heater drain pumps are operated, and performance characteristics are verified.

b. The operability of system valve and pump control circuits is verified.

14.2.12.2.4.4 Acceptance Criteria

The operating characteristics of the heater drain pumps are within design specifications.

14.2.12.2.5 Condensate and Feedwater Chemical Feed System Preoperational Test (S-04AQ01)

14.2.12.2.5.1 Objectives

a. To demonstrate the operating characteristics of the condensate oxygen control chemical addition pumps, condensate pH control chemical addition pumps, condensate oxygen control chemical circulating pumps, condensate pH control chemical circulating pumps, feedwater chemical addition pumps, and feedwater chemical addition circulating pump and verify the operation of the associated control circuits.

b. To demonstrate the operability of the drum dispensing pumps.

14.2.12.2.5.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The demineralized water storage and transfer system is available to provide a source of demineralized water to the oxygen and pH control chemical supply and mixing tanks.

d. The compressed air system is available to provide air to the drum dispensing pumps.

e. The service gas system is available to provide a source of nitrogen to the oxygen and pH control chemical supply, measuring, and mixing tanks.

14.2.12.2.5.3 Test Method

a. System pumps are operated, and performance characteristics are verified.

b. The response of the condensate oxygen control chemical circulating pumps, condensate pH control chemical circulating pumps, and the feedwater chemical addition feed pumps to a low level in their associated tank is verified.

14.2.12.2.5.4 Acceptance Criteria

a. The operating characteristics of the condensate oxygen control chemical addition pumps, condensate pH control chemical addition pumps, condensate oxygen control chemical circulating pumps, condensate ph control chemical circulating pumps, feedwater chemical addition pumps, feedwater chemical addition circulating pump, and the drum dispensing pumps are within design specifications.

b. The condensate oxygen control chemical circulating pumps, condensate pH control chemical circulating pumps, feedwater chemical addition feed pumps, and the feedwater chemical addition circulating pump trip on a low level signal from their associated tanks.

14.2.12.2.6 Reactor Makeup Water System Preoperational Test (S-04BL01)

14.2.12.2.6.1 Objectives

a. To demonstrate the operating characteristics of the reactor makeup water transfer pumps and verify that the associated control circuits are functioning properly.

b. To demonstrate the operation of the system automatic valves, including the response of the reactor makeup water system containment supply valve to a CIS.

14.2.12.2.6.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The demineralized water storage and transfer system is available to provide a source of water to the reactor makeup water storage tank.

14.2.12.2.6.3 Test Method

a. The reactor makeup water transfer pumps are operated, and pump operating data are recorded.

b. Reactor makeup water transfer pumps and system automatic valves control logics are verified, including their response to safety signals.

c. The reactor makeup water containment supply valve is operated under flow conditions and operating times recorded.

14.2.12.2.6.4 Acceptance Criteria

a. The operating characteristics of the reactor makeup water transfer pumps are within design specifications.

b. Each reactor makeup water transfer pump trips on receipt of a reactor makeup water storage tank low level signal.

c. Each reactor makeup water transfer pump starts, after a time delay, with the other pump running and the receipt of a low header pressure signal.

d. The reactor makeup water containment supply valve closure time is within design specifications.

e. The reactor makeup containment supply valve closes on receipt of a CIS.

14.2.12.2.7 Condenser Air Removal System Preoperational Test (S-04CG01)

14.2.12.2.7.1 Objectives

a. To demonstrate the operation of the condenser air removal portion of the turbine building HVAC system motoroperated dampers, including automatic operation on a safety injection signal.

b. To demonstrate the capacities of the condenser air removal filtration fans and verify the operation of their associated control circuits.

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

14.2.12.2.7.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The condenser air removal filtration system portion of the turbine building HVAC system is available to support this test.

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

e. The service water system is available to provide cooling water to the mechanical vacuum pump seal water coolers.

14.2.12.2.7.3 Test Method

a. The condenser air removal filtration fans are operated, and fan capacities are verified.

b. Operation of the condenser air removal filtration dampers is verified, including their response to a safety injection signal.

c. The ability of the mechanical vacuum pumps to reduce condenser pressure during startup operation is verified.

d. Operability of the mechanical vacuum pumps and their associated control valves' control circuits is verified, including their response to a low condenser vacuum signal.

14.2.12.2.7.4 Acceptance Criteria

a. The condenser air removal filtration fans' capacities are within design specifications.

b. The condenser air removal filtration dampers close on receipt of a safety injection signal.

c. The rate at which the mechanical vacuum pumps reduce condenser pressure is within design specifications.

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

14.2.12.2.8 Circulating Water System Preoperational Test (SU4-DA01)

14.2.12.2.8.1 Objective

a. To demonstrate the operating characteristics of the circulating water pumps, water box venting pumps, and the condenser drain pump and verify the operation of their associated control circuits.

b. To demonstrate by operational test that the circulating water pump discharge valves operating times are within design specifications.

c. To demonstrate that the gland water system flow to the circulating water pumps is within design specifications.

14.2.12.2.8.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are completed.

b. Required electrical power supplies and control circuits are operational.

c. The circulatng water system and condenser are available to receive flow from the circulating water pumps.

14.2.12.2.8.3 Test Method

a. The circulating water pumps, water box venting pumps, and the condenser drain pump are operated and pump operating data is recorded.

b. The response of the circulating water pumps and the condenser drain pump to control signals is verified.

c. Circulating water pump discharge valve operating times are recorded.

14.2.12.2.8.4 Acceptance Criteria

a. The circulating water pumps operating characteristics are within design specifications.

b. The water box venting pumps operating characteristics are within design specifications.

c. The condenser drain pump operating characteristics are within design specifications

d. The condenser drain pump stops on receipt of a standpipe low-level signal.

e. Each circulating water pump trips on receipt of a two out of three condenser pit high level signal.

f. Low gland seal water pressure or low gland seal flow will prevent start of the circulating water pumps.

g. The gland seal water flow to each circulating water pump is within design specifications.

h. The operating times of the circulating water pump discharge valves are within design specifications.

14.2.12.2.9 Service Water System Preoperational Test (S-04EA01).

14.2.12.2.9.1 Objectives

a. To demonstrate the capability of the service water system and essential service water system to provide rated cooling water flow during the normal and normal-shutdown modes of operation to their respective loads.

b. To demonstrate the operating characteristics of the Service Water (SW) Pumps.

c. To verify proper operation of site service water system controls and instrumentation.

14.2.12.2.9.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The essential service water system has been flow balanced in the LOCA mode.

d. Site system controls and instruments are calibrated.

e. The SW system is available to receive flow from the SW pumps.

14.2.12.2.9.3 Test Method

a. Service water and essential service water system flows are verified in the normal and normal-shutdown modes. (The service water pumps provide the motive force.)

b. The SW pumps are operated and pump operating data is recorded.

14.2.12.2.9.4 Acceptance Criteria

a. Components supplied by the service water system and essential service water system receive flows that are within design specifications with the system operating in the normal and normal-shutdown modes.

b. The SW pumps operating characteristics are within design specifications.

14.2.12.2.10 Closed Cooling Water System Preoperational Test (S-04EB01)

14.2.12.2.10.1 Objectives

a. To demonstrate the capability of the closed cooling water system to provide cooling water flow to its associated components.

b. To demonstrate the operating characteristics of the closed cooling water pumps and to verify that the associated instrumentation and controls are functioning properly.

14.2.12.2.10.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.2.10.3 Test Method

Performance characteristics of the closed cooling water pumps and flow data to supplied components are verified.

14.2.12.2.10.4 Acceptance Criteria

a. The performance characteristics of each closed cooling water pump are within design specifications.

b. Flow to all components supplied by the closed cooling water system is verified.

14.2.12.2.11 Fire Protection System Preoperational Test (SU4-FP03)

14.2.12.2.11.1 Objectives

a. To demonstrate the operating characteristics of the Fire Protection (FP) system jockey pump, motor-driven fire pump and the diesel-driven fire pump and verify the operation of their associated control circuits.

b. To demonstrate the operability of the diesel oil system, including system instrumentation and controls.

14.2.12.2.11.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are completed.

b. Required electrical power supplies and control circuits are operational.

14.2.12.2.11.3 Test Method

a. The jockey pump, the motor-driven fire pump and the diesel-driven fire pump are operated and operating data are recorded.

b. The response of the motor-driven fire pump and diesel-driven fire pump to automatic start signals are verified.

c. With the diesel-driven fire pump operating at rated capacity, the capacity of the diesel oil day tank is verified.

14.2.12.2.11.4 Acceptance Criteria

a. The FP pumps operating characteristics are within design specifications.

b. The motor-driven fire pump and the diesel-driven fire pump automatically start upon receipt of their associated decreasing fire protection system pressure signal.

c. With the diesel fire pump operating at rated capacity, the capacity of the diesel oil day tank is within design specifications.

d. With the diesel fire pump operating at rated capacity and upon receipt of a diesel oil day tank low level alarm, the remaining capacity of the diesel oil day tank is within design specifications.

14.2.12.2.12 Radwaste Building HVAC System Preoperational Test (S-04GH01)

14.2.12.2.12.1 Objectives

a. To verify the radwaste building supply and exhaust fans' control circuits, including automatic transfer between exhaust fans.

b. To demonstrate the fan capacities of the radwaste building supply and exhaust fans, recycle evaporator room fan coil unit, waste evaporator room fan coil unit, control room (solidification) fan coil unit, sample laboratory fan coil unit, ground floor fan coil unit, basement floor fan coil unit, SLWS evaporator fan coil unit, and control room fan coil unit, and to verify that the associated instrumentation and controls function properly.

14.2.12.2.12.2 Prerequisites

a. Required component testing, instrument calibration, and system air balancing are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.2.12.3 Test Method

a. The radwaste building system fans are operated, and fan capacities are verified.

b. Operability of the radwaste building supply and exhaust fans' control circuits is verified.

14.2.12.2.12.4 Acceptance Criteria

a. The radwaste building system fan capacities are within design specifications.

b. The radwaste building supply air unit will not operate unless either radwaste exhaust fan is operating.

c. A low flow on the operating radwaste building exhaust fan will cause the operating fan to stop and the standby fan to start.

14.2.12.2.13 Local Containment Leak Rate Test (SU8-GP01)

14.2.12.2.13.1 Objectives

To determine the leakage rate of the containment penetrations and the leakage rate of the containment isolation valves.

14.2.12.2.13.2 Prerequisites

a. All containment isolation valves are closed by normal actuation methods.

b. Associated piping is drained, and vent paths for leakage are established.

c. Required instrument calibration is complete.

14.2.12.2.13.3 Test Method

The containment penetrations and containment isolation valves are leak tested by performing type B and type C tests, in accordance with 10 CFR 50, Appendix J.

14.2.12.2.13.4 Acceptance Criteria

The combined leakage from containment penetrations and containment isolation valves is within design limits.

14.2.12.2.14 Liquid Radwaste System Preoperational Test (S-04HB01).

14.2.12.2.14.1 Objectives

a. To demonstrate the operating characteristics of the liquid radwaste system pumps and to verify the operation of their associated control circuits.

b. To demonstrate the operation of the liquid radwaste system containment isolation valves, including their response to a CIS.

c. To determine by operational test that the liquid radwaste system containment isolation valves' closure times are within design specifications.

14.2.12.2.14.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The component cooling water system is available to provide cooling water to the reactor coolant drain tank heat exchanger.

14.2.12.2.14.3 Test Method

a. The liquid radwaste system pumps are operated, and performance characteristics are recorded.

b. The operability of the system pump and valve control circuits is verified.

c. The liquid radwaste system containment isolation valves are operated under flow conditions, and operating times are recorded.

14.2.12.2.14.4 Acceptance Criteria

a. The performance characteristics of the liquid radwaste system pumps are within design specifications.

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

c. The liquid radwaste system containment isolation valves close on receipt of a CIS.

d. The liquid radwaste system containment isolation valves' closure times are within design specifications.

e. The liquid radwaste effluent discharge valve closes on a high process radiation signal.

14.2.12.2.15 Waste Evaporator Preoperational Test (SU4-HB02)

14.2.12.2.15.1 Objectives

To demonstrate the operability of the waste evaporator and its associated pumps, valves, and control circuits.

14.2.12.2.15.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. Cooling water is available to the waste evaporator.

d. The auxiliary steam system is available to supply steam to the waste evaporator.

e. The waste evaporator condensate tank and the primary evaporator bottoms tank are available to receive waste evaporator effluent.

14.2.12.2.15.3 Test Method

a. The waste evaporator is operated, and performance data is recorded.

b. With the waste evaporator in operation, a low feed inlet pressure signal is initiated, and the evaporator is verified to shift to the recycle mode.

c. The waste evaporator distillate pump is verified to trip on a low evaporator condenser level.

14.2.12.2.15.4 Acceptance Criteria

a. The waste evaporator process flow is within design specifications.

b. The waste evaporator goes into the recycle mode on low feed inlet pressure.

c. The waste evaporator distillate pump trips on a low evaporator condenser level.

14.2.12.2.16 Solid Waste System Preoperational Test (S-04HC01)

14.2.12.2.16.1 Objectives

a. To demonstrate the operating characteristics of the solid waste system pumps and to verify the operation of their associated control circuits.

b. To demonstrate the ability of the decant station, drumming station, cement filling station, and the solid radwaste bridge crane to process, solidify, and handle waste and to verify the operation of their associated control circuits.

c. To demonstrate the ability of the dry waste compactors to process compressible wastes and to verify the operation of their associated control circuits.

14.2.12.2.16.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operable.

c. Reactor makeup water is available to provide a source of water to the decanting station.

14.2.12.2.16.3 Test Method

a. The solid waste system pumps are operated, and the pump operating data are recorded.

b. The system component control circuits are verified, and the ability of the solid radwaste system to process, solidify, and handle waste is verified.

14.2.12.2.16.4. Acceptance Criteria

a. The operating characteristics of the evaporator bottoms tank pumps (primary and secondary) are within design specifications.

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

c. The evaporator bottoms tank pumps (primary and secondary) trip on their respective tank low level signal.

14.2.12.2.17 Solid Waste Filter Handling System Preoperational Test (S-04HC02)

14.2.12.2.17.1 Objectives

To demonstrate the ability of the solid radwaste filter handling system to remove, transfer, and install a spent resin sluice filter assembly.

14.2.12.2.17.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.2.17.3 Test Method

a. Operability of the solid radwaste monorail hoist and handling cask winch and associated control circuits is verified.

b. The ability of the solid radwaste filter handling system to remove, transfer, and install a spent resin sluice filter assembly is verified.

14.2.12.2.17.4 Acceptance Criteria

The filter handling system functions in accordance with design specifications.

14.2.12.2.18 Resin Transfer Preoperational Test (SU4-HC03)

14.2.12.2.18.1 Objectives

a. To demonstrate the ability to charge resins and activated charcoal to those systems containing potentially contaminated demineralizers or adsorbers. The ability of the spent resin sluice pumps to transfer resins and charcoal from demineralizers and adsorbers is also verified.

b. To demonstrate the operating characteristics of the spent resin sluice pumps, chemical addition metering pumps, and chemical drain tank pumps.

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

14.2.12.2.18.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. Those systems containing potentially contaminated demineralizers and adsorbers are available to support this test.

d. The reactor makeup water system is available to provide a source of water for resin charging.

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

14.2.12.2.18.3 Test Method

a. Resins and charcoal are charged and transferred from selected potentially contaminated demineralizers and adsorbers.

b. The spent resin sluice pumps, chemical addition metering pumps, and chemical drain tank pumps are operated, and performance characteristics are obtained.

c. The response of the spent resin sluice pumps, chemical addition metering pumps, and the chemical drain tank pumps to a low-level trip signal from their respective tanks is verified.

14.2.12.2.18.4 Acceptance Criteria

a. The operating characteristics of the spent resin sluice pumps, chemical addition metering pumps, and the chemical drain tank pump are within design specifications.

b. The spent resin sluice pumps, chemical addition metering pumps, and the chemical drain tank pump trip on receipt of a low-level trip signal from their respective tanks.

14.2.12.2.19 Fire Protection System (Water) Preoperational Test (SU4-KC01A, SU4-KC01B)

14.2.12.2.19.1 Objectives

a. To demonstrate the operability of the preaction sprinkler system, wet-pipe sprinkler system, and the automatic water spray system, including system instrumentation, alarms, and interlocks.

b. To demonstrate the operability of system valves, including their response to safety signals.

c. To verify spray to the applicable electrical system transformers.

14.2.12.2.19.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operable.

c. The fire water pumps are available to provide a source of water to the fire protection system headers.

14.2.12.2.19.3 Test Method

a. Response of the preaction sprinkler system, wet-pipe sprinkler system, and automatic water spray system to fire detection signals is verified, including the operability of associated alarms, instrumentation, and interlocks.

b. The fire protection system containment isolation valves are operated under flow conditions and operating times recorded.

c. Response of the fire protection system containment isolation valves to a CIS is verified.

d. Spray to the applicable electrical transformers is verified.

14.2.12.2.19.4 Acceptance Criteria

a. The preaction sprinkler system, wet-pipe sprinkler system, automatic water spray system and associated alarms, and instrumentation and interlocks operate in accordance with system design specifications.

b. The fire protection system containment isolation valves' closure time is within design specifications.

c. The fire protection system containment isolation valves close on receipt of a CIS.

d. The spray to applicable electrical transformers is within design specifications.

14.2.12.2.20 Fire Protection System (Halon) Preoperational Test (S-04KC02)

14.2.12.2.20.1 Objectives

To demonstrate the operability of the halon system, including the associated instrumentation, control circuits, and alarms.

14.2.12.2.20.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operable.

14.2.12.2.20.3 Test Method

The operability of the halon system, including the associated instrumentation and alarms, is verified. System response to fire detection signals is also verified.

14.2.12.2.20.4 Acceptance Criteria

The halon fire protection system operates in accordance with system design specifications.

14.2.12.2.21 Fire Protection System Detection and Alarm Preoperational Test (S-04KC03)

14.2.12.2.21.1 Objectives

To demonstrate the operability of the fire protection system detectors and alarms not verified during the performance of the halon and water system preoperational tests.

14.2.12.2.21.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operable.

14.2.12.2.21.3 Test Method

Actuation of system alarms upon receipt of fire detection signals is verified.

14.2.12.2.21.4 Acceptance Criteria

Fire protection system detectors and alarms operate in accordance with system design specifications.

14.2.12.2.22 Oily Waste System Preoperational Test (S-04LE01)

14.2.12.2.22.1 Objectives

To demonstrate the sump pumps and miscellaneous condensate drain tank pumps' operating characteristics and response to sump/tank, level signals. The operation of system valves and associated control circuits and sump/tank level alarms are also verified.

14.2.12.2.22.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The compressed air system is available to supply air to system valves and pumps.

d. A water source (fire system) and a collection receptacle (oil/water separator, main condenser) are available for the testing of each sump/tank.

14.2.12.2.22.3 Test Method

a. The sump pumps and miscellaneous condensate drain tank pumps are operated, and performance characteristics are verified.

b. The response of each pump and associated alarms to sump/tank high and low level signals is verified.

c. The operability of system air-operated valves is verified, including the response to a process radiation signal.

14.2.12.2.22.4 Acceptance Criteria

a. The performance characteristics of the system pumps are within design specifications.

b. The turbine building oily waste header discharge valve closes on a high-radiation signal.

14.2.12.2.23 Floor and Equipment Drain System Preoperational Test (SU4-LF01)

14.2.12.2.23.1 Objectives

To demonstrate the sump pumps and hot machine shop oil interceptor pump's capacities and response to sump/tank level signals. The operation of system valves, their response to safety signals, and sump/tank level alarms are also verified.

14.2.12.2.23.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operational.

c. The compressed air system is available to supply air to system valves and pumps.

d. A water source (fire system or ESW) and a collection receptacle (holdup tank, radwaste system, etc.) are available for the testing of each sump/tank.

14.2.12.2.23.3 Test Method

a. The sump pumps and hot machine shop oil interceptor pumps are operated, and their capacities are verified.

b. The response of each system pump, system indication, and alarms, to sump/tank high and low level signals is verified.

c. The operability of system air- and motor-operated valves is verified, including their response to safety signals.

14.2.12.2.23.4 Acceptance Criteria

a. The capacities of the floor and equipment drain system pumps are within design specifications.

b. System valves properly respond to safety injection signals and containment isolation signals.

c. The valve response times are within design specifications.

14.2.12.2.24 13.8-kV System Preoperational Test (S-04PA01)

14.2.12.2.24.1 Objectives

a. To demonstrate that the 13.8-kV busses can be energized from the startup transformer.

b. To demonstrate that automatic fast transfer of the busses from the unit auxiliary source to the startup source is within design specifications.

c. To demonstrate that the unit auxiliary source or startup source feeder breakers will trip on a stuck breaker condition.

d. To demonstrate proper operation of system instrumentation and controls.

14.2.12.2.24.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The 13.8-kV system has been energized.

14.2.12.2.24.3 Test Method

a. The 13.8-kV busses are energized from the startup transformer, and bus voltages are recorded.

b. Automatic fast transfer from the unit auxiliary source to the startup source is verified.

c. Stuck breaker conditions are simulated, and proper operation of the 13.8-kV auxiliary source and startup source feeder breakers is verified.

14.2.12.2.24.4 Acceptance Criteria

a. The 13.8-kV bus voltages are within design specifications, when energized from the startup transformer.

b. Automatic fast transfer of the busses from the unit auxiliary source to the startup source is within design specifications.

c. The 13.8-kV auxiliary source and startup source feeder breakers trip on receipt of a stuck breaker signal.

14.2.12.2.25 4,160-V (Non-Class IE) System Preoperational Test (S-04PB01)

14.2.12.2.25.1 Objectives

a. To demonstrate that the 4,160-V busses can be energized from their normal and alternate sources, and to verify the operability of supply breaker and bus tie breaker protective interlocks.

b. To demonstrate that automatic transfer is achieved through the tie breaker from the normal source to the alternate source in the event of an electrical fault.

c. To demonstrate proper operation of system instrumentation and controls.

14.2.12.2.25.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The 4,160-V (non-Class IE) system has been energized.

14.2.12.2.25.3 Test Method

a. The 4,160-V non-Class IE busses are energized from their normal and alternate source, and bus voltages are recorded.

b. System supply breakers and bus tie breakers are operated, and breaker interlocks are verified.

c. System electrical fault signals are simulated, and automatic transfer is verified through the tie breaker from the normal source to the alternate source for each 4,160-V bus.

14.2.12.2.25.4 Acceptance Criteria

a. The voltage of each 4,160-V non-Class IE bus, when supplied from its normal source and alternate source, is within design specifications.

b. System supply breaker and bus tie breaker interlocks operate in accordance with the system design.

c. Automatic transfer is achieved through the tie breaker from the normal source to the alternate source, for each 4,160-V bus, upon receipt of an electrical fault signal.

14.2.12.2.26 480-Volt (Non-Class IE) System Preoperational Test (S-04PG01)

14.2.12.2.26.1 Objectives

a. To demonstrate that the 480-V non-Class IE load centers can be energized from their normal sources and alternate sources, as applicable, and verify the operability of feeder breaker and bus tie breaker protective interlocks.

b. To demonstrate that the 480-V busses supplied by 4160-V (Class IE) source breakers are shed on receipt of a load shed signal.

c. To demonstrate proper operation of system instrumentation and controls.

14.2.12.2.26.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The 480-V (non-Class IE and Class IE) systems have been energized.

14.2.12.2.26.3 Test Method

a. The 480-V non-Class IE load centers are energized from their normal source and alternate source, as applicable and voltages are recorded.

b. System feeder breakers and bus tie breakers are operated, and breaker interlocks verified.

c. A load shed signal is simulated, and the 480-V busses supplied by the 4,160-V (Class IE) source breakers are verified to shed.

14.2.12.2.26.4 Acceptance Criteria

a. The voltage for each 480-V non-Class IE load center, when supplied from its normal source and alternate source, as applicable, is within design specifications.

b. System feeder breaker and bus tie breaker interlocks operate in accordance with the system design.

c. The 480-V busses supplied by the 4160-V (Class IE) source breakers shed on receipt of a load shed signal.

14.2.12.2.27 250-V DC System Preoperational Test (S-04PJ01)

14.2.12.2.27.1 Objectives

To demonstrate the ability of the battery and battery chargers to provide power to the busses. The battery chargers' ability to recharge their respective battery is also demonstrated. Proper operation of system instrumentation and controls is also verified.

14.2.12.2.27.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. Ventilation for the battery room is available.

d. The 250-V dc system has been energized.

14.2.12.2.27.3 Test Method

a. The battery is discharged, using a test load at the design duty cycle discharge rate.

b. The battery is fully discharged to determine its capacity factor.

c. The ability of each battery charger to charge the battery to normal conditions, after the battery has undergone a design duty cycle, while simultaneously supplying power at a rate equivalent to the largest motor current load is verified.

d. A load shed signal is initiated, and the battery charger PJ31 ac supply breaker is verified to trip.

14.2.12.2.27.4 Acceptance Criteria

a. The battery is capable of maintaining output voltage above the design minimum, during a design duty cycle.

b. The battery capacity factor is in accordance with design requirements.

c. The battery chargers are able to recharge the battery to normal conditions, after the battery has undergone a design duty cycle, while simultaneously supplying power at a rate equivalent to the largest motor current load.

d. Battery charger PJ31 ac supply breaker trips on receipt of a load shed signal.

14.2.12.2.28 125-V (Non-Class IE) DC System Preoperational Test (S-04PK01, S-04PK02)

14.2.12.2.28.1 Objectives

To demonstrate the ability of the batteries and chargers to provide power to the busses. The battery chargers' ability to recharge their respective battery is also demonstrated. Proper operation of system instrumentation and controls is also verified.

14.2.12.2.28.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. Ventilation for the battery room is available.

14.2.12.2.28.3 Test Method

a. Each battery is discharged, using a test load at the design duty cycle discharge rate.

b. Each battery is fully discharged to determine its capacity factor.

c. The ability of each battery charger to charge its respective battery to normal conditions, after the battery has undergone a design duty cycle, while simultaneously supplying power at a rate equivalent to the design instrumentation loading.

d. A safety injection load shed signal is initiated, and the battery charger PK21, PK22, PK23, and PK24 supply breaker is verified to trip.

14.2.12.2.28.4 Acceptance Criteria

a. Each battery is capable of maintaining output voltage above the design minimum, during a design duty cycle.

b. Each battery capacity factor is in accordance with design requirements.

c. The battery chargers are able to recharge the batteries to normal conditions, after the battery has undergone a design duty cycle, while simultaneously supplying power at a rate equivalent to the design load.

d. Battery charger PK21, PK22, PK23, and PK24 supply breaker trips on receipt of a safety injection load shed signal.

14.2.12.2.29 Instrument AC (Non-Class IE) System Preoperational Test (S-04PN01)

14.2.12.2.29.1 Objectives

To demonstrate that the 120-V non-Class IE ac distribution panels can be fed from their associated supply transformers. Proper operation of system instrumentation and controls is also verified.

14.2.12.2.29.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.2.29.3 Test Method

The 120-V non-Class IE ac distribution panels are energized from their associated supply transformers, and the panel voltages are recorded.

14.2.12.2.29.4 Acceptance Criteria

Each 120-V non-Class IE ac distribution panel voltage is within design specifications.

14.2.12.2.30 Emergency Lighting System Preoperational Test (S-04QD01)

14.2.12.2.30.1 Objectives

To demonstrate the capability of the emergency lighting system to provide adequate lighting. Proper operation of system instrumentation and controls is also verified.

14.2.12.2.30.2 Prerequisites

Required electrical power supplies and control circuits are operable.

14.2.12.2.30.3 Test Method

The ability of the emergency lighting system to provide adequate lighting is verified. The operability of associated instrumentation and control circuits is also verified.

14.2.12.2.30.4 Acceptance Criteria

The emergency lighting system operates in accordance with system design specifications.

14.2.12.2.31 Public Address System Preoperational Test (S-04QF01)

14.2.12.2.31.1 Objectives

To demonstrate the capability of the public address system to provide adequate intraplant communications and to verify the operability of the evacuation alarm system.

14.2.12.2.31.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operable.

14.2.12.2.31.3 Test Method

a. The public address system is operated from all locations, and adequate communications verified.

b. Operability of the evacuation alarm system is verified.

14.2.12.2.31.4 Acceptance Criteria

a. The evacuation alarm system operates in accordance with system design specifications.

14.2.12.2.32 Heat Tracing Freeze Protection System Preoperational Test (S-04QJ01)

14.2.12.2.32.1 Objectives

To demonstrate the ability of the freeze protection system to automatically control the associated heat tracing circuits in accordance with system design. The operation of system instrumentation and controls is also verified.

14.2.12.2.32.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.2.32.3 Test Method

Temperature signals are varied and the energization/ deenergization of the associated heat tracing circuits is verified.

14.2.12.2.32.4 Acceptance Criteria

The freeze protection system automatically controls the associated heat tracing circuits, in accordance with system design.

14.2.12.2.33 Secondary Sampling System Preoperational Test (S-04RM01)

14.2.12.2.33.1 Objectives

a. To demonstrate the operating characteristics of the steam generator blowdown sample drain tank pump, sample chiller pump, and the condenser sample pumps, and verify the operability of their associated control circuits.

b. To demonstrate that the system sample flows are within design specifications.

14.2.12.2.33.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required electrical power supplies and control circuits are operable.

c. Plant conditions are established, and systems are available, as necessary, to facilitate drawing samples from the sample points.

d. The steam generator blowdown system is available to receive effluent from the steam generator blowdown sample drain tank.

e. The closed cooling water system is available to provide cooling water to the system sample coolers and chiller package.

14.2.12.2.33.3 Test Method

a. The steam generator blowdown sample drain tank pump, sample chiller pump, and the condenser sample pumps are operated, and pump performance data recorded. Operability of their associated control circuits is also verified.

b. System samples are obtained, and flows are recorded.

14.2.12.2.33.4 Acceptance Criteria

a. The steam generator blowdown sample drain tank pump, sample chiller pump, and condenser sample pump performance characteristics are within design specifications.

b. Sample system flows are within design specifications.

14.2.12.2.34 Area Radiation Monitoring Preoperational Test (S-04SD01)

14.2.12.2.34.1 Objectives

To demonstrate the operation of the area radiation monitors and to verify that a high radiation signal at each monitor will initiate an alarm.

14.2.12.2.34.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.2.34.3 Test Method

A calibration source is utilized to actuate the area radiation monitors, and their operability and associated alarms are verified.

14.2.12.2.34.4 Acceptance Criteria

Each area radiation monitor actuates the associated alarms, on receipt of a high radiation signal.

14.2.12.2.35 Seismic Monitoring Instrumentation System Preoperational Test (S-04SG01)

14.2.12.2.35.1 Objectives

To demonstrate the operability of the seismic triggers and switches and strong motion accelerometers, including their associated alarms and recording and playback systems.

14.2.12.2.35.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.2.35.3 Test Method

A test signal is initiated, and the operability of the seismic triggers and switches and strong motion accelerometers, including their associated alarms and recording and playback systems, is verified.

14.2.12.2.35.4 Acceptance Criteria

The seismic triggers and switches and strong motion accelerometers, including their associated alarms and recording and playback systems, operate in accordance with system design specifications.

14.2.12.2.36 Loose Parts Monitoring System Test (SU4-SQ02).

14.2.12.2.36.1 Objective

To demonstrate the operability of the accelerometers, signal conditioning devices and diagnostic equipment, including associated alarms and recording and playback systems.

14.2.12.2.36.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. Reactor coolant system is filled with water.

d. Reactor coolant system is at normal operating temperature and pressure with all reactor coolant pumps running, and hot functional testing is in progress (for those portions of the testing to be performed during hot functional testing).

e. Reactor coolant system is at normal operating temperature and pressure with all reactor coolant pumps running after fuel loading during startup testing (for those portions of the testing to be performed during startup testing).

14.2.12.2.36.3 Test Method

a. Test signals are initiated and the operability of the accelerometers, signal conditioners, and diagnostic circuitry, including alarms and recording and playback systems, is verified.

b. Channel audio outputs are also recorded during hot functional testing and after fuel loading during startup testing to obtain a record of the reactor coolant system noise "signature."

14.2.12.2.36.4 Acceptance Criteria

The accelerometers, signal conditioners, and diagnostic circuitry, including alarms and recording and playback systems operate to detect loose parts as specified in USAR Section 4.4.6.4.

14.2.12.2.37 Plant Performance Test (SU8-0007)

14.2.12.2.37.1 Objectives

a. To monitor the balance-of-plant and electrical systems under loaded conditions during hot functional and power ascension testing. The ability of the ventilation systems to maintain ambient temperatures within design limits is also verified. To monitor the concrete temperatures surrounding hot penetrations and to verify evacuation alarm audibility in high noise areas.

14.2.12.2.37.2 Prerequisites

a. Required component testing, instrument calibration, and system flushing/cleaning are complete.

b. Required HVAC systems have been balanced.

c. Required electrical power supplies and control circuits are operational.

14.2.12.2.37.3 Test Method

This procedure does not provide a test method. It provides a monitoring and data collection function only, with the resultant datum evaluated against provided design values, as applicable.

14.2.12.2.37.4 Acceptance Criteria

a. Evacuation alarm audibility in high noise areas is verified.

b. The containment coolers maintain containment temperature within design.

Note: Each monitored point is evaluated throughout the test to verify that the applicable system or component is functioning per design.

14.2.12.2.38 Electrical Distribution System Voltage Verification Test (S-090023)

14.2.12.2.38.1 Objectives

To record actual loaded electrical distribution parameters during various steady-state and transient conditions.

14.2.12.2.38.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.2.38.3 Test Method

The bus voltages and loadings of the electrical distribution system (down to the Class lE 120/208 V ac system) are recorded for various steady state configurations. Data is also recorded during the starting of the largest Class 1E and non-Class 1E motors. All monitored busses are loaded to at least 30 percent.

14.2.12.2.38.4 Acceptance Criteria

Not applicable.

Note: The data obtained from this test procedure are used to verify electrical system voltage analysis.

14.2.12.3 Startup Test Procedures

The following sections are the test abstracts for each startup test. Table 14.2-3 provides an index of these tests.

14.2.12.3.1 Automatic Steam Generator Level Control (S-07AB01)

14.2.12.3.1.1 Objectives

a. To verify the stability of the automatic steam generator level control following simulated transients at low power conditions and the proper operation of the variable speed feature of the feedwater pumps.

b. To demonstrate the performance characteristics of the steam generator feedwater pumps.

14.2.12.3.1.2 Prerequisites

a. The steam generator level control system has been checked and calibrated.

b. Steam generator level instruments and set points have been set and calibrated.

c. Main feedwater is operational.

14.2.12.3.1.3 Test Method

a. Induce simulated steam generator level transients to verify proper steam generator level control response.

b. Verify the variable speed features of the steam generator feedwater pumps by manipulation of controllers and test input signals, and verify the performance characteristics of the steam generator feedwater pumps.

14.2.12.3.1.4 Acceptance Criteria

a. Automatic steam generator level control system response must be in accordance with the vendor's technical manual.

b. The steam generator feedwater pump's performance characteristics are within design specifications.

14.2.12.3.2 Dynamic Automatic Steam Dump Control (SU7-AB02)

14.2.12.3.2.1 Objectives

To verify automatic operation of the T average steam dump control system, demonstrate controller setpoint adequacy, and obtain final settings for steam pressure control of the condenser dump valves.

14.2.12.3.2.2 Prerequisites

a. The reactor coolant system is at normal operating pressure and temperature.

b. The reactor is critical.

c. The steam dump system has been checked and calibrated.

d. Main feedwater and the condenser are operational.

14.2.12.3.2.3 Test Method

a. Reactor power is increased by rod withdrawal and steam dump to condenser to demonstrate setpoint adequacy.

b. Pressure controller setpoint is increased prior to switching to T average control, which will rapidly modulate open condenser dump valves.

c. Simulate turbine operating conditions with reactor at power, then simulate turbine trip, resulting in the rapid opening of the steam dump valves.

14.2.12.3.2.4 Acceptance Criteria

The steam dump system controllers must maintain stable reactor coolant system T average at the controllers set point with no divergent oscillations.

14.2.12.3.3 RTD Bypass Flow Measurement (S-07BB01)

14.2.12.3.3.1 Objectives

To determine the flow rate necessary to achieve the design reactor coolant transport time in each resistance temperature detector

(RTD) bypass loop and to measure the flow rate in each RTD bypass loop to ensure that the transport times are acceptable.

14.2.12.3.3.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The reactor core is installed, and the plant is at normal operating temperature and pressure with all reactor coolant pumps running.

14.2.12.3.3.3 Test Method

The flow rate necessary to achieve the design reactor coolant transport time for each hot and cold leg bypass loop is calculated, utilizing the hot and cold leg RTD bypass loop piping lengths. Hot and cold RTD bypass loop flow data are recorded.

14.2.12.3.3.4 Acceptance Criteria

The flow rate in each hot and cold leg RTD bypass loop, required to achieve the design reactor coolant transport time, is within design specifications.

14.2.12.3.4 Pressurizer Heater and Spray Capability Test (S-07BB02)

14.2.12.3.4.1 Objectives

To determine the rate of pressure reduction caused by fully opening the pressurizer spray valves and the rate of pressure increase from the operation of all pressurizer heaters.

14.2.12.3.4.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The reactor core is installed with the plant in the hot shutdown condition at normal operating temperature and pressure with all reactor coolant pumps running.

d. The final setting of the continuous spray flow valves is complete.

e. The reactor coolant system is borated to the value required for fuel loading.

f. This test is performed prior to initial criticality.

14.2.12.3.4.3 Test Method

a. With the pressurizer spray valves closed, all pressurizer heaters are energized, and the time to reach a 2,300 psig system pressure is measured and recorded.

b. With the pressurizer heaters deenergized, both spray valves are fully opened, and the time to reach a 2,000 psig system pressure is measured and recorded.

14.2.12.3.4.4 Acceptance Criteria

The pressurizer pressure response to the opening of the pressurizer spray valves and to the actuation of all pressurizer heaters is within design limits.

14.2.12.3.5 Reactor Coolant System Flow Measurement (S-07BB03)

14.2.12.3.5.1 Objectives

a. To confirm, after core installation but before initial critical operation, that reactor coolant system (RCS) flow rate as measured by loop elbow differential pressure readings is greater than or equal to 90 percent of the thermal design flow rate.

b. To confirm during initial power operation that RCS flow rate as computed from calorimetric data is greater than or equal to the thermal design flow rate.

14.2.12.3.5.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The reactor core is installed, and the plant is at normal operating temperature and pressure.

14.2.12.3.5.3 Test Method

a. Before critical operation, loop elbow differential pressure readings are taken with all reactor coolant pumps running, and RCS flow rate is calculated.

b. During initial power operation, calorimetric data are taken from Procedure S-07SC03, "Thermal Power Measurement and Statepoint Data Collection," and RCS flow rate is calculated.

14.2.12.3.5.4 Acceptance Criteria

RCS flow rate by loop elbow differential pressure measurement is greater than or equal to 90 percent of the thermal design value and by calculation from calorimetric data is greater than or equal to the thermal design value.

14.2.12.3.6 Reactor Coolant System Flow Coastdown Test (SU7-BB04)

14.2.12.3.6.1 Objectives

a. To measure the rate at which reactor coolant flow changes, subsequent to simultaneously tripping all reactor coolant pumps.

b. To determine that the reactor coolant system low-flow delay time is less than or equal to the total low-flow delay time assumed in the safety analysis for loss of flow.

14.2.12.3.6.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The reactor core is installed, and the plant is at normal operating temperature and pressure with all reactor coolant pumps running.

14.2.12.3.6.3 Test Method

Flow coastdown stabilization and loss of coolant delay-time data are recorded while tripping reactor coolant pumps.

14.2.12.3.6.4 Acceptance Criteria

a. The rate of change of reactor coolant flow is within design specifications.

b. The reactor coolant system low-flow delay time is less than or equal to the total low-flow delay time assumed in the safety analysis for loss of flow.

14.2.12.3.7 Pressurizer Continuous Spray Flow Verification (S-07BB05)

14.2.12.3.7.1 Objectives

To establish a setting for the pressurizer continuous spray flow valves to obtain an optimum continuous spray flow.

14.2.12.3.7.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The reactor core is installed with the plant in the hot shutdown condition at normal operating temperature and pressure with all reactor coolant pumps running.

d. The reactor coolant system is borated to the value required for fuel loading.

e. This test shall be performed prior to initial criticality.

f. The preliminary setting of the continuous spray flow valves has been completed during hot functional testing.

14.2.12.3.7.3 Test Method

Continuous spray flow valves are adjusted to establish the optimum continuous spray flow, and the valve throttle positions are recorded.

14.2.12.3.7.4 Acceptance Criteria

The continuous spray flow valves are throttled to establish the optimum continuous spray flow to keep the spray line warm and minimize normal steady-state pressurizer heater loads.

14.2.12.3.8 RTD/TC Cross Calibration (S-07BB06)

14.2.12.3.8.1 Objectives

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

NOTE

This portion of the test need be performed only if the data collected in S-03BB16, RTD/TC Cross Calibration, during hot functional testing, so warrants.

b. To provide a functional checkout of the core subcooling monitor system including the detecting thermocouples.

14.2.12.3.8.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. Plant heatup, following core loading, is in progress, and all reactor coolant pumps are operating.

14.2.12.3.8.3 Test Method

a. At various temperature plateaus RTD and incore thermocouple data are recorded. Isothermal cross-calibration correction factors for individual thermocouples and the installation corrections for individual RTDs are determined.

b. At normal operating temperature, the thermocouple core subcooling monitors’ operational and programmable functions are verified, including associated alarms, displays, and printouts.

14.2.12.3.8.4 Acceptance Criteria

a. Individual RTD readings are within the design specifications.

b. The installation corrections of the RTDs are within design specifications.

c. The thermocouple core subcooling monitor alarms, displays, and printouts function in accordance with design specifications.

14.2.12.3.9 Core Loading Instrumentation and Neutron Source Requirements (S-07SC01)

14.2.12.3.9.1 Objectives

To verify proper alignment, calibration, and neutron response of the temporary core loading instrumentation prior to start of fuel- loading; to check the neutron response of the nuclear instrumentation system (NIS) source range channels prior to start of fuel-loading; and to check the neutron response of the temporary and NIS source range instrumentation prior to resumption of fuel-loading following any delay of 8 hours or more. To verify the signal to noise ratio is greater than 2.

14.2.12.3.9.2 Prerequisites

a. Hot functional testing is completed.

b. The nuclear instrumentation system is installed and calibrated.

14.2.12.3.9.3 Test Method

a. A portable neutron source (1-5 curie), plus preshipment equipment checkout data, is used to verify proper alignment, calibration, and neutron response of the temporary core-loading instrumentation.

b. A portable neutron source (1-5 curie) is used to check the neutron response of the NIS source range detectors.

c. A portable neutron source (1-5 curie) or movement of a source-bearing fuel element to produce the desired change in neutron level to verify the neutron response of the temporary and NIS source range instrumentation prior to resumption of fuel-loading following any delay of 8 hours or more.

d. Perform a statistical evaluation of 10 observations for each channel, to verify operability of the equipment.

14.2.12.3.9.4 Acceptance Criteria

Neutron instrumentation is operational, calibrated, and indicates a positive/negative change in count rate as the neutron level is increased and/or decreased. The signal to noise ratio is greater than 2.

14.2.12.3.10 Thermal Power Measurement and Statepoint Data Collection (S-07SC03)

14.2.12.3.10.1 Objectives

To measure core thermal power and obtain data for instrumentation calibration.

14.2.12.3.10.2 Prerequisites

a. Calorimetric instrumentation is installed.

b. This test is performed at 30-percent, 50-percent, 75-percent, 90-percent, and 100-percent power.

14.2.12.3.10.3 Test Method

Collect data and calculate thermal power. Obtain statepoint data, compute the average for each parameter measured, convert to the appropriate units, and summarize the data for each RCS loop.

14.2.12.3.10.4 Acceptance Criteria

This test is for the collection of data.

14.2.12.3.11 Nuclear Instrumentation System Test (SU7-SE01)

14.2.12.3.11.1 Objectives

The purpose of this test is to verify that the nuclear instrumentation system performs the required indications and control functions through the source, intermediate, and power ranges of operation prior to core loading.

14.2.12.3.11.2 Prerequisites

a. The nuclear instrumentation system is installed, calibrated, aligned, and operational for a period of at least 4 hours.

b. The plant is at ambient temperature and pressure.

14.2.12.3.11.3 Test Method

a. The source and intermediate range channels are subjected to various test signals to verify that the appropriate indicators alarm, illuminate, or actuate, and the source range local and remote speakers function.

b. The power range channels are subjected to various test signals to observe proper meter reading and function of the comparator and rate circuitry.

c. The high voltage circuitry of the source and intermediate range channels is tested.

14.2.12.3.11.4 Acceptance Criteria

The control and indication functions and the reactor trip set points of the nuclear instrumentation system source, intermediate, and power range channels have been verified.

14.2.12.3.12 Operational Alignment of Nuclear Instrumentation (S-07SE02)

14.2.12.3.12.1 Objectives

To establish and determine voltage settings, trip settings, operational settings, alarm settings, and overlap of channels on source range, intermediate range, and power range instrumentation from prior to initial criticality to at or near full reactor power.

14.2.12.3.12.2 Prerequisites

a. The nuclear instrumentation system has been aligned.

b. This test is conducted prior to criticality, during power escalation, and at or near full power.

14.2.12.3.12.3 Test Method

a. All functions are calibrated, tested, and verified, utilizing permanently installed controls and adjustment mechanisms.

b. Operational modes of the source range, intermediate range, and power range channels are set for their proper functions, as per the test instructions.

14.2.12.3.12.4 Acceptance Criteria

The overlap between the source, intermediate, and power range channels must be at least 1-1/2 decades, and the power range channels are capable of being adjusted to agree with the results of plant calorimetric calculations.

14.2.12.3.13 Axial Flux Difference Instrumentation Calibration (S-07SE03)

14.2.12.3.13.1 Objectives

To derive calibration factors for overpower, overtemperature, and T setpoints, based on incore flux data, calorimetric data, and excore nuclear instrumentation detector currents.

14.2.12.3.13.2 Prerequisites

a. The axial flux difference instrumentation system has been aligned.

b. Data has been obtained from flux maps taken at 30-percent and 50-percent power.

14.2.12.3.13.3 Test Method

Collect data, as required by test instruction, at 50-percent and 75-percent power, perform $F\Delta I$ calculations to calibration factors, and extrapolate results for use at the 100-percent power plateau.

14.2.12.3.13.4 Acceptance Criteria

Calibration factors agree with Technical Specifications.

14.2.12.3.14 Control Rod Drive Mechanism Operational Test (S-07SF01)

14.2.12.3.14.1 Objectives

To demonstrate the proper operation of the rod drive mechanisms under both cold and hot plant conditions and to provide verification of proper slave cycler timing.

14.2.12.3.14.2 Prerequisites

a. The control rod drive mechanisms are installed.

b. The rod drive motor-generator sets are installed and power is available.

c. For the control rod drive mechanism timing test, the core is installed, rod position indication is installed, and the control rod driving mechanism cooling fans are operational.

d. Nuclear instrumentation channels operable and operating.

e. A fast speed oscillograph (Visicorder or equivalent) to monitor test parameters is available.

14.2.12.3.14.3 Test Method

a. With the reactor core installed and reactor in the cold shutdown condition, confirm that the slave cycler devices supply operating signals to the proper CRDM stepping magnet coils.

b. Verify proper operation of all CRDMs under both cold and hot shutdown conditions. CRDM magnet coil currents and audio noise signals are recorded.

14.2.12.3.14.4 Acceptance Criteria

The control rod drive mechanisms conform to the requirements for proper mechanism operation and timing as described in the magnetic control rod drive mechanism instruction manual.

14.2.12.3.15 Rod Control System (S-07SF02)

14.2.12.3.15.1 Objectives

To demonstrate and document that the rod control system performs the required control and indication functions just prior to initial criticality. To demonstrate operation of the rod inhibit functions.

14.2.12.3.15.2 Prerequisites

a. The reactor coolant system is at normal operating pressure and temperature.

b. The rod control system is installed and aligned.

c. The source range nuclear instruments are operable.

d. The rods are capable of withdrawal.

e. The rod position indication system is operable.

14.2.12.3.15.3 Test Method

a. With the reactor at no load operating temperature and pressure, and just prior to initial criticality, the control is checked for each applicable position of the bank selector switch for proper operation.

b. Status lights, alarms, and indicators are verified.

14.2.12.3.15.4 Acceptance Criteria

The control and indication functions in accordance with the rod position indication system and rod control system manuals. Rod motion is inhibited upon application of an inhibit function.

14.2.12.3.16 Rod Drop Time Measurement (SU7-SF03)

14.2.12.3.16.1 Objectives

To determine the rod drop time of each rod cluster control assembly under no-flow and full-flow conditions, with the reactor in the cold shutdown condition and at normal operating temperature and pressure.

14.2.12.3.16.2 Prerequisites

a. Initial core loading is completed.

b. Rod control system is installed and tested.

c. Individual rod position indication is installed and checked.

14.2.12.3.16.3 Test Method

Withdraw each rod cluster control assembly, interrupt the electrical power to the associated rod drive mechanism, and measure and record the rod drop time. This test is performed with the reactor at cold and hot conditions and at no-flow and full- flow.

14.2.12.3.16.4 Acceptance Criteria

The rod drop times are acceptable in accordance with plant technical specifications.

14.2.12.3.17 Rod Position Indication System (SU7-SF04)

14.2.12.3.17.1 Objectives

To verify that the rod position indication system satisfactorily performs required indication functions for each individual rod and that each rod operates satisfactorily over its entire range of travel.

14.2.12.3.17.2 Prerequisites

a. Plant system conditions are established as follows:

1. Test performed at $T_{avg} \leq 200°F$, nominal RCS pressure for T_{avg} noted
2. Test results verified at T_{avg} nominally 557°F, RCS pressure nominally 2235 psig and at least one reactor coolant pump in service.

14.2.12.3.17.3 Test Method

a. All shutdown rod banks are fully withdrawn by bank stopping at 18,210 and 228 steps to record the rod position, the Digital Rod Position Indication display (DRPI), and the group step position indication.

b. All control rod banks are fully withdrawn by bank in 24 step increments while recording rod position as indicated by the plant control room DRPI readout, and the group step position indication.

c. In addition, the pulse-to-analog converter chassis bank position digital readout is recorded for all control rod banks.

14.2.12.3.17.4 Acceptance Criteria

The rod position indication system performs the required indication functions, and each rod operates over its entire range of travel within the limits of the rod position indication instruction manual and the plant precautions, limitations,setpoints manual, and WCGS Technical Specifications.

14.2.12.3.18 Automatic Reactor Control System (S-07SF05)

14.2.12.3.18.1 Objectives

To demonstrate the capability of the reactor control system to respond properly to input signals and to transmit proper control signals to other plant control systems and components.

14.2.12.3.18.2 Prerequisites

a. The reactor is at approximately 30-percent power.

b. Pressurizer level and pressure, steam dump, steam generator level, and main feed pump speed control systems are in automatic.

14.2.12.3.18.3 Test Method

T average will be successively varied from the T_{ref} set point to verify the transient recovery capabilities of the auto reactor control system.

14.2.12.3.18.4 Acceptance Criteria

a. No manual intervention should be required to bring the plant conditions to equilibrium values following initiation of a 6°F temperature transient.

b. T_{avg} should return to within $\pm$1.5°F of T_{ref} following initiation of a 6°F temperature transient.

c. Rod motion is inhibited by application of the appropriate inhibit inputs.

14.2.12.3.19 Incore Flux Mapping (S-07SR01, S-07SR02)

14.2.12.3.19.1 Objectives

To obtain core power and temperature profiles for evaluating core performance.

14.2.12.3.19.2 Prerequisites

a. The incore monitoring system has been functionally tested.

b. This test is performed at low power, 30-, 50-, 75-, 90-, and 100-percent power.

c. The reactor is stabilized prior to taking a map.

14.2.12.3.19.3 Test Method

The movable detectors are inserted into the core, data is obtained, and thermocouples are monitored while at a stable power. The obtained data is retained for evaluation.

14.2.12.3.19.4 Acceptance Criteria

Flux and temperature data is obtained at the various power levels.

14.2.12.3.20 Incore Instrumentation Test (S-07SR03, S-07SR04)

14.2.12.3.20.1 Objectives

To set up and demonstrate operation of the incore instrumentation system.

14.2.12.3.20.2 Prerequisites

a. The incore instrumentation system is installed.

b. Proper rotation and limit switch operation has been verified.

c. Testing is performed at cold shutdown and hot standby.

14.2.12.3.20.3 Test Method

At cold shutdown a dummy cable is inserted into each thimble, and proper rotation and limit switch operation is verified. At hot standby the detectors are inserted into the thimbles to demonstrate performance in all operational modes.

14.2.12.3.20.4 Acceptance Criteria

The incore instrumentation system is capable of taking a flux map.

14.2.12.3.21 Operational Alignment of Process Temperature Instrumentation (S-07SF06)

14.2.12.3.21.1 Objectives

To align ΔT and T_{avg} process instrumentation under isothermal conditions, prior to criticality and at power.

14.2.12.3.21.2 Prerequisites

a. This alignment is performed prior to initial criticality and again at 75-percent power. Alignment is checked at 100-percent power.

b. All reactor coolant pumps shall be operating.

14.2.12.3.21.3 Test Method

a. Align ΔT and Tavg per test instructions under isothermal conditions prior to criticality and at approximately 75 percent power. Extrapolate the 75-percent power data to determine ΔT and T_{avg} values for the 100-percent power plateau.

b. At or near full power, check the alignment of the ΔT and T_{avg} channels for agreement with the results of thermal power measurement. Realign any channels, as necessary, to meet test specifications.

14.2.12.3.21.4 Acceptance Criteria

The 100 percent power indications for ΔT and T_{avg} channels must be within the maximum design values as specified in vendor design documents.

14.2.12.3.22 Startup Adjustments of Reactor Control System (S-07SF07)

14.2.12.3.22.1 Objectives

To obtain the optimum plant efficiency.

14.2.12.3.22.2 Prerequisites

a. The reactor coolant system is at normal operating pressure and temperature.

b. Plant instrumentation shall have been aligned according to Operational Alignment of Process Temperature Instrumentation.

c. The turbine control system shall have been aligned.

14.2.12.3.22.3 Test Method

a. Obtain system temperature and steam pressure data at steady-state conditions for zero power and at hold points during power escalations.

b. Evaluation of these data will provide the basis for adjustments to the reactor control system.

14.2.12.3.22.4 Acceptance Criteria

The Tavg controller must be capable of maintaining full load steam pressure within turbine pressure limitations specified in the vendor's technical manual.

14.2.12.3.23 RCCA or Bank Worth Measurement at Zero Power (S-07SF08)

14.2.12.3.23.1 Objectives

To determine the differential and integral reactivity worth of a rod cluster control bank (RCC) or an individual rod cluster control assembly (RCCA).

14.2.12.3.23.2 Prerequisites

a. The reactor is critical with the neutron flux level within the range established for zero power physics testing.

b. The reactor coolant system is at normal operating pressure and temperature.

14.2.12.3.23.3 Test Method

RCC and RCCA worth are validated by constant addition and/or dilution of boron in the reactor coolant system, causing rod movement to compensate for the boron addition and/or dilution. This rod movement will cause step changes in reactivity which are used to compute the worths.

14.2.12.3.23.4 Acceptance Criteria

The integral reactivity worth of the RCC or RCCA over its entire range of travel agrees with acceptance criteria given in the Nuclear Design Report within tolerance values specified in vendor design documents.

14.2.12.3.24 RCCA or Bank Worth Measurement at Power (SU7-SF09)

14.2.12.3.24.1 Objectives

a. To measure RCCA worth for a rod ejected from the HFP rod insertion limit position.

b. To determine in-core response resulting from a dropped rod with all other control rods near fully withdrawn.

14.2.12.3.24.2 Prerequisites

Testing will be performed at 30-percent power with the reactor stable. *

14.2.12.3.24.3 Test Method

a. Ejected rod - Compute the change in reactivity associated with the change in RCCA position.

b. Dropped rod - Determine the quadrant power tilt ratio and hot channel factors by use of the in-core flux mapping system.

14.2.12.3.24.4 Acceptance Criteria

a. Ejected rod - The rod worth of the ejected rod is within tolerance values specified in vendor design documents.

b. Dropped rod - The peaking factors are within the limits specified in vendor design documents.

14.2.12.3.25 Reactor Systems Sampling for Core Load (S-07SJ01)

14.2.12.3.25.1 Objectives

To verify uniform boron concentration, prior to core load, in the reactor coolant system and directly connected auxiliary systems.

14.2.12.3.25.2 Prerequisites

a. Boric acid tanks, pumps, and transfer lines are all filled with 4 percent boric acid solution.

b. Reactor coolant system is filled with reactor grade water which has been borated to a concentration as specified in the technical specifications.

14.2.12.3.25.3 Test Method

a. Filling and circulating the reactor coolant system with borated water should be accomplished, utilizing normal flow paths as much as possible.

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* This test was performed at 50 percent power at Callaway. Callaway has the same core and Nuclear Instrumentation System as Wolf Creek. Wolf Creek Core parameters measured prior to the pseudo rod drop test were compared with the corresponding results for Callaway to verify that the plant response was the same. This exemption was approved in a July 3, 1985 letter from the NRC.

b. Collect and analyze four samples taken at equidistant depths in the reactor vessel simultaneously with one sample from the operating residual heat removal loop to check uniform boron concentration.

14.2.12.3.25.4 Acceptance Criteria

Boron concentration of the samples obtained from the designated sample points must be within a 30-ppm range of values.

14.2.12.3.26 Initial Core Loading (SU7-0001)

14.2.12.3.26.1 Objectives

a. To load fuel in a controlled manner.

b. To measure boron concentration.

14.2.12.3.26.2 Prerequisites

a. Sufficient preoperational testing has been completed to ensure the necessary equipment and attendant instrumentation is functional.

b. Required technical specification surveillance is completed and the necessary systems are operable.

14.2.12.3.26.3 Test Method

Instruction includes a core-loading sequence which specifies the loading in a step-by-step fashion with the appropriate data collection records.

14.2.12.3.26.4 Acceptance Criteria

A permanent record of the final as-loaded core configuration has been made, and the configuration is consistent with the fuel assembly core loading plan. Boron concentration is as specified in the Technical Specifications.

14.2.12.3.27 Inverse Count Rate Ratio Monitoring For Core Loading (S-070002)

14.2.12.3.27.1 Objectives

a. To obtain nuclear monitoring data during initial core loading.

b. To prevent criticality during core loading.

14.2.12.3.27.2 Prerequisites

a. Temporary and plant source range nuclear instrumentation has been operational for a minimum of 4 hours to achieve stable operation.

b. Plant is prepared for initial core loading.

14.2.12.3.27.3 Test Method

Data from the nuclear monitoring channels is used to assess the safety with which core loading operations may be conducted. Inverse count rate ratio is plotted and evaluated to prevent any unexpected deviation from subcriticality. The core is monitored and maintained in a subcritical configuration throughout the core loading.

14.2.12.3.27.4 Acceptance Criteria

The core is loaded without achieving criticality.

14.2.12.3.28 Inverse Count Rate Ratio Monitoring for Approach to Initial Criticality (S-070003)

14.2.12.3.28.1 Objectives

a. To obtain nuclear monitoring data during initial criticality.

b. To anticipate and determine criticality.

14.2.12.3.28.2 Prerequisites

a. Both source range and intermediate range nuclear channels alarm, trip functions, and indicating devices have been checked out and calibrated.

b. Both source range and intermediate range nuclear channels have been energized a minimum of 4 hours to insure stable operation.

14.2.12.3.28.3 Test Method

a. Obtain base line count rates prior to rod withdrawal and boron dilution. After each increment of rod withdrawal, and periodically during boron dilution, count rates are obtained, and inverse count rate ratio is evaluated.

b. Core reactivity is monitored during the approach to criticality.

14.2.12.3.28.4 Acceptance Criteria

To determine criticality.

14.2.12.3.29 Initial Criticality (S-070004)

14.2.12.3.29.1 Objectives

To achieve initial criticality in a controlled manner.

14.2.12.3.29.2 Prerequisites

a. Initial core loading is completed.

b. Required technical specification surveillance is completed and the necessary systems operable.

c. Sufficient post-core loading precritical testing has been completed to ensure the necessary equipment and attendant instrumentation is functional.

14.2.12.3.29.3 Test Method

a. At preselected points during rod withdrawal and/or boron dilution, data is taken and inverse count rate plots made to enable extrapolation to be carried out to the expected critical point.

b. Initial criticality is achieved by boron dilution or, if desired, by withdrawing control rods.

14.2.12.3.29.4 Acceptance Criteria

The reactor is critical with the flux level established at approximately 1×10^{-8} amps on the intermediate range nuclear channels.

14.2.12.3.30 Determination of Core Power Range for Physics Testing (S-070005)

14.2.12.3.30.1 Objectives

To determine the reactor power level at which effects from fuel heating is detectable and to establish the range of neutron flux in which zero power reactivity measurements are to be performed.

14.2.12.3.30.2 Prerequisites

a. The reactor is critical and stable in the intermediate range.

b. Control rods are sufficiently deep in the core to allow positive reactivity insertion by rod withdrawal.

c. Reactor coolant temperature is established at a value that minimizes the moderator temperature coefficient reactivity feedback.

14.2.12.3.30.3 Test Method

a. Withdraw control rod bank and allow the neutron flux level to increase until nuclear heating effects are indicated by the reactivity computer.

b. Record the reactivity computer picoammeter flux level and, if possible, the corresponding IR channel currents at which nuclear heating occurs, to obtain zero power testing range.

14.2.12.3.30.4 Acceptance Criteria

The power level at which zero power testing is conducted is determined.

14.2.12.3.31 Boron Endpoint Determination (S-070006)

14.2.12.3.31.1 Objectives

To determine the critical reactor coolant system boron concentration appropriate to an endpoint configuration (RCC configuration).

14.2.12.3.31.2 Prerequisites

a. The reactor is critical within the range for zero power testing and stable.

b. The reactor coolant is at normal operating pressure and temperature.

c. Rods are at the approximate end point configuration.

14.2.12.3.31.3 Test Method

Boron endpoints are measured by determining the boron concentration of the reactor coolant system with the rods close to or at the desired configuration. If not, the rods are then quickly moved to the desired configuration with no boron adjustment. The change in reactivity is measured, and this reactivity is converted to an equal amount of boron to yield the endpoint at that particular rod configuration.

14.2.12.3.31.4 Acceptance Criteria

The results of the boron endpoint calculations meet the requirements of the Nuclear Design Report within tolerance values specified in vendor design documents.

14.2.12.3.32 Isothermal Temperature Coefficient Measurement (S-070007)

14.2.12.3.32.1 Objectives

To determine isothermal temperature coefficient, then derive the moderator temperature coefficient from the isothermal data.

14.2.12.3.32.2 Prerequisites

a. The reactor is critical within the range for zero power testing and stable.

b. The reactor coolant is at normal operating pressure and temperature.

c. Control rods are at the approximate end point configuration.

14.2.12.3.32.3 Test Method

The isothermal temperature coefficient is determined by heating/cooling the reactor coolant system at a constant rate and plotting temperature versus reactivity. The moderator temperature coefficient may be derived from isothermal data, if desired.

14.2.12.3.32.4 Acceptance Criteria

The average of the measured values of the isothermal and, if desired, the derived moderator temperature coefficient agrees with acceptance criteria given in the Nuclear Design Report within tolerance values specified in vendor design documents.

14.2.12.3.33 Power Coefficient Determination (S-070008)

14.2.12.3.33.1 Objectives

To verify the power coefficient of reactivity.

14.2.12.3.33.2 Prerequisites

a. Reactor power level, reactor coolant temperature and pressures, and RCCA and RCC bank configuration are as follows:

1. RCS pressure - nominal 2235 psig

2. RCCA, RCC bank configuration - nominally all rods out, D at bite position

3. Reactor power level - nominally 30, 50, 75, and 90 percent RTP

4. T_{avg} - consistent with the nominal value corresponding to the T_{avg} program at the identified nominal power levels.

b. All subsystems which affect overall plant transient response should be in automatic mode of operation with the exception of the rod control system and automatic makeup. The CVCS demineralizer shall be bypassed.

14.2.12.3.33.3 Test Method

a. As generator electrical load is changed, the primary side is permitted to freely respond without any control rod motion.

b. The power coefficient verification factor is calculated by measuring the change in RCS temperature and the corresponding change in core power.

14.2.12.3.33.4 Acceptance Criteria

The average value of the measured verification factor agrees with that obtained from design predictions of the isothermal temperature coefficient and doppler power coefficient. This agreement is within limits given in the test instructions.

14.2.12.3.34 Load Swing Tests (S-070009)

14.2.12.3.34.1 Objectives

To verify proper nuclear plant transient response, including automatic control system performance, when load changes are introduced at the turbine generator.

14.2.12.3.34.2 Prerequisites

Step load changes are initiated from steady state conditions at approximately 30-, 75-, and 100-percent power.

14.2.12.3.34.3 Test Method

a. Manually reduce the turbine generator output as rapidly as possible to achieve an approximate 10-percent load decrease/increase.

b. Plant variables are recorded, along with values observed on the normal plant instrumentation, during the load transient for those parameters required.

14.2.12.3.34.4 Acceptance Criteria

The following acceptance criteria are to be used to determine successful test completion. Failure to meet these criteria does not constitute a need for stopping the test program, but correction of any deficiences should be accomplished, as required, consistent with the current plant schedule.

a. Reactor and turbine must not trip.

b. Safety injection is not initiated.

c. Neither steam generator atmospheric relief valves nor safety valves shall lift.

d. Neither pressurizer relief valves nor safety valves shall lift.

e. No manual intervention shall be required to bring plant conditions to steady state.

f. Nuclear power overshoot (undershoot) must be less than 3 percent for load increase (decrease).

14.2.12.3.35 Large Load Reduction Test (S-070010)

14.2.12.3.35.1 Objectives

To demonstrate satisfactory plant transient response to various specified load changes, to monitor the reactor control systems during these transients, and, if necessary, optimize the reactor control system setpoints.

14.2.12.3.35.2 Prerequisites

Step load reduction changes of 50 percent are initiated from steady state conditions at approximately 75- and 100-percent power.

14.2.12.3.35.3 Test Method

a. Manually reduce the turbine generator output to achieve an approximate 50-percent load reduction.

b. Monitor plant response during the transient and record plant variables, as required.

c. If necessary, adjust the reactor control system setpoints until optimal response is obtained.

14.2.12.3.35.4 Acceptance Criteria

The following acceptance criteria are to be used to determine successful test completion. Failure to meet these criteria does not constitute a need for stopping the test program, but correction of any deficiencies should be accomplished, as required, consistent with the current plant schedule.

a. Reactor and turbine must not trip.

b. Safety injection is not initiated.

c. Steam generator safety valves shall not lift.

d. Pressurizer safety valves shall not lift.

e. No manual intervention shall be required to bring plant conditions to steady state.

14.2.12.3.36 Plant Trip From 100 Percent Power (S-070011)

14.2.12.3.36.1 Objectives

To verify the ability of the plant automatic control systems to sustain a trip from 100 percent and to bring the plant to stable conditions following the transient, to determine the overall response time of the hot leg resistance temperature detectors, and to evaluate the data resulting from the trip to determine if changes in the control system setpoints are warranted to improve transient response based on actual plant operations.

14.2.12.3.36.2 Prerequisites

a. The rod control system, steam generator level, pressurizer pressure and level, and the steam dump system are in the automatic control mode.

b. The plant is operating at normal steady state full power.

c. Diesel generators in standby idling condition.

14.2.12.3.36.3 Test Method

a. Initiate a plant trip by opening the main generator output breaker, monitor plant response, and record plant variables, as required.

b. If necessary, adjust the control system setpoints to obtain optimal response.

14.2.12.3.36.4 Acceptance Criteria

The system parameters must stay within the limitations specified in the vendor's design transient analysis document.

14.2.12.3.37 Rods Drop and Plant Trip (S-070012)

14.2.12.3.37.1 Objectives

To demonstrate that the negative rate trip circuit will trip the reactor and to monitor plant response.

14.2.12.3.37.2 Prerequisites

a. The rod control system, steam generator level, pressurizer pressure and level, and the feedwater pump speed control are in the automatic control mode. Steam dump control system is in the Tavg mode.

b. The plant is operating at a steady state power of 30 to 50 percent.

c. The rod group and the selected rods to be dropped have been identified.

14.2.12.3.37.3 Test Method

a. Drop two RCCAs from a common group which, because of their worth and location, are the most difficult to detect by the nuclear instrumentation system (NIS).

b. Monitor systems behavior and plant response to trip from an intermediate power level prior to the plant trip test from full power.

14.2.12.3.37.4 Acceptance Criteria

The following acceptance criteria are to be used to determine successful test completion:

a. The reactor shall have tripped as a result of the negative rate trip.

b. All RCCAs shall release and bottom on receipt of a trip signal.

c. The pressurizer safety valves shall not lift.

d. Steam generator safety valves shall not lift.

e. Safety injection is not initiated.

14.2.12.3.38 Shutdown and Maintenance of Hot Standby External to the Control Room (S-070014)

14.2.12.3.38.1 Objectives

To demonstrate, using a plant procedure, that the plant can be taken from ≥10 percent power to hot standby conditions, and verify that the plant can be maintained in hot standby for at least 30 minutes with a minimum shift crew, using controls and instrumentation external to the control room.

14.2.12.3.38.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. The plant is at normal operating conditions at ≥10 percent power.

d. The authority and responsibility of the control room observers has been established and is specified in this procedure.

14.2.12.3.38.3 Test Method

a. The plant is taken from ≥10 percent power to hot standby conditions, using a plant procedure, minimum shift crew, and controls and instrumentation external to the control room.

b. Hot standby conditions are maintained for at least 30 minutes.

c. All actions performed by the control room observers is documented within this procedure for use in evaluating their impact on the test results.

14.2.12.3.38.4 Acceptance Criteria

The plant can be taken from $\geq$ 10 percent power to hot standby conditions which are maintained for $\geq$30 minutes, using a plant procedure, minimum shift crew, and controls and instrumentation external to the control room.

14.2.12.3.39 Power Ascension Thermal Expansion and Dynamic Test (S-070015)

14.2.12.3.39.1 Objectives

a. To demonstrate during specified power ascension transients that the systems' monitored points respond in accordance with design.

b. To demonstrate during the heatup to full power temperature that the systems' piping can expand without obstruction and that the expansion is in accordance with design. Also, during the subsequent cooldown to ambient temperature, the piping returns to its cold position in accordance with system design.

14.2.12.3.39.2 Prerequisites

a. Reference points for measurement of the systems are established.

b. Power ascension testing is in progress.

c. All subject systems are available for the specified dynamic operations.

d. Required instrument calibration is complete.

e. A preservice inspection of the associated piping snubbers has been completed within 6 months.

14.2.12.3.39.3 Test Method

a. Record cold baseline data.

b. Obtain measurement data at various specified temperature plateaus.

c. The systems are aligned for the specified dynamic operation.

d. The specified dynamic event of pump operation, valve operation, etc., is initiated, and the system is monitored for response.

e. On completion of cooldown to ambient temperature, obtain measurement data.

14.2.12.3.39.4 Acceptance Criteria

a. There shall be no evidence of blocking of the thermal expansion of any piping or components, other than by design.

b. The total stresses shall not exceed applicable code limits.

c. Spring hanger movement must remain within the hot and cold set points, snubber swing clearance remains satisfactory., and snubbers must not become fully retracted or expanded.

d. Piping and components must return to their baseline position on cooldown in accordance with system design.

e. The measured thermal movement shall be within 25 percent of the analytical value or $\pm$0.25 inch, whichever is greater.

14.2.12.3.40 Biological Shield Testing (S-070016)

14.2.12.3.40.1 Objectives

a. To measure and record the neutron and gamma ray radiation levels in accessible areas of the plant where radiation levels above background are anticipated.

b. To determine locations if any, where shielding is deficient.

c. To ensure that plant personnel are not subjected to overexposure from radiation as a result of inadequate shielding.

14.2.12.3.40.2 Prerequisites

a. Required instrument calibration is complete.

b. Appropriate reactor power levels are attained.

14.2.12.3.40.3 Test Method

Neutron and gamma ray surveys are conducted in each of the following reactor power level ranges.

Test	% Reactor Power Range
Preoperational Shield Tests	$\leq$0
Low Power Tests	0-5
Intermediate Power Tests	5-50
High Power Tests	50-100

14.2.12.3.40.4 Acceptance Criteria

Neutron and gamma ray radiation surveys in all accessible areas of the plant where radiation levels above background are anticipated reveal no shielding deficiencies; or identify and implement appropriate administrative controls in accordance with 10 CFR 20 for the areas determined to be radiation areas.

14.2.12.3.41 Loss of Heater Drain Pump Test (S-070017)*

14.2.12.3.41.1 Objectives

To verify proper nuclear plant response to a loss of heater drain pump accident.

14.2.12.3.41.2 Prerequisites

The plant is operating at steady state conditions at 90-percent power.

14.2.12.3.41.3 Test Method

The heater drain pumps are tripped and plant variables are recorded, along with values observed on the normal plant instrumentation, during the transient for those parameters required.

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* This test was performed at Callaway only, with the consent of the NRC, as Callaway and Wolf Creek have identical Heater Drain Systems.

14.2.12.3.41.4 Acceptance Criteria

The following acceptance criteria are to be used to determine successful test completion. Failure to meet these criteria does not constitute a need for stopping the test program, but correction of any deficiencies should be accomplished as required, consistent with the current plant schedule.

a. Reactor and turbine must not trip.

b. Safety injection is not initiated.

c. Neither steam generator atmospheric relief valves nor safety valves shall lift.

d. Neither pressurizer relief valves nor safety valves shall lift.

e. No manual intervention shall be required to bring plant conditions to steady state.

14.2.12.3.42 Calibration of Steam and Feedwater Flow Instrumentation at Power Test (S-070018)

14.2.12.3.42.1 Objectives

a. To calibrate the steam flow transmitters against feed-water flow.

b. To perform a cross-check verification of all signals indicating feedwater and steam flow.

14.2.12.3.42.2 Prerequisites

a. Test equipment, including transmitters, has been calibrated for expected ranges of plant conditions.

b. The plant shall be at steady state conditions for each power level at which testing is performed.

14.2.12.3.42.3 Test Method

At 30 and 50 percent power, perform Step a if the steam flow/ feedwater flow mismatch alarm actuates. At 75 and 100 percent power, perform Steps a and b.

a. Verify calibration of the steam flow by comparing steam flow signal to referenced feedwater flow.

b. Compare, using plots, the steam and feedwater flow values to determine if recalibration is necessary prior to the next power escalation.

14.2.12.3.42.4 Acceptance Criteria

a. Steam flow/feedwater flow mismatch alarm does not actuate at 30, 50, 75, and 100 percent power.

b. Steam flow indication should be within ±4 percent of feedwater flow panel indicator at 75 and 100 percent power.

c. The test feedwater flow instrument versus plant feedwater flow instrument and plant steam flow instrument curves should be within ±2.5 percent and ±3.0 percent of their respective ideal curves at 75 and 100 percent power.

14.2.12.3.43 Natural Circulation Test (S-090024)*

14.2.12.3.43.1 Objectives

To demonstrate the length of time required to stabilize natural circulation; to demonstrate core flow distribution during natural circulation using incore thermocouples.

14.2.12.3.43.2 Prerequisites

a. Required low power physics testing has been completed.

b. Required instrumentation is installed and calibration complete.

c. The plant is operating at steady state conditions at 3 percent power.

14.2.12.3.43.3 Test Method

All reactor coolant pumps are simultaneously tripped while at 3 percent rated power. The transients are monitored and establishment of natural circulation verified.

* Due to similar plant design for Callaway and Wolf Creek, the NRC allowed WCGS to use Callaway Natural Circulation test data and pertinent results.

14.2.12.3.43.4 Acceptance Criteria

Natural circulation has been demonstrated. The measured core ΔT as a function of core power under natural circulation conditions is no greater than the limiting reactor coolant system ΔT based on design requirements.

TABLE 14.2-1

SAFETY-RELATED PREOPERATIONAL TEST PROCEDURES

Test Number	Title	Test Abstract USAR Section
S-03AB01	Steam Dump System Preoperational Test	14.2.12.1.1
SU3-AB02	Main Steam Safety Valve Test	14.2.12.1.2
S-03AB03	Main Steam Line Isolation Valve Test	14.2.12.1.3
S-03AB04	Main Steam System Preoperational Test	14.2.12.1.4
S-03AE01	Main Feedwater System Preoperational Test	14.2.12.1.5
S-03AE02	Steam Generator Level Control Test	14.2.12.1.6
S-03AL01	Auxiliary Feedwater Motor-Driven Pump and Valve Preoperational Test	14.2.12.1.7
SU3-AL02	Auxiliary Feedwater Turbine-Driven Pump and Valve Preoperational Test	14.2.12.1.8
SU3-AL03	Auxiliary Feedwater Motor-Driven Pump Endurance Test	14.2.12.1.9
S-03AL04	Auxiliary Feedwater System Water Hammer Test	14.2.12.1.10
SU3-AL05	Auxiliary Feedwater Turbine-Driven Pump Endurance Test	14.2.12.1.11
S-03BB01	Reactor Coolant Pump Initial Operation	14.2.12.1.12
SU3-BB02	PRT Cold Preoperational Test	14.2.12.1.13
SU3-BB03	RTD Bypass Flow Measurement	14.2.12.1.14
S-03BB04	Pressurizer Pressure Control Test	14.2.12.1.15
S-03BB05	Reactor Coolant System Hot Preoperational Test	14.2.12.1.16
S-03BB06	Thermal Expansion	14.2.12.1.17
d-03BB07	Pressurizer Level Control Test	14.2.12.1.18
SU3-BB08	Pressurizer Heater and Spray Capability Test	14.2.12.1.19
SU3-BB09	Reactor Coolant System Flow Measurement Test	14.2.12.1.20
SU3-BB10	Reactor Coolant System Flow Coastdown Test	14.2.12.1.21
S-03BB11	Reactor Coolant System Hydrostatic Test	14.2.12.1.22
SU3-BB12	Pressurizer Continuous Spray Flow Verification Test	14.2.12.1.23
S-03BB13	Pressurizer Relief Valve and PRT Hot Preoperational Test	14.2.12.1.24
S-03BB14	Reactor Coolant Loop Vibration Surveillance Test	14.2.12.1.25
SU3-BB15A	Leak Detection System Preoperational Test	14.2.12.1.26
SU3-BB15B	Leak Detection System Preoperational Test	14.2.12.1.27
S-03BB16	RTD/TC Cross Calibration	14.2.12.1.28

TABLE 14.2-1 (Sheet 2)

Test Number	Title	USAR Section
S-03BG01	Chemical and Volume Control System Major Component Test	14.2.12.1.29
SU3-BG02	Seal Injection Preoperational Test	14.2.12.1.30
SU3-BG03	Charging System Preoperational Test	14.2.12.1.31
SU3-BG04	Boron Thermal Regeneration System Preoperational Test	14.2.12.1.32
SU3-BG05	Boric Acid Blending System Preopera-tional Test	14.2.12.1.33
S-03BG06	Chemical and Volume Control System Hot Preoperational Test	14.2.12.1.34
SU3-EC01	Fuel Pool Cooling and Cleanup System Preoperational Test	14.2.12.1.35
S-03EC02	Spent Fuel Pool Leak Test	14.2.12.1.36
SU3-EF01	Essential Service Water System Pre-operational Test	14.2.12.1.37
SU3-EF02	Essential Service Water Pump Preopera-tional Test	14.2.12.1.37
S-03EG01	Component Cooling Water System Pre-operational Test	14.2.12.1.38
SU3-EJ01	Residual Heat Removal System Cold Pre-operational Test	14.2.12.1.39
SU3-EJ02	Residual Heat Removal System Hot Preoperational Test	14.2.12.1.40
SU3-EM01	Safety Injection System Cold Pre-operational Test	14.2.12.1.41
SU3-EM02	Safety Injection Flow Verification Test	14.2.12.1.42
SU3-EM03	Safety Injection Check Valve Test	14.2.12.1.43
SU3-EM04	Boron Injection Tank and Recirculation Pump Test	14.2.12.1.44
S-03EN01	Containment Spray System Nozzle Air Test	14.2.12.1.45
SU3-EN02	Containment Spray System Preoperational Test	14.2.12.1.46
S-03EP01	Accumulator Testing	14.2.12.1.47
SU3-FC01	Auxiliary Feedwater Pump Turbine Preoperational Test	14.2.12.1.48
SU3-GD01	Essential Service Water Pumphouse HVAC Preoperational Test	14.2.12.1.49
SU3-GF01 SU3-GF02 SU3-GF03	Miscellaneous Building HVAC System Preoperational Tests	14.2.12.1.50
S-03GG01	Fuel Building HVAC System Preoperational Test	14.2.12.1.51
SU3-GK01	Control Building HVAC System Preopera-tional Test	14.2.12.1.52
SU3-GL01	Auxiliary Building HVAC System Pre-operational Test	14.2.12.1.53
S-03GM01	Diesel Generator Building HVAC Pre-operational Test	14.2.12.1.54

TABLE 14.2-1 (Sheet 3)

Test Number	Title	USAR Section
SU3-GN01	Containment Cooling System Preoperational Test	14.2.12.1.55
S-03GN02	CRDM Cooling Preoperational Test	14.2.12.1.56
SU3-GP01	Integrated Containment Leak Rate Test	14.2.12.1.57
SU3-GP02	Reactor Containment Structural Integrity Acceptance Test	14.2.12.1.58
S-03GS01	Post-Accident Hydrogen Removal System Preoperational Test	14.2.12.1.59
S-03GT01	Containment Purge System HVAC Preoperational Test	14.2.12.1.60
S-03HA01	Gaseous Radwaste System Preoperational Test	14.2.12.1.61
S-03JE01	Emergency Fuel Oil System Preoperational Test	14.2.12.1.62
SU3-KE01	Spent Fuel Pool Crane Preoperational Test	14.2.12.1.63
SU3-KE02	New Fuel Elevator Preoperational Test	14.2.12.1.64
SU3-KE03	Fuel Handling and Storage Preoperational Test	14.2.12.1.65
SU3-KE04	Fuel Transfer System Preoperational Test	14.2.12.1.66
SU3-KE05	Refueling Machine and RCC Change Fixture Preoperational Test	14.2.12.1.67
S-03KE06	Refueling Machine Indexing Test	14.2.12.1.68
SU3-KE07	Fuel Handling System Integrated Preoperational Test	14.2.12.1.69
S-03KJ01	Diesel Generator Mechanical Preoperational Test	14.2.12.1.70
S-03NB01	4160-V (Class IE) System Preoperational Test	14.2.12.1.71
S-03NE01	Diesel Generator Electrical Preoperational Test	14.2.12.1.72
SU3-NF01	Integrated Control Logic Test	14.2.12.1.73
S-03NF02	LOCA Sequencer Preoperational Test	14.2.12.1.74
S-03NF03	Shutdown Sequencer Preoperational Test	14.2.12.1.75
S-03NG01	480-V (Class IE) System Preoperational Test	14.2.12.1.76
SU3-NG02	480-V Class IE System (ESW) Preoperational Test	14.2.12.1.77
S-03NK01	125-V (Class IE) DC System Preoperational Test	14.2.12.1.78
S-03NN01	Instrument AC System (Class IE) Preoperational Test	14.2.12.1.79
SU3-SA01	Engineered Safeguards (NSSS) Preoperational Test	14.2.12.1.80

TABLE 14.2-1 (Sheet 4)

Test Number	Title	USAR Section
SU3-SA02	Engineered Safeguards (BOP) Pre-operational Test	14.2.12.1.81
SU3-SA03	Engineered Safeguards Verification Test	14.2.12.1.82
S-03SB01	Reactor Protection System Logic Test	14.2.12.1.83
S-03SJ01	Primary Sampling System Preoperational Test	14.2.12.1.84
S-03SP01	Process Radiation Monitoring System Preoperational Test	14.2.12.1.85
SU3-0004	Power conversion and ECCS Systems Thermal Expansion Test	14.2.12.1.86
S-030005	Power Conversion and ECCS Systems Dynamic Test	14.2.12.1.87
SU3-0006	HEPA Filter Test	14.2.12.1.88
S-030008	Cooldown from Hot Standby External to the Control Room	14.2.12.1.89
S-030009	Compressed Gas Accumulator Testing	14.2.12.1.90

TABLE 14.2-2

NONSAFETY-RELATED PREOPERATIONAL TESTS

Test Number	Title	USAR Section
S-04AC02	Turbine Trip Test	14.2.12.2.1
S-04AC03	Turbine System Cold Test	14.2.12.2.2
S-04AD01	Condensate System Preoperational Test	14.2.12.2.3
S-04AF01	Secondary Vent and Drain System Preoperational Test	14.2.12.2.4
S-04AQ01	Condensate and Feedwater Chemical Feed System Preoperational Test	14.2.12.2.5
S-04BL01	Reactor Makeup Water System Preoperational Test	14.2.12.2.6
S-04CG01	Condenser Air Removal System Preoperational Test	14.2.12.2.7
SU4-DA01	Circulating Water System Preoperational Test	14.2.12.2.8
S-04EA01	Service Water System Preoperational Test	14.2.12.2.9
S-04EB01	Closed Cooling Water System Preoperational Test	14.2.12.2.10
SU4-FP03	Fire Protection System Preoperational Test	14.2.12.2.11
S-04GH01	Radwaste Building HVAC System Preoperational Test	14.2.12.2.12
SU8-GP01	Local Containment Leak Rate Test	14.2.12.2.13
S-04HB01	Liquid Radwaste System Preoperational Test	14.2.12.2.14
SU4-HB02	Waste Evaporator Preoperational Test	14.2.12.2.15
S-04HC01	Solid Waste System Preoperational Test	14.2.12.2.16
S-04HC02	Solid Waste Filter Handling System Preoperational Test	14.2.12.2.17
SU4-HC03	Resin Transfer Preoperational Test	14.2.12.2.18
SU4-KC01A SU4-KC01B	Fire Protection System (Water) Preoperational Test	14.2.12.2.19
S-04KC02	Fire Protection System (Halon) Preoperational Test	14.2.12.2.20
S-04KC03	Fire Protection System Detection and Alarm Preoperational Test	14.2.12.2.21
S-04LE01	Oily Waste System Preoperational Test	14.2.12.2.22
SU4-LF01	Floor and Equipment Drain System Preoperational Test	14.2.12.2.23
S-04PA01	13.8-kV System Preoperational Test	14.2.12.2.24
S-04PB01	4,160-V (Non-Class IE) System Preoperational Test	14.2.12.2.25
S-04PG01	480-Volt (Non-Class IE) System Preoperational Test	14.2.12.2.26

TABLE 14.2-2 (Sheet 2)

Test Number	Title	USAR Section
S-04PJ01	250-V DC System Preoperational Test	14.2.12.2.27
S-04PK01 S-04PK02	125-V (Non-Class IE) DC System Pre-operational Test	14.2.12.2.28
S-04PN01	Instrument AC (Non-Class IE) System Pre-operational Test	14.2.12.2.29
S-04QD01	Emergency Lighting System Preopera-tional Test	14.2.12.2.30
S-04QF01	Public Address System Preoperational Test	14.2.12.2.31
S-04QJ01	Heat Tracing Freeze Protection System Preoperational Test	14.2.12.2.32
S-04RM01	Secondary Sampling System Preoperational Test	14.2.12.2.33
S-04SD01	Area Radiation Monitoring Preoperational Test	14.2.12.2.34
S-04SG01	Seismic Monitoring Instrumentation System Preoperational Test	14.2.12.2.35
SU4-SQ02	Loose Parts Monitoring System Test	14.2.12.2.36
SU8-0007	Plant Performance Test	14.2.12.2.37
S-090023	Electrical Distribution System Voltage Verification Test	14.2.12.2.38

TABLE 14.2-3

INITIAL STARTUP TEST

Test Number	Title	USAR Section
S-07AB01	Automatic Steam Generator Level Control	14.2.12.3.1
SU7-AB02	Dynamic Automatic Steam Dump Control	14.2.12.3.2
S-07BB01	RTD Bypass Flow Measurement	14.2.12.3.3
S-07BB02	Pressurizer Heater and Spray Capability Test	14.2.12.3.4
S-07BB03	Reactor Coolant System Flow Measurement	14.2.12.3.5
SU7-BB04	Reactor Coolant System Flow Coastdown Test	14.2.12.3.6
S-07BB05	Pressurizer Contiuous Spray Flow Verification	14.2.12.3.7
S-07BB06	RTD/TC Cross Calibration	14.2.12.3.8
S-07SC01	Core Loading Instrumentation and Neutron Source Requirements	14.2.12.3.9
S-07SC03	Thermal Power Measurement and Statepoint Data Collection	14.2.12.3.10
SU7-SE01	Nuclear Instrumentation System Test	14.2.12.3.11
S-07SE02	Operational Alignment of Nuclear Instru-mentation	14.2.12.3.12
S-07SE03	Axial Flux Difference Instrumentation Calibration	14.2.12.3.13
S-07SF01	Control Rod Drive Mechanism Operational Test	14.2.12.3.14
S-07SF02	Rod Control System	14.2.12.3.15
SU7-SF03	Rod Drop Time Measurement	14.2.12.3.16
SU7-SF04	Rod Position Indication System	14.2.12.3.17
S-07SF05	Automatic Reactor Control System	14.2.12.3.18
S-07SR01/ S-07SR02	Incore Flux Mapping	14.2.12.3.19
S-07SR03/ S-07SR04	Incore Instrumentation Test	14.2.12.3.20
S-07SF06	Operational Alignment of Process Temperature Instrumentation	14.2.12.3.21
S-07SF07	Startup Adjustments of Reactor Control System	14.2.12.3.22
S-07SF08	RCCA or Bank Worth Measurement at Zero Power	14.2.12.3.23
SU7-SF09	RCCA or Bank Worth Measurement at Power	14.2.12.3.24
S-07SJ01	Reactor Systems Sampling for Core Load	14.2.12.3.25
SU7-0001	Initial Core Loading	14.2.12.3.26
S-070002	Inverse Count Rate Ratio Monitoring for Core Loading	14.2.12.3.27

TABLE 14.2-3 (Sheet 2)

Test Number	Title	USAR Section
S-070003	Inverse Count Rate Ratio Monitoring for Approach to Initial Criticality	14.2.12.3.28
S-070004	Initial Criticality	14.2.12.3.29
S-070005	Determination of Core Power Range for Physics Testing	14.2.12.3.30
S-070006	Boron Endpoint Determination	14.2.12.3.31
S-070007	Isothermal Temperature Coefficient Measurement	14.2.12.3.32
S-070008	Power Coefficient Determination	14.2.12.3.33
S-070009	Load Swing Tests	14.2.12.3.34
S-070010	Large Load Reduction Test	14.2.12.3.35
S-070011	Plant Trip from 100 Percent Power	14.2.12.3.36
S-070012	Rods Drop and Plant Trip	14.2.12.3.37
S-070014	Shutdown and Maintenance of Hot Standby External to the Control Room	14.2.12.3.38
S-070015	Power Ascension Thermal Expansion and Dynamic Test	14.2.12.3.39
S-070016	Biological Shield Testing	14.2.12.3.40
S-070017	Loss of Heater Drain Pump Test	14.2.12.3.41
S-070018	Calibration of Steam and Feedwater Flow Instrumentation at Power Test	14.2.12.3.42
S-090024	Natural Circulation Test	14.2.12.3.43