CHAPTER 14

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CHAPTER 14

INITIAL TEST PROGRAM

14.1 SPECIFIC INFORMATION TO BE INCLUDED IN PRELIMINARY SAFETY ANALYSIS REPORT

This section is not applicable; Section 14.2 covers the specific information for the Final Safety Analysis Report.

14.2 START-UP AND TEST PROGRAM

14.2.1 Summary of Test Program and Objectives

The Beaver Valley Power Station - Unit 2 (BVPS-2) Start-up and Test Program was established to administratively and technically control all testing activities, commencing with construction completion and ending with Power Level Escalation Testing. This test program was applied to all safety-related structures, systems, and components, and was in compliance with the basic intent of Regulatory Guide 1.68 "Initial Test Program for Water-Cooled Nuclear Power Plants".

The Start-up and Test Program provided properly documented assurance that the plant's safety-related structures, systems, and components will operate in compliance with their design criteria and in a manner that does not endanger the health and safety of the public, plant personnel, or plant equipment.

To the extent practicable, plant operating and emergency procedures were tested and evaluated during the execution of this program. The Start-up and Test Program also assisted in the training of the plant operating and maintenance personnel by providing them with hands-on experience in the operation and maintenance of plant equipment utilizing plant procedures.

To facilitate a systematic approach in conducting the Start-up and Test Program, the program was divided into three major phases: 1) Start-up Proof Test, 2) Pre-operational Test, and 3) Initial Start-up Test.

14.2.1.1 Start-up Proof Test Phase

The Start-up Proof Test Phase began with pre-installation testing of instrumentation and/or installation of components as construction of the individual structures, systems, and components neared completion. The prime objective of this phase was to verify that construction activities associated with the respective structure, system, or components were completed and documented.

The testing requirements associated with this phase verified installation integrity and component and system functional characteristics, and ensured that the system, structures, and components were ready for the Pre-operational Test Phase. Start-up proof tests, in general, included Instrument Calibration, Electrical Continuity and Megger Checks, Pump and Motor Rotation, Vibration Checks, and Hydrostatic Testing, Cleaning, and Flushing.

14.2.1.2 Pre-operational Test Phase

The Pre-operational Test Phase normally commenced after Start-up Proof Testing on individual components and systems or subsystems was completed. This phase included the tests required to demonstrate that structures, systems, and components performed satisfactorily and that they were ready to support fuel loading and Initial Start-up Testing Phase. In general, it was expected that the majority of tests performed during the pre-operational test phase would be completed before fuel loading. However, in some cases it was necessary to defer certain pre-operational test phases until after fuel loading. In such cases, sufficient testing was performed prior to fuel loading to provide reasonable assurance that the post-loading tests would be successful.

During the conduct of the Pre-operational Test Phase, two types of tests were performed: Pre-operational Tests and System Operability Verification (SOV) Tests. The Pre-operational Tests were tests performed on safety-related structures, systems, or components in accordance with the intent of Section XI of Appendix B of 10 CFR 50. The SOV Tests were tests performed on structures, systems, or components which were not classified as safety-related. Although these two types of tests were similar in scope, the administrative processing of the tests and results may be different.

Although it was initially intended to perform all of the SOV Tests listed in Section 14.2.12, at the discretion of the Joint Test Group (JTG) some of these tests were deleted or only performed in part. Additionally, where test methods, system conditions and configurations were equivalent and with prior approval of the System Test Supervisor, portions of tests performed under the Start-up Proof Test Phase whose test results met the applicable acceptance criteria may have been substituted for applicable portions of Pre-operational Test Phase test procedures.

Where practicable, testing during the Pre-operational Testing Phase was performed under conditions similiar to those experienced during normal operations. Tests for which these conditions were not available or could not be simulated were performed to the extent possible without these conditions. The remainder of the tests were performed when the required parameters became available.

Many system tests were conducted as part of Pre-operational and SOV Tests that lent themselves to operator training. Plant operating personnel obtained hands-on experience during testing of these systems in accordance with the general direction provided in the U.S. Nuclear Regulatory Commission's (USNRC) NUREG-0737. Use of operating procedures is described in Section 14.2.9.

14.2.1.3 Initial Start-up Test Phase

The Initial Start-up Phase of the Start-up and Test Program commenced with the preparation for fuel load and extended through operation at rated power and warranty demonstrations. The Initial Start-up Test Phase was divided into three periods: 1) Fuel Loading Testing, 2) Post-Loading Testing, and 3) Criticality Testing. Testing performed during this phase of the program was to ensure that fuel loading was accomplished in a safe manner, confirm the plant nuclear design basis, demonstrate that the plant could withstand anticipated transients and postulated accidents, and ensure that the plant could be safely brought to sustained rated power operation and also could be safely shutdown.

14.2.2 Organization and Staffing

Duquesne Light Company (DLC) had the overall responsibility for development, supervision, performance, and documentation of Start-up Proof, Pre-operational, and Initial Start-up Testing at BVPS-2. Test procedure preparation and test performance at BVPS-2 were under the control of DLC to ensure that proper and effective emphasis was maintained on personnel and plant safety by individuals participating in the test program. Duquesne Light Company, along with various vendors, contractors, and consultants, was involved to varying degrees and capacities in each phase of the Start-up and Test Program.

14.2.2.1 DLC Start-up Group Organization

The BVPS-2 Start-up Group (SUG) consisted of a Start-up Manager who reported directly to the DLC Senior Nuclear Group Vice President to the Start-up Manager are four section directors: Director - Start-up Proof Test Section, Director - Systems Testing Section, Superintendent - Operations and Maintenance, and Director - Support Services Section. These groups consisted of personnel drawn from various organizations such as DLC Construction, BVPS Plant Staff, Stone and Webster Engineering Corporation (SWEC), Westinghouse Electric Corporation (Westinghouse), and other outside consultants.

14.2.2.1.1 Start - up Proof Test Section

This section was supervised by the Director - Start-up Proof Test Section and was responsible for Start-up Proof Testing, Initial Operating Procedures (IOP's), the Flush/Cleanness Verification Program, management of hydrostatic testing and software development to support the above programs.

14.2.2.1.1.1 Director - Start-up Proof Test Section

The Director - Start-up Proof Test Section was responsible for the overall administration and coordination of the activities of the Start-up Proof Test Section. Reporting to the Director - Start-up Proof Test Section were six lead supervisors: Electrical/Instrumentation and Control Testing Supervisor, NSSS Testing Supervisor, Balance of Plant Testing Supervisor, Test Technician Supervisor, Flushing/Hydro Test Supervisor and Independent Review Group (IRG). These supervisors directed the efforts of the Test Engineers and Test Specialists assigned to their groups, and were responsible for participating in test procedure preparation, review, and performance to ensure that the safety of components and systems was verified and that design objectives were met; and for placing into service all equipment and related items in their respective areas of responsibility.

14.2.2.1.1.2 Testing Supervisors

The Electrical/Instrumentation and Control Testing Supervisor, Nuclear Steam Supply System Testing Supervisor, and Balance of Plant Testing Supervisor reported to the Director - Start-up Proof Test Section, and were responsible for supervision of development, technical review, and approval/obtaining approval of test procedures, and providing planning/scheduling input and rework impact identification to the Support Services Section for schedule development and status identification. In addition, these Testing Supervisors assigned qualified test personnel to conduct tests as scheduled, monitored the performance of testing related to their particular discipline, ensured required documentation and records were maintained for all related activities, and ensure appropriate independent review and approval of test results.

14.2.2.1.1.3 Test Technicians Supervisor

The Test Technicians Supervisor reported to the Director - Start-up Proof Test Section and was responsible for the establishment of training and indoctrination criteria for test technicians, assignment of qualified test personnel to conduct tests as scheduled, and the coordination of operator and craft support for Start-up Proof Test Section activities. The Test Technician Supervisor also ensured tests were conducted in accordance with properly approved test procedures and that results were properly documented and forwarded to the Testing Supervisor/Review Test Engineer for Independent Review.

14.2.2.1.1.4 Flushing/Hydro Test Supervisor

The Flushing/Hydro Test Supervisor reported to the Director - Start-up Proof Test Section and was responsible for the development and review of flush/cleanness verification procedures, determination of the acceptability of systems/subsystems to permit flush/cleanness verification activities to be conducted and ensuring that flush/cleanness verification activities were accomplished in accordance with approved procedures. SWEC as the N certificate holder was responsible under the ASME Code for pressure testing of components N stamped by SWEC. SWEC delegated the responsibility for performance to Schneider Power Corporation, the NA certificate holder, but retained responsibility for the adequacy and code compliance of these activities. The Flushing/Hydro Test Supervisor provided administrative and technical direction to assigned Test personnel to ensure technical support was available during the conduct of hydro testing.

14.2.2.1.1.5 Independent Review Group (IRG)

The Independent Review Group Engineers were responsible for Independent Review and approval recommendations of Start-up Proof Test Section procedures and test results to ensure that applicable engineering requirements were addressed.

14.2.2.1.2 Systems Testing Section

The Systems Testing Section was supervised by the Director - Systems Testing Section and was responsible for pre-operational and system operability verification testing procedure development and approval, test performance, results evaluation, and approval prior to fuel load.

14.2.2.1.2.1 Director - Systems Testing Section

The Director - Systems Testing Section was responsible for the overall administration and coordination of the activities of the Systems Testing Section. Reporting to the Director - Systems Testing Section were the Supervisor - Systems Test Software Development Group and the Supervisor - Systems Test Group.

14.2.2.1.2.2 Supervisor - Systems Test Software Development Group

The Supervisor - System Test Software Development was responsible for coordinating the preparation and review of Pre-operational and SOV test procedures in support of the BVPS-2 Start-up and Test Program prior to fuel load. Reporting to the Supervisor - Systems Test Software Development were Senior Procedure Engineers who were responsible for ensuring that all testing requirements were met in the Pre-operational and SOV test procedures.

14.2.2.1.2.3 Supervisor - Systems Test Group

The Supervisor - Systems Test was responsible for coordinating the performance of Pre-operational and SOV test procedures and for analysis of test results in support of the BVPS-2 Start-up and Test Program prior to fuel load. Reporting to the Supervisor - Systems Test were Senior Test Engineers who were responsible for coordinating Pre-operational and SOV testing activities by ensuring that Systems Test Group personnel were available to support performance of Pre-operational and SOV test procedures and that all Test Results Reports were accurate and complete.

14.2.2.1.3 Superintendent - Operations and Maintenance

The Superintendent - Operations and Maintenance was responsible for the overall administration and coordination of the activities of the Operations Section and the Maintenance and Materials Section. Reporting to the Superintendent - Operations and Maintenance were the Director - Maintenance and Material Section and four supervisors from the Operations Section (Post Core Load Testing Group Senior Test Coordinator, Start-up Engineer, Nuclear Operations Group Supervisor and the Procedure Review Committee Chairman).

14.2.2.1.3.1 Maintenance and Materials Section

This section was supervised by the Director - Maintenance and Materials Section and was responsible for: post turnover support to the Start-up Group, the development of start-up and permanent plant maintenance instrument and control software, the ASME Section XI Repair and Replacement Program, the BVPS-2 Operational Phase Welding Program, the Spare and Replacement Parts Procurement Program, the conduct of corrective and preventive calibration maintenance activities, coordination with the Authorized Nuclear Insurer concerning pertinent maintenance activities, and implementation of the Site Environmental Protection and Hazardous Waste Program.

14.2.2.1.3.2 Operations Section

The Operations Section was made up of the following subsections: Post Core Load Testing Technical Document Review Group, Joint Test Group, Nuclear Operations Group and the Procedure Review Committee. Each subsection was responsible for the activities under their area of responsibility as described below.

14.2.2.1.3.2.1 Post Core Load Testing Group Senior Test Coordinator

The Senior Test Coordinator - Post Core Load Testing (PCLT) Group was responsible for coordinating the preparation, review and approval of the Initial Start-up Test procedures in support of the BVPS-2 Start-up and Test Program. The Senior Test Coordinator - PCLT Group was also responsible for coordinating the preparation review and approval of the Beaver Valley Test (BVT) surveillance procedures.

14.2.2.1.3.2.2 Start-up Engineer

The Start-up Engineer coordinated the activities of the Technical Document Review Group and served as chairman of the Joint Test Group.

14.2.2.1.3.2.2.1 Technical Document Review Group

This group was supervised by the Start-up Engineer and was responsible for providing input for position determination for IE Notices, Bulletins, Circulars, and Generic Letters for BVPS-2. This group also handled and coordinated station responses to various INPO documents and vendor technical bulletins.

14.2.2.1.3.2.2.2 Joint Test Group

The Start-up Engineer served as chairman of the Joint Test Group (JTG). The JTG consisted of, qualified representatives from DLC, SWEC, and Westinghouse as appropriate and was the primary review and approval organization during the Pre-operational and Initial Start-up Phases of the BVPS-2 Start-up and Test Program. The functions of the JTG included review and approval of test procedures, revisions, test schedule, and test results. The JTG review for approval ensured that FSAR commitments were satisfied. See Section 14.2.2.1.6 for details.

14.2.2.1.3.2.3 Nuclear Operating Supervisor

The Nuclear Operating Supervisor was responsible for coordination of technical functions required to support Pre-operational and SOV Testing at BVPS-2 including the BVPS-2 Operating Manual preparation and review, preparation of BVPS-2 chemistry requirements, and preparation of administrative procedures, as necessary, to control the related duties.

14.2.2.1.3.2.4 Procedure Review Committee

The Procedure Review Committee (PRC) was supervised by the PRC chairman who directed the activities of the PRC. The PRC provided independent review of specified procedures and, as appropriate, recommended their approval to the Start-up Manager or the Superintendent - Operations and Maintenance.

14.2.2.1.4 Support Services Section

This section was supervised by the Director - Support Services Section and was responsible for planning and scheduling of start-up proof tests, Systems Testing and Operations Sections' tests, flush/cleanness verification activities, commitment tracking control and software development tracking, system and subsystem turnover including isometric review, walkdown coordination and turnover status activities, coordination of the rework coordination program, and test/data package management. This section was also responsible for the BVPS-2 Start-up Group's budget and cost control, contract administration, document control, SUG personnel training and certification coordination, secretarial and clerical coordination, safeguards information control, and BVPS-2 Start-up Group records retention and transfer.

14.2.2.1.5 Beaver Valley Power Station Plant Staff

The BVPS Plant Staff consisted of those permanent DLC employees who staffed, maintained, and operated Beaver Valley Power Station - Unit 1 (BVPS-1). Chapter 13 details their duties and general responsibilities. When the Initial Start-up Test Phase of the BVPS-2 Start-up and Test Program commenced approximately 90 days prior to fuel load, the BVPS Plant Staff under the coordination of the Plant Manager assumed responsibility for control of the BVPS-2 Start-up and Test Program. The BVPS Plant Staff provided technical and manpower support and coordinated the operations and maintenance of structures, systems and components prior to and during the Initial Start-up Test Phase Testing. The manpower requirements were provided by the plant maintenance staff or by contract organization personnel in accordance with approved administrative procedures. Following successful completion of the Start-up and Test Program, the BVPS Plant Staff assumed full responsibility for the operation and maintenance of the plant.

14.2.2.1.6 Joint Test Group

In order to accomplish Pre-operational Testing associated with the BVPS-2 start-up with a maximum assurance of safety and acceptability, a JTG was established.

The JTG was the primary review and approval organization during the Pre-operational Test Phase and the Initial Start-up Test Phase of the Start-up and Test Program. The Start-up Engineer was the primary chairperson of the JTG. When required by the Start-up Engineer or the permanent JTG members, other individuals were directed to be present at specific JTG meetings for consultation. The functions of the JTG included:

1. Review and approval of Pre-operational, SOV, and Initial Start-up Test procedures prior to testing.

2. Review and approval of changes or revisions to JTG approved test procedures when the changes or revisions affected the scope of the test.

3. Review and approval of the overall test schedule and sequence.

4. Review and recommended approval of Pre-operational, SOV, and Initial Start-up Test results.

5. Recommended retests or supplemental tests as required.

6. Approved other documents as required.

The JTG consisted of qualified representatives from DLC, SWEC, and Westinghouse, as appropriate. The JTG functioned in the capacity described until DLC formally accepted BVPS-2 for commercial operation. At that time, the responsibilities of the JTG were assumed by DLC.

As noted in Section 14.2.3.2, the Onsite Safety Committee (OSC) reviewed and approved all tests involving reactivity control systems or engineered safeguard systems following initiation of fuel loading.

14.2.2.1.7 Procedure Review Committee (PRC)

The PRC was composed of qualified personnel from the various BVPS-2 Start-up Group Sections. These sections included: Systems Testing, Start-up Proof, Support Services, Operations and Maintenance and Materials Sections. The PRC functioned as the Unit Review Group until approximately 90 days prior to the fuel load when the BVPS-2 PRC and the BVPS-1 Onsite Safety Committee (OSC) merged. Subsequent to JTG review and approval the PRC reviewed all procedures that were performed (in part or in total) after fuel load. The primary objective of this review was to verify that the performance of the procedure would not jeopardize personnel or plant safety. Additionally, the PRC reviewed: applicable procedures recommended in Appendix A of Regulatory Guide 1.33, Revision 2, February 1978; all changes or modifications to BVPS-2 systems or equipment on which Pre-operational testing was completed and which affected nuclear safety; and Start-up Manuals and revisions. The PRC also performed special reviews, investigations or analysis as required by the Superintendent - Operations and Maintenance.

14.2.2.1.8 Qualification of Personnel

The staffing and qualifications of the BVPS Plant Staff were detailed in Chapter 13. The minimum qualifications of all personnel actively engaged in testing activities during the Start-up Proof Test Phase were in accordance with Regulatory Guide 1.58, "Qualification of Nuclear Power Plants Inspection, Examination, and Testing Personnel." The minimum qualifications of supervisory personnel involved in the Pre-operational and Initial Start-up Test Phases (for safety-related tests only) were in accordance with Regulatory Guide 1.8, "Personnel Selection and Training."

14.2.3 Test Procedures

In general, testing during all phases of the Initial Start-up and Test Program was conducted using approved procedures to control the conduct of each test. These test procedures included appropriate methods to control test performance (including as necessary the sequencing of testing), specify acceptance criteria by which the test would be evaluated, and provide for or specify the format by which data or observations would be recorded. The SOV tests were performed on structures, systems, or components which were not classified as safety-related. Although SOV tests were similar in scope to pre-operational tests performed on safety-related items, the administrative processing of SOV tests and test results sometimes differed. Preparation, review, and approval of procedures used during the Start-up Proof, Pre-operational, and Initial Start-up Test Phases were governed by detailed administrative procedures.

14.2.3.1 Start-up Proof Test Procedures

Documents, drawings, specifications and procedures related to the Start-up Proof Test Phase were prepared, reviewed, and approved in accordance with DLC Start-up Manual and the BVPS-2 Project Manual. Start-up Proof Test procedures and instructions which implement the preceding engineering documents were prepared, reviewed and approved in accordance with DLC Start-up Group administrative procedures.

14.2.3.2 Pre-operations, System Operability Verification, and Initial Start-up Test Procedures

Usually, Pre-operational and Initial Start-up Test Procedures were initially drafted by SWEC engineers in accordance with the various regulatory requirements and/or design specifications generated by SWEC or by Westinghouse. These procedures were also prepared on site by DLC's Systems Software Development and Post Core Load Testing Groups at the direction of the respective group's supervisor. Draft test procedures prepared by SWEC were submitted to the BVPS-2 Start-up Group for review and comment, whereas draft procedures prepared by DLC were normally reviewed by SWEC engineers. System Operability Verification Tests drafted by DLC were not normally sent to SWEC for review. In all cases, however, review comments were resolved and/or incorporated and the resulting revised copies of the test procedures were submitted to the BVPS-2 JTG for review and comment.

JTG reviewed the procedures and its comments were forwarded for resolution and incorporation. The procedure was then issued in final form for JTG approval. The JTG reviewed and approved all Pre-operational, SOV and Initial Start-up Test procedures. At the JTG's discretion, some of the SOV tests were deleted or only performed in part. Draft test procedures were prepared, reviewed, and approved in accordance with approved administrative procedures. Until approximately 90 days before fuel load, procedures which were to be performed (in total or in part) after fuel load were reviewed by the PRC subsequent to the JTG review and approval.

Additionally, when fuel loading in the reactor vessel commenced, it was required for the OSC to review and approve all tests involving reactivity control systems or engineered safeguards subsequent to the JTG approval. This review dealt with the scheduling of the tests, the test procedures, and the test evaluations. The OSC determined on an individual case basis whether review by the Offsite Review Committee (ORC) was required. The OSC was defined in Chapter 13.

14.2.3.2.1 Procedure Format

The format used for Pre-operational, SOV, and Initial Start-up Tests was defined as follows:

1. Cover Page - This page provided a descriptive title, issue date, identifying number, revision number, and an approval signature section.

2. Purpose of the Test - This section provided a brief statement of the objective of the test and/or the reason for performing the test including an indication of the extent or scope of the test. Applicable BVPS-2 Technical Specifications were referenced, and reference was made to appropriate USNRC Regulatory Guides, equipment specifications, etc.

3. General Test Method - This section provided a brief description of the test method and the manner in which the test would be performed. The description indicated the extent of nonstandard or temporary arrangements required by this procedure or test. This description was not a step-by-step procedure, but it was in sufficient detail to allow the reader to understand how the test was to be conducted.

4. Special Test Equipment - This section provided a list of the test equipment required to obtain the necessary test data or to perform the test. Details included as appropriate or applicable: the quantity, range, calibration requirements, cleanliness, and accuracy.

5. Prerequisites - This section provided a list of items, events, or actions that must be completed prior to the start of a test.

6. Initial Conditions - This section provided a description of plant conditions and/or instructions pertaining to the configuration of the components, system, or structure and supporting systems at the beginning of the test.

7. Precautions and Limitations - This section provided a list of the precautions to be taken before, during, and after the performance of the test to provide for the safety of personnel and equipment. As applicable, this section identified maximum and minimum set points that may damage equipment or affect personnel safety, limitations that may be approached, personnel protective apparel and devices, and any restrictions on components or personnel conduct pertaining to the test.

8. Procedure - This section provided concise step-by-step instructions to the testing personnel on how to conduct the test. It also indicated when data were recorded, which specific instruments were read, and the frequency of recording data. For procedures which were anticipated to be performed only once, the data sheets were sometimes located in the back of the procedure, or data were recorded within this section. This section may specify temporary plant changes necessary to conduct the test and specify the requirements for returning the plant to normal configuration.

9. Acceptance Criteria - This section listed the qualitative and/or quantitative acceptance criteria against which the success or failure of the test was judged.

10. References - This section listed all pertinent sources of information considered necessary for the successful completion of the test.

11. Data Sheets - This section provided data sheets for recording of required data for tests that are of a periodic nature or where the required data were too extensive to be included in the procedure section noted previously.

14.2.4 Conduct of Test Program

The BVPS-2 Start-up and Test Program was conducted in accordance with approved administrative procedures. These procedures establish the following administrative control mechanisms relative to each phase of the program:

1. Controls to govern the preparation, review, revision, and approval of test procedures.

2. Controls to ensure prerequisites were satisfied for each phase and for individual tests.

3. Controls to ensure plant modifications and maintenance required as a result of testing were initiated.

4. Controls to ensure retesting after plant modification or maintenance was completed.

5. Controls to ensure compliance with approved test procedures.

6. Controls for qualification of personnel.

7. Controls for tagging procedures.

14.2.4.1 Startup Proof Test Phase

Responsibilities and controls for testing safety-related equipment during this phase were delineated in the DLC Start-up Manual. Procedures conforming to the requirements of this manual detailed the test objectives and prerequisites, the testing method, and the method utilized in documenting test results. Testing during this phase was the responsibility of the Start-up Proof Test Section and was subject to audit as established by the DLC Quality Assurance Program.

14.2.4.2 Pre-operational and Initial Start-up Test Phase

During the Pre-operational Test Phase the systems and equipment were normally under the jurisdictional control of the Start-up Group. Procedures were coordinated such that a section of a test was not performed until the prerequisites to that section were verified as complete. Pre-operational and SOV Test Procedures were released for performance by the JTG. This mechanism offered assurance that the system was ready for testing, and that the procedure to be used was current.

Approval for fuel loading was forthcoming after a review of the test program to date indicated that the unit was prepared for Initial Start-up Testing. At this time, the OSC exercised test review and approval responsibilities, subsequent to JTG, for all tests involving reactivity control. Individual Initial Start-up Tests specified prerequisites that must be validated prior to performance. Each operating shift had a required complement of licensed senior reactor and reactor operators who were responsible for operation of the unit during Initial Start-up Testing.

14.2.4.3 Test Procedure Revisions

Tests were conducted in accordance with approved procedures, but, when necessary, procedures were revised to complete testing. Such revisions were documented on a special test revision form. There were two types of test procedure revisions which were made: those which had no effect on the intent of the test, and those which altered the intent of the test. If, during Pre-operational, SOV, or Initial Start-up Testing, a revision was required which did not alter the intent of the test, approval of the revision was authorized by the Individual in charge of the particular test and by the on-shift operations supervisor or applicable Senior Test Engineer.

Revisions to approved Pre-operational, SOV, or Initial Start-up Test procedures which altered the intent of the test were authorized by the JTG and/or the OSC as appropriate. The JTG and/or the OSC authorization of revisions to approved test procedures was obtained in accordance with telecon as required.

14.2.4.4 Control of Rework, Modifications, and Repairs

During the Start-up and Test Program, a listing of outstanding work items was maintained. This listing was maintained to ensure that work items identified during the test program were resolved. Typical listed work items included:

1. Incomplete or incorrect equipment installation,

2. Equipment repairs (corrective maintenance), and

3. Approved facility modifications.

This work was performed by the construction organization, the plant maintenance staff, or a contract organization in accordance with approved administrative procedures. In any event, in order to maintain the required controls, formal authorization was required to perform the work. This authorization was provided through the implementation of the appropriate DLC Construction Department or Operations Start-up Group administrative procedures. Following completion of the required work, the Construction Start-up Group, the JTG, and/or the OSC determined the amount of retesting which was required.

14.2.5 Review, Evaluation, and Approval of Test Results

Upon completion of a Pre-operational, SOV, or Initial Start-up Test, a qualified engineer responsible for that test reviewed and evaluated the test data for completeness and evaluated the test results to ensure that they met the acceptance criteria. The test engineer prepared a test report summarizing the testing and results obtained. This test report, along with required supporting test data, was approved by the JTG for Pre-operational and SOV Tests. Additionally, for those tests involving reactivity control systems or engineered safeguards systems, OSC review was required following initiation of fuel loading. These initial startup tests results receive final approval by the Plant Manager/Designee.

Prior to initial fuel load and commencement of Initial Start-up Testing, a comprehensive review of the Pre-operational Test Phase was conducted by the JTG and the OSC to provide assurance that plant systems and structures were capable of supporting initial fuel load and subsequent testing. Structures, systems, and components not completely tested prior to fuel load were identified, and the appropriate tests were rescheduled for after fuel loading.

Each period of Initial Start-up Testing (fuel loading, post loading, and criticality testing) was reviewed and evaluated by the OSC prior to starting testing in the succeeding period. The test results of each Power Level Escalation testing power plateau were reviewed, evaluated, and approved by the Director of Site Testing and Plant Performance before proceeding to the next test plateau.

14.2.6 Test Records

Test procedures, test data sheets, and test result reports were retained in accordance with DLC requirements for record retention.

14.2.7 Conformance of Test Program with Regulatory Guides

The conformance of the test program with the applicable regulatory guide is discussed in Section 1.8 and included the following:

1. Regulatory Guide 1.20, Comprehensive Vibration Assessment Program for Reactor Internals During Pre-operational and Initial Start-up Testing.

2. Regulatory Guide 1.41, Preoperational Testing of Redundant On-Site Electric Power Systems to Verify Proper Load Group Assignments.

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

4. Regulatory Guide 1.68, Initial Test Programs for Water-Cooled Nuclear Power Plants.

5. Regulatory Guide 1.68.2, Initial Start-up Test Program to Demonstrate Remote Shutdown Capability for Water-Cooled Nuclear Power Plants.

6. Regulatory Guide 1.68.3, Pre-operational Testing of Instrument and Control Air Systems.

7. Regulatory Guide 1.79, Pre-operational Testing of Emergency Core Cooling System for Pressurized Water Reactors.

8. Regulatory Guide 1.80, Pre-operational Testing of Instrument Air Systems.

9. Regulatory Guide 1.95, Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release.

10. Regulatory Guide 1.108, Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants.

11. Regulatory Guide 1.118, Periodic Testing of Electric Power and Protection Systems.

12. Regulatory Guide 1.120, Fire Protection Guidelines for Nuclear Power Plants.

13. Regulatory Guide 1.133, Loose-Part Detection Program for the Primary System of Light-Water-Cooled Reactors.

14. Regulatory Guide 1.139, Guidance for Residual Heat Removal.

15. Regulatory Guide 1.140, Design, Testing, and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants.

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

The Duquesne Light Company Start-up Group organization maintained responsibility for incorporation of reactor operating and testing experiences as needed for the Initial Start-up and Test Program.

Personnel developing Pre-operational, SOV, initial start-up, and other start-up related procedures for BVPS-2 reviewed the following information and incorporated experiences learned or recommendations into the applicable procedures:

1. NRC-initiated Bulletins, Circulars, and Information Notices,

2. Input from the Institute of Nuclear Power Operations (INPO) "Nuclear Note Pad,"

3. Pertinent operating experiences from similar power plants for at least 2 years prior to the start of BVPS-2 Construction Start-up Testing, and

4. Vendor information notices.

14.2.9 Trial Use of Plant Operating and Emergency Procedures

The schedule for preparation, review, and approval of plant operating and emergency procedures was specified in Chapter 13. This schedule provided sufficient time for confirming procedure adequacy by trial use during the Initial Start-up and Test Program. Procedures that did not require nuclear power operation were confirmed, to the extent practicable, during the Pre-operational Test Phase. Procedures that required nuclear power operation were confirmed to the extent practicable during the Initial Start-up Test Phase. During the Pre-operational Test Phase, controlled draft copies of the operating and emergency procedures were sometimes used.

Test procedures used these operating and emergency procedures in several ways: 1) the test procedure may reference the procedure directly, 2) the test procedure may extract a series of steps from the procedure, or 3) the test procedure may use a combination of these methods.

14.2.10 Initial Fuel Loading and Initial Criticality

Fuel loading began when required Pre-operational Testing was completed and approved by the JTG and the OSC. Upon completion of fuel loading, the reactor upper internals and pressure vessel head were installed, and additional mechanical and electrical tests were performed. The purpose of this phase of activities was to prepare the plant for nuclear operation and to establish that all design requirements necessary for operation were achieved. The core-loading and post-loading tests are described as follows:

14.2.10.1 Fuel Loading

The reactor containment structure was to be completed, and containment integrity shall be established and maintained during fuel loading.

Fuel handling tools and equipment was to be checked, and dry runs conducted in the use of operation equipment.

The reactor vessel and associated components was to be in a state of readiness to receive fuel. Water level was to be maintained above the bottom of the nozzles and recirculation maintained to ensure a uniform boron concentration. Boron concentration could be increased via the residual heat removal system or directly to the open vessel.

The overall responsibility and direction for initial core loading was exercised by station management with technical assistance provided by Westinghouse.

Those activities described in Sections 14.2.12.2.5, 14.2.12.2.15 and 14.2.12.2.17 were accomplished jointly by Westinghouse and the Duquesne Light Company Beaver Valley Refueling Group and were not considered to be part of the testing program. These activities were subject to administrative controls governing fueling activities. Procedures were reviewed by the Duquesne Light Company Refueling Group, Duquesne Light Company Operations Quality Control and the Onsite Safety Committee/Procedures Review Committee. The procedures then were approved by the Plant Manager/designee.

The overall process of initial core loading was, in general, supervised from the operating floor of the containment structure by a licensed senior reactor operator with no other concurrent duties. Procedures for the control of personnel and maintenance of containment integrity were established prior to fuel loading.

The as-loaded core configuration was specified as part of the core design studies conducted well in advance of fuel loading, and as such was not subject to change at start-up. In the event that mechanical damage was sustained during core loading operations to a fuel assembly of a type for which no spare is available onsite, an alternate core loading scheme was to be determined. Any such changes were approved by appropriate DLC and Westinghouse personnel.

The core was assembled in the reactor vessel, submerged in primary grade water containing enough dissolved boric acid to maintain a calculated core effective multiplication factor (K_{eff}) of 0.90 or lower. The refueling cavity was dry during initial core loading. Core moderator chemistry conditions (particularly boron concentration) were prescribed in the core loading procedures and were verified periodically by chemical analysis of moderator samples taken prior to and during core loading operations.

Core loading instrumentation consisted of two permanently installed source range (pulse type) nuclear channels and two temporary incore source range channels plus a third temporary channel which could be used as a spare. The permanent channels were monitored in the main control room by licensed reactor operators; the temporary channels were installed in the containment structure and were monitored by reactor engineering personnel and licensed reactor operators. At least one permanent channel was equipped with an audible count rate indicator. Both permanent channels had the capability of displaying the neutron flux level on a strip chart recorder. The temporary channels indicate on rate meters with a minimum of one channel recorded on a strip chart recorder. Minimum count rates of two counts per second, attributable to core neutrons, were required on at least two of the four (that is, two temporary and two permanent source range detectors) available nuclear source range channels at all times following installation of the initial nucleus of eight fuel assemblies.

At least two artificial neutron sources were introduced into the core at specified points in the core loading program to ensure a minimum neutron population equivalent to two counts per second.

Fuel assemblies, together with inserted components (control rod assemblies, burnable poison inserts, and source spider or thimble plugging devices) were placed in the reactor vessel one at a time according to a previously established and approved sequence which was developed to provide reliable core monitoring with minimum possibility of core mechanical damage. The core loading procedures prescribed and verified 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. Checks were made of component serial numbers, types, and orientation at successive transfer points to guard against possible inadvertent exchanges or substitutions of components, and fuel assembly status boards were maintained through the core loading operation.

An initial nucleus of eight fuel assemblies, the first of which contained an activated neutron source, was the minimum source-fuel nucleus which permited subsequent meaningful inverse count rate monitoring. This initial nucleus was determined by calculation and previous experience to be markedly subcritical (K_{eff}) less than or equal to 0.90) under the required conditions of loading.

Each subsequent fuel addition was accompanied by detailed neutron count rate monitoring to ensure the just-loaded fuel assembly did not excessively increase the count rate and that the extrapolated inverse count rate ratio was behaving as expected. The results of each loading step were evaluated before the next prescribed step was started.

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

1. An unanticipated steady state increase in the neutron count rate by a factor of two occurred on two of the four nuclear channels during any single loading step after the initial nucleus of eight fuel assemblies were loaded (excluding anticipated change due to detector and/or source movement).

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

3. An unanticipated decrease in boron concentration greater then 20 ppm as determined from two successive samples of reactor coolant water.

An alarm in the containment and main control room was coupled to the source range channels with a set point equal to or less than five times the current count rate. This alarm would automatically alert the loading operation personnel of high count rate and required an immediate stop of all operations until the situation was evaluated. Normally, the alarm used for this purpose was the containment evacuation alarm. In the event the evacuation alarm was actuated during core loading and after it had been determined that no hazards to personnel existed, preselected personnel would be permitted to re-enter the containment structure to evaluate the cause and determine future action.

Core loading procedures specified the condition of fluid systems to prevent inadvertent dilution of the boron concentration of the reactor coolant, specified the movement of fuel to preclude the possibility of mechanical damage, prescribe the conditions under which loading can proceed, identified responsibility and authority, and provided for continuous and complete fuel and core component accountability.

14.2.10.2 Post-loading Tests

Upon completion of core loading, the reactor upper internals and the pressure vessel head were installed, and additional mechanical and electrical tests were performed prior to initial criticality. The final pressure test was conducted after filling and venting was completed to check the integrity of the vessel head installation.

Mechanical and electrical tests were performed on the control rod drive mechanisms. These tests included a complete operational checkout of each mechanism and each individual rod position indication.

Tests were performed on the reactor trip circuits to test manual trip operation. The actual control rod assembly drop times were measured for each control rod assembly. The reactor control and protection system was checked with simulated signals which produced a trip signal for the various conditions that required unit trip.

At all times that control rod drive mechanisms were being tested, the boron concentration in the coolant-moderator was maintained such that criticality could not be achieved with all control rod assemblies fully withdrawn.

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

14.2.10.3 Criticality Tests

After post-loading tests, nuclear operation of the reactor began. Criticality tests included initial criticality, low power physics testing, and power level escalation testing. The purpose of these tests was to establish the operational characteristics of the unit and core, to acquire data for the proper calibration of set points, and to ensure that operation was within license requirements. A brief description of the testing is presented in the following subsection.

14.2.10.3.1 Initial Criticality Testing

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 was specified by approved procedures. Initial criticality was approached on a start-up rate of less than 1 decade per minute.

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 then 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 concentrate ion.

Inverse count rate ratio monitoring, using data from the normal plant source data range instrumentation, was used as an indication of the proximity and rate of approach to criticality. Inverse count rate ratio data were 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.

14.2.10.3.2 Low Power Testing

A prescribed program of reactor physics measurements was undertaken to verify that basic static and kinetic characteristics of the core were as expected and that values of kinetic coefficients assumed in the safety analysis were indeed conservative.

The measurements were made at low power and primarily at or near operating temperature and pressure. Measurements, to include verification of calculated values of control rod assembly group reactivity worths, of isothermal temperature coefficient under various core conditions, of differential boron concentration reactivity worth, and of critical boron concentrations as functions of control rod assembly group configuration were made.

In addition, measurements of relative power distributions were made. Concurrent tests were conducted on instrumentation including the source and intermediate range nuclear channels.

Procedures specified the sequence of tests and measurements to be conducted and the conditions under which each procedure was to be performed, which ensure both safety of operation and the relevancy and consistency of the results obtained. If significant deviations from design predictions existed or apparent anomalies developed, the plant would be brought to a safe stable condition and the situation reviewed to determine whether a question of safety was involved.

14.2.10.3.3 Power Level Escalation

When the operating characteristics of the reactor and unit were verified by the low power testing, a program of power level escalation brought the unit to its full rated power level. Both reactor and unit operational characteristics were closely examined at each stage. Conformance with the safety analysis was verified or discrepancies resolved before escalation to the next programmed level.

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

Secondary system heat balance calculations ensured that indications of power level were consistent and provided the basis for calibration of the power range nuclear channels. The ability of the reactor control 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 reactor coolant and steam systems were evaluated. Responses of the systems 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 inside containment and throughout the station site at various power levels. Periodic sampling was performed to verify the chemical and radio-chemical analysis of the reactor coolant.

Testing performed following core loading and during unit start-up was outlined in Section 14.2.12. Prerequisites for performing a test were specified in the individual test procedure. The sequence of testing was planned such that required prerequisite testing was completed prior to performing subsequent testing. Special test instruments required for a test were specified to be installed in the test procedure that specified the test equipment. Where test instruments were not left installed for future use, they were removed from the systems and removal was verified. The probable sequence of testing following core loading was shown in Section 14.2.11. Any modification of the sequence of testing was accomplished in accordance with approved BVPS-2 administrative procedures.

14.2.11 Test Program Schedule

14.2.11.1 Initial Test Program Schedule

The schedule for the performance of Pre-operational, SOV, and Initial Start-up Tests was shown on Figure 14.2-3. The schedule depicted certain milestones, at which time each test or portions of the test would be completed. The detailed schedules for testing were prepared, reviewed, and revised on a continuing basis as plant construction progressed.

Operational testing of the various systems and components commenced approximately 18 months prior to fuel load. Initial Start-up Tests were scheduled to be conducted over a period of approximately 6 months subsequent to fuel load.

Tests were scheduled such that the safety of plant systems, structures, or components would not depend on the performance of an untested system or design feature. As a minimum, plant equipment and structures that were relied upon to prevent, mitigate, or limit the consequences of an accident were tested prior to exceeding 30 percent power. Section 14.2.12 provides detailed information on each test performed.

14.2.11.2 Availability of Procedures for Regulatory Review

Test procedures prepared for implementation during the Pre-operational and Initial Start-up Test Phases were usually available for review by the U.S. Nuclear Regulatory Commission 60 days prior to the scheduled performance of the test. Start-up testing procedures were usually available 60 days prior to fuel loading.

14.2.12 Individual Test Descriptions

14.2.12.1 Pre-operational, SOV, and Initial Start-up Tests

The test summaries described in this section are identified by procedure type at the end of each test abstract title. Each type of procedure, System Operability Verification (SOV), Preoperational Test (PO), and Initial Start-up Test (IST) is described in Section 14.2.1.2 and 14.2.1.3.

The procedures were written to comply with the intent of the regulatory guides identified in Section 14.2.7. The scope and titles of these summaries may not in all cases correspond directly to the actual test procedures which were used during the Start-up and Test Program. Certain test procedures covered more than one test as described in these summaries, and in some cases, testing described in one summary may have been covered under more than one procedure. For nonsafety-related systems, the applicant reserved the right to deviate from the descriptions of testing in this section, as necessary, to ensure that a graded approach to testing remained consistent with, and was accomplished in, a cost effective manner.

14.2.12.1.1 General Prerequisites

The general prerequisites listed subsequently were normally required during the Initial Test Program in accordance with Regulatory Guide 1.68, Revision 2, Appendix C. The test prerequisites section of each test abstract included more specific prerequisites as appropriate for individual testing.

General prerequisites normally included, but were not limited to the verification of the following:

1. Rinsing, flushing, and blowout of piping and equipment.

2. Hydrostatic, pneumatic, and leak rate tests.

3. Megger and high potential tests.

4. Wire continuity checks.

5. Instrumentation and control loop calibration tests.

6. Motor rotation checks.

7. Adjustment of motor-operated valves.

8. Adjustment of air-operated valves.

9. Checking and adjustment of safety relief valves as required.

10. Initial operation of major equipment.

11. Required support systems were available to provide:

    a. Electric power,
    b. Make-up water,
    c. Instrument air,
    d. Cooling water,
    e. Lube oil, and
    f. Seal water.

12. Required calibrated test equipment was available.

13. No bus undervoltage nor motor electrical protection trips.

14. Communication established between test personnel.

14.2.12.2 Reactor Control and Protection System

14.2.12.2.1 Reactor Trip Switchgear and Control Rod Drive Motor-Generator Power Supply Test (PO)

Test Objectives

To verify proper operation and control of the reactor trip breakers, the bypass breakers, and the control rod drive motor-generator (MG) sets.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The reactor trip and bypass breakers will be tested locally and remotely for proper breaker operation and for activation of breaker position indicators and alarms. It will be verified that a manual reactor trip will both remove voltage from the undervoltage coil and energize the shunt trip coil and either action will trip the breaker.

2. The control rod drive power supply MG sets will be tested individually and checked for proper operating parameters.

3. With the plant at normal operating pressure and no load T_{avg} temperature, the MG sets will be loaded and operated in parallel and the reverse current breaker operation will be tested.

Acceptance Criteria

1. All reactor trip and bypass breakers function in accordance with the control logic and design specifications.

2. The operating parameters of the control rod drive MG set are in accordance with design specifications in all modes of operation.

14.2.12.2.2 Reactor Protection System and Engineered Safety Features Actuation System Time Response Test (PO)

Test Objectives

To determine the response times of the reactor protection system (RPS) and the engineered safety features actuation system (ESFAS) from initiating device to the output contacts of the actuation relays.

Prerequisites

1. The applicable general prerequisites, as listed Section 14.2.12.1.1, are met.

2. Special test circuitry required to produce the "step" change used as an input signal to initiate channel trip is available.

Test Methods

1. Prior to fuel load, each trip function of the RPS and ESFAS will be initiated by simulated initiating event signals.

2. The response time for RPS is divided into the following four segments: (a) sensor response time - a constant time provided by vendor; (b) analog and logic circuitry delay time - the time from event actuation to the time at which the voltage of the reactor trip breaker undervoltage coil falls below 30 percent of its initial value; (c) reactor trip breaker delay time - the time from 30 percent voltage on the undervoltage coil to the time the voltage on the reactor trip breakers is interrupted (the reactor trip breaker delay time will be recorded the first time the test is performed and then this time will be used as a constant for all subsequent tests); and (d) gripper release time - a constant time provided by vendor.

3. The response time for ESFAS will be obtained for the analog and logic circuitry including time delay for the master relay. Actuation time for slave relays will also be obtained.

Acceptance Criteria

The response times of the RPS and ESFAS are in accordance with the Technical Specifications.

14.2.12.2.3 Verification of Reactor Plant Set Points (PO)

Test Objectives

1. To verify and record the initial calibration of the reactor plant trip set points prior to fuel load.

2. To obtain a record of set points after start-up adjustments have been made during power ascension testing.

Prerequisites

Instrumentation shall have been energized a sufficient length of time to achieve stability.

Test Methods

1. Prior to fuel load, all initial reactor plant set points will be verified by using the latest plant documentation and/or actual instrumentation module settings to obtain set point values. These values and the source document will be recorded on the initial set point data sheets.

2. During plant power ascension testing, adjustments to the reactor plant set points will be noted and final values recorded.

Acceptance Criteria

Reactor plant set points, measured prior to fuel load and during power ascension testing, have been recorded and are within Technical Specification tolerance limits.

14.2.12.2.4 Solid State Protection System Cabinet Test Panel Logic Test (PO)

Test Objectives

To verify the self-testing equipment associated with the solid state protection system (SSPS), then utilize that equipment to verify the logic and master relay actuation of the SSPS.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

Using the installed test switches of the SSPS, checks will be made of Train A and Train B logic, reactor trip functions, engineered safety features actuation functions, blocking functions and permissives through the master relays, and the input continuity of the slave relays.

Acceptance Criteria

1. The self-testing capability and logic of the solid state protection system functions in accordance with design specifications.

14.2.12.2.5 Core Load Neutron Detector Checkout

Test Objectives

To verify proper alignment, calibration, and neutron response of the temporary core loading instrumentation (TCLI) and to verify nuclear instrumentation system (NIS) source range channels prior to fuel load.

Prerequisites

1. The TCLI package and a portable neutron source is available.

2. The TCLI preshipment checkout results and data are available.

3. The radiological manual for control and use of neutron test sources is available.

4. The NIS test is completed.

Test Methods

1. Prior to fuel load, the TCLI will be set up and aligned at its required location for core load.

2. Using a portable neutron source, the calibration of TCLI will be verified by determining the high voltage and discriminator settings for each channel.

3. Within eight hours prior to core loading or within any 8-hour delay in the core loading operation, the TCLI and the NIS source range channels will be checked for neutron response.

4. This test will be performed by a joint effort between Westinghouse and Unit No. 1 refueling group and is not considered a preoperational test.

Acceptance Criteria

1. Results of the on-site checkout of the TCLI agrees closely with data obtained during the preshipment equipment checkout.

2. During the response check, each of the channels respond by indicating a positive change in count rate as the neutron test source approaches its associated detector.

14.2.12.2.6 Reactor Protection System and Engineered Safety Feature Actuation System Logic Test (PO)

Test Objectives

To verify the logic combinations of the reactor protection system (RPS) and the engineered safety features actuation system (ESFAS) using signal inputs from the plant process instrumentation systems.

Prerequisites

The applicable general requirements, as listed in Section 14.2.12.1.1, are met.

Test Methods

Input signals will be applied to the solid state protection system (SSPS) from test equipment and plant process instrumentation in all logic combinations causing the SSPS to actuate the reactor trip breakers, bypass breakers, and/or the master relays. The permissive and blocking circuits will also be tested.

Acceptance Criteria

The RPS and ESFAS logics function in accordance with design specifications.

14.2.12.2.7 Start-up Adjustments to the Reactor Control System (IST)

Test Objectives

To determine adjustments required by the T_{avg} program to optimize the main steam pressure at full power operation.

Prerequisites

The plant is in operational mode 3 or 1 as required.

Test Methods

1. Testing will begin at hot standby conditions. Steam pressure and temperature readings at the steam generator outlet will be taken, and any additional measurements required to calculate rated thermal power will be obtained.

2. The power level will be increased and data will be collected at 30, 50, 75, and 100 percent power levels.

3. At 50 percent and higher power levels, adjustments will be made to the reactor control system, based upon the plant parameters, to optimize the main steam pressure and control T_{avg}.

Acceptance Criteria

1. Main steam pressure at 100 percent power is within design specifications.

2. T_{avg} at 100 percent power is within design specifications.

14.2.12.2.8 This section intentionally deleted from the FSAR.

14.2.12.2.9 This section intentionally deleted from the FSAR.

14.2.12.2.10 This section intentionally deleted from the FSAR.

14.2.12.2.11 This section intentionally deleted from the FSAR.

14.2.12.2.12 Automatic Reactor Control Test (IST)

Test Objectives

To verify the ability of the reactor control system to maintain T_{avg} during steady state conditions when placed in automatic.

Prerequisites

The plant is in operational mode 1 at approximately 30 percent power level.

Test Methods

1. The ability to automatically control the reactor operating parameters during steady state conditions will be verified by monitoring T_{avg}.

2. Control rods will be manually withdrawn to increase T_{avg} to a value above T_{ref}.

3. The reactor control system will be returned to automatic control. The pressurizer level and pressure and steam generator level control will be monitored to verify normal transient response, and T_{avg} will be monitored to verify that it returns to T_{ref}.

4. The plant will be allowed to stabilize, and a similar test will be performed by inserting the control rods manually to decrease T_{avg} to a specified valve below T_{ref}.

5. The recorded data will be evaluated to determine whether any set point changes are required to improve reactor control system performance. Transient response verification will be repeated if T_{ref} set points are changed.

Acceptance Criteria

During steady state and transient conditions, the reactor control system returns the plant to equilibrium conditions and T_{avg} returns to within design limits of T_{ref}.

14.2.12.2.13 Full Power Demonstration Test (IST)

Test Objectives

To demonstrate the reliability of the nuclear steam supply system (NSSS) by maintaining the plant at 95 to 100 percent power for 100 hours.

Prerequisites

The reactor is in operational mode 1 at 95 to 100 percent power.

Test Methods

1. A 100-Hour Reliability Demonstration Test will be performed for 100 continuous hours of operation at or near rated thermal output. During this time, primary and secondary calorimetric data will be recorded and evaluated to verify the proper operation and output of the NSSS.

2. Two separate performance measurement tests consisting of a 4-hour measurement of reactor thermal output at a nominal 100-percent power level will be performed concurrently with the reliability test. The data obtained will be utilized to calculate 4-hour thermal output averages of the NSSS.

Acceptance Criteria

The reliability of the NSSS has been demonstrated.

14.2.12.2.14 This section intentionally deleted from the FSAR.

14.2.12.2.15 Initial Core Loading

Test Objectives

To specify the sequence of loading fuel assemblies into the core.

Prerequisites

1. The water in the reactor vessel and coolant loops has been borated to a concentration that will provide minimum shutdown margin required by the Technical Specifications.

2. The residual heat removal system is in service maintaining the reactor coolant system at a temperature less than 130°F.

Test Methods

1. The sequence and placement of temporary incore neutron detectors while loading fuel assemblies will be specified.

2. The sequence and placement of fuel assemblies will be specified.

3. This test will be performed by a joint effort between Westinghouse and Unit No. 1 refueling group and is not considered a preoperational test.

Acceptance Criteria

All fuel assemblies have been verified to be in their proper location and orientation.

14.2.12.2.16 Core Loading Prerequisite and Periodic Check-Off (PO)

Test Objectives

To verify all necessary prerequisites are met prior to fuel loading.

Prerequisites

Hot functional testing has been completed.

Test Methods

1. All necessary prerequisites for fuel loading will be verified and documented.

2. Periodic surveillance verification of necessary items during fuel loading will be documented.

Acceptance Criteria

All core loading prerequisites have been met.

14.2.12.2.17 Inverse Count Rate Ratio Monitoring for Core Loading

Test Objectives

To monitor for changes in neutron population during initial core loading.

Prerequisites

1. Prerequisites for initial core loading have been completed.

2. Both temporary and permanent source range instrumentation have been installed, checked out, and are operational.

Test Method

1. Source range instrumentation data will be recorded during fuel loading.

2. This test will be performed by a joint effort between Westinghouse and Unit No. 1 refueling group and is not considered a preoperational test.

Acceptance Criteria

Minimum shutdown margin (as defined by the technical specification) is maintained.

14.2.12.2.18 Safeguards Test Cabinet Actuation Test (PO)

Test Objectives

1. To verify that all safeguards system outputs operate as required.

2. To verify the proper operation of the safeguards test cabinets.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

Each slave relay will be energized by use of test switches located in the safeguards test cabinets. Proper actuation of all engineered safety features actuation system (ESFAS) devices associated with the safeguards test cabinets will be verified.

Acceptance Criteria

1. The ESFAS devices actuate in accordance with the design specifications of the safeguards test cabinets upon actuation of their associated slave relays.

2. The safeguards test cabinet functions in accordance with its design specifications.

14.2.12.2.19 Engineered Safety Features Time Response Summary (PO)

Test Objectives

To demonstrate that the engineered safety features actuation system (ESFAS) response time of each ESFAS function is within Technical Specification limits.

Prerequisites

Reactor protection system and ESFAS time response test (14.2.12.2.2), emergency diesel generator full load test (14.2.12.55.2), and various system tests which have ESFAS equipment timed in the tests have been completed.

Test Method

The ESFAS response time of each ESFAS function will be determined by combining the response time of individual pieces of equipment recorded in the prerequisite tests and the appropriate sensor times. (Sensor times are supplied by the vendors).

Acceptance Criteria

Total ESFAS response time meet Technical Specification limits.

14.2.12.3 Control Rod Drive Mechanism System

14.2.12.3.1 Full Length Rod Control System Checkout (PO)

Test Objectives

To perform the initial checkout of the full length rod control system.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The reactor trip switchgear and control rod drive motor generator test is completed.

Test Methods

Each power and logic cabinet will be tested separately to verify satisfactory performance of the required control and indication functions of the full length rod control system. Testing will include checks on voltages, coil currents, system timing, bank overlap circuitry, and the ability to detect urgent and non-urgent alarms.

Acceptance Criteria

Control and indication functions of the full length rod control system operate in accordance with design specifications.

14.2.12.3.2 Control Rod Position Indication System Test (IST)

Test Objectives

To verify that the digital rod position indication system satisfactorily performs the required indication and alarm functions for each individual rod over the entire range of travel.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The ability of the system to indicate rod position using simulated inputs will be demonstrated.

2. The proper functioning of all circuitry will be verified including rod deviation and position monitoring outputs to the plant computer, rod bottom indicators, and alarm outputs.

Acceptance Criteria

The control rod position indication system performs indication and alarm functions over the entire range of travel in accordance with design and the Technical Specifications.

14.2.12.3.3 Control Rod Drive Mechanism Timing Test (IST)

Test Objectives

To verify proper slave cycles timing and proper operation of each full length control rod drive mechanism (CRDM).

Prerequisites

The plant is in operational mode 5 or 3 as required.

Test Methods

1. With the reactor coolant system (RCS) in the cold shutdown condition, each CRDM will be manually operated with a rod cluster control assembly (RCCA) attached. Recorder traces will be obtained while control rods are withdrawn and inserted. The traces will be evaluated to verify proper slave cycles timing and mechanism operation.

2. With the reactor coolant system (RCS) in the hot standby condition, each CRDM will be manually operated with a rod cluster control assembly (RCCA) attached. Recorder traces will be obtained while control rods are withdrawn and inserted. The traces will be evaluated to verify proper slave cycle timing and mechanism operation.

Acceptance Criteria

Control rod drive mechanism timing and operation are in accordance with design specifications.

14.2.12.3.4 Control Rod Drop Time Measurement Test (IST)

Test Objectives

To verify the drop time for each rod cluster control assembly (RCCA) under no flow and full flow reactor coolant system (RCS) conditions, with the reactor in the cold shutdown condition; and additionally to verify the drop time for each RCCA under full flow RCS conditions with the reactor in the hot standby condition.

Prerequisites

The plant is in operational mode 5 or 3 as required.

Test Methods

1. The drop time will be determined by monitoring the rod position indication signal following de-energization of the stationary winding of the RCCA drive mechanism. The drop time

will be determined in the same manner for each of the RCS conditions.

2. Rods having drop times which fall outside the two-sigma limit will undergo additional drop testing to verify performance.

3. The effectiveness of the thimble dashpot region for decelerating the rod will be monitored during each drop time measurement.

Acceptance Criteria

1. Drop times do not exceed the times stated in the Technical Specifications.

2. Rods having drop times which fall outside the two-sigma limit exhibit consistent drop times during the additional drop testing.

3. Control rod deceleration through the dashpot region is similar for all rods being dropped under the same plant conditions.

14.2.12.3.5 Rod Control System Test (IST)

Test Objectives

To demonstrate and document that the full length rod control system satisfactorily performs the required control and indication functions.

Prerequisites

The plant is in operational mode 3.

Test Methods

1. Rod motion, rod direction, rod speed and rod position indication will be verified using the digital step counters, rod position system indicator, and rod speed indicators while operating in the "individual rod bank control" mode.

2. The control rod bank overlap will be verified by setting the bank overlap digital thumb-wheel switches in the rod control system logic cabinet to a specified position and using the digital step counters while operating in the "manual" mode.

3. The operability of the control rod withdrawal inhibit functions will be demonstrated.

Acceptance Criteria

1. The control and indication functions for the rod ontrol system are in accordance with design specifications,

2. The bank overlap circuit operates in accordance with design specifications.

14.2.12.4 Reactor Incore Instrumentation System

14.2.12.4.1 Nuclear Instrumentation System Test (PO)

Test Objectives

1. To verify that indications, alarms, control functions, and set points of the nuclear instrumentation system (NIS) are aligned and properly operating for the source, intermediate, and power range instrumentation.

2. To verify the response of the source range detectors by exposure to a neutron source.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The NIS has been energized for a specified time period prior to testing.

Test Methods

1. Prior to full load, the source, intermediate, and power range instrumentation will be tested as required using a simulated test input signal to verify that the indications, alarms, control functions, and set points associated with each detector are aligned and properly operating. Proper output signals will be verified.

2. Each source range detector will be exposed to a neutron source and the high voltage and discriminator voltage setting will be properly adjusted. The high voltage will then be varied to verify the loss of detector voltage alarm.

Acceptance Criteria

The NIS source range channels respond to the test source and the source, intermediate, and power range channels are calibrated in accordance with design specifications.

14.2.12.4.2 Alignment of Nuclear Instrumentation System (IST)

Test Objectives

To operationally align the nuclear instrumentation system.

Prerequisites

The NIS Test is completed.

Test Methods

1. Prior to initial criticality, the initial trip set points for the intermediate range and power range channels will be established and recorded.

2. The gain settings for the flux deviation averaging amplifier will be determined.

3. During power ascension, the amount of overlap between source range and intermediate range channels, and between intermediate range and power range channels will be determined.

4. Adjustments will be made as required to align the nuclear instrumentation with the calorimetric power measurements.

5. Post-shutdown measurements and adjustments of the NIS will be performed following a planned reactor trip.

Acceptance Criteria

The NIS is operationally aligned in accordance with design specifications.

14.2.12.4.3 Initial Approach to Criticality Test (IST)

Test Objectives

To achieve reactor plant initial criticality.

Prerequisites

The plant is in operational mode 3.

Test Methods

1. All control rods will be withdrawn to a predetermined point. Continuous dilution will be initiated until criticality is reached; plots of the inverse neutron count rate ratio are continuously monitored.

Acceptance Criteria

1. Initial criticality is achieved.

14.2.12.4.4 Low Power Physics Test (IST)

Test Objectives

To verify that key parameters of the core are in agreement with core design.

Prerequisites

1. Initial approach to criticality test is completed.

2. The plant is at hot zero power.

Test Methods

1. The hot zero power (HZP) physics testing decade will be determined by identifying where nuclear heating starts to occur.

2. A check on the reactivity computer will be performed by measuring the doubling time of the reactor flux after the indicated reactivity stabilizes at a constant value.

3. Boron endpoint measurements will be performed to find the endpoint values of the critical boron concentrations at selected rod configurations.

4. The RCS T_{avg} will be changed by dumping main steam to the condenser, and the isothermal temperature coefficient of reactivity will be measured. The moderator temperature coefficient will be derived from the isothermal data.

5. An All Rods Out Movable Detector Flux Map will be taken to determine the initial flux distribution in the core and to verify correct core loading and hot channel factors.

6. The highest worth control bank (reference bank) will be diluted into the core to measure its reactivity worth. All other reactivity worth measurements will be done by bank exchange with the reference bank.

7. The differential boron worth will be calculated from rod worth data and boron endpoint measurements.

Acceptance Criteria

1. The boron endpoints are in accordance with design specifications.

2. The HZP physics testing decade is determined.

3. The accuracy of the reactivity computer output is verified against calculated reactivity values.

4. The moderator temperature coefficient and hot channel factors are in accordance with the Technical Specifications.

5. The measured RCCA bank worths are in accordance with the core design predictions.

6. The measured differential boron worth is in accordance with design predictions.

14.2.12.4.5 Power Coefficient Measurement (IST)

Test Objectives

To verify design predictions of the Doppler only power coefficient.

Prerequisites

The plant is in operational mode 1 with reactor power level established as required.

Test Methods

1. The plant will be increased to the specified power level and allowed to stabilize.

2. Secondary plant calorimetric data will be obtained to determine core thermal power output.

3. T_{avg} and ΔT data will be collected during load changes.

4. Using T_{avg}, ΔT, and the core power calculated from the secondary plant calorimetric data, core thermal power output is calculated before and after each load change.

5. Data will be analyzed to determine the Doppler only power coefficient.

Acceptance Criteria

The power coefficient is in accordance with core design predictions.

14.2.12.4.6 Alignment of Process Temperature Instruments (IST)

Test Objectives

To align the ΔT and T_{avg}, process instrumentation.

Prerequisites

The plant is in operational mode 3 or 1 as required.

Test Methods

1. Prior to initial criticality, isothermal reactor coolant system (RCS) conditions will be established to initially align the ΔT, and T_{avg} instrumentation of the process control system.

2. The ΔT and T_{avg} process instrumentation will be aligned at power levels up to approximately 75 percent power. At approximately 75 percent power, the 100 percent power ΔT and T_{avg} value for each channel will be determined by extrapolating the data taken during performance of Thermal Power Calorimetric Measurements.

3. At approximately 100 percent power, the alignment of the ΔT and T_{avg} channels will be checked for agreement with the results of the Thermal Power Calorimetric Measurements. Channels will be realigned as necessary.

Acceptance Criteria

The extrapolated 100 percent value of ΔT and T_{avg} for each channel is within acceptable limits of the average of all channels.

14.2.12.4.7 Thermal Power Calorimetric Measurements (IST)

Test Objectives

To determine the reactor core thermal power output from secondary side calorimetric measurements at approximately 30-, 50-, 75-, 90-, and 100-percent power levels.

Prerequisites

The plant is in operational mode 1 with reactor power level established as required.

Test Methods

1. The plant will be verified to be at steady state conditions. Secondary plant calorimetric data, such as steam pressure, feedwater flow, and feedwater temperature will be measured. Steam generator blowdown operating parameters will be measured if the system is not isolated.

2. Reactor core thermal power output will be calculated from the calorimetric data accounting for heat losses and heat gains from the reactor coolant pumps.

Acceptance Criteria

Not applicable

14.2.12.4.8 Incore/Excore Detector Calibration for Axial Offset Measurement

Test Objectives

1. To demonstrate that the response of the excore power range detectors is linear with respect to incore axial power distribution.

2. To calibrate the excore power range detector input and excore power range detector signals.

Prerequisites

Test data is available from a minimum of three movable detector flux maps obtained over a range of incore axial offsets.

Test Methods

1. Calculations, utilizing prior test data, will be performed to demonstrate that the response of the excore power range detectors is linear with respect to incore axial power distribution.

2. The excore power range detector input will be calibrated to the ΔT reactor trip set point calculator.

3. The excore power range detector signals to the axial flux difference, Δq, meters, and flux recorders will be calibrated.

Acceptance Criteria

1. The response of the excore power range detectors is linear with respect to incore axial power distribution.

2. The excore power range detector input and excore power range detector signals are properly calibrated.

14.2.12.5 Reactor Incore Instrumentation System

14.2.12.5.1 Incore Moveable Detector System Checkout (IST)

Test Objectives

1. To demonstrate system operation for incore flux mapping.

2. To provide a check of the associated leak detection and gas purge subsystems.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. Fuel loading is complete.

Test Methods

1. Prior to initial criticality, each detector drive assembly will be tested in the insert and withdrawal mode for each detector path to demonstrate proper operability of the system. The top and bottom core set points will be established for each detector path within the core.

2. The leak detection system will be checked for proper operation by manually simulating a leak with the float pressure switch and verifying that the drain valve opens and the alarm actuates.

3. The gas purge system will be checked for proper operation by measuring a slightly positive pressure on the outlet tube of one ten path transfer device.

Acceptance Criteria

1. The incore moveable detector system functions in accordance with design specifications.

2. The leak detection and gas purge systems operate in accordance with design specifications.

14.2.12.5.2 Incore Thermocouple and Resistance Temperature Detector Cross Calibration (PO)

Test Objectives

To provide the functional checkout and cross calibration data for the incore thermocouples and resistance temperature detectors (RTD).

Prerequisites

The applicable general prerequisites as listed in Section 14.2.12.1.1, are met.

Test Methods

1. This test will be initiated at the start of hot functional testing, during the heatup of the reactor coolant system (RCS).

2. At specified RCS temperature plateaus, primary plant heatup will be terminated and temperature measurements of the RCS, RTDs and incore thermocouples will be taken and recorded.

3. The “true temperature” at each specified temperature plateau of the RCS will be determined from the average of the RTDs and isothermal correction factors calculated for each thermocouple.

4. The average RTD data will be used as a basis for any required installation corrections for individual RTDs.

5. The RTDs disconnected for this test will be reconnected. and during the cooldown of the RCS, data will be taken to verify proper reconnection of each RTD.

Acceptance Criteria

Each RTD and thermocouple readout is within design tolerances of the RCS true temperature for each temperature plateau.

14.2.12.5.3 Measurement of Core Parameters During Steady State Conditions (IST)

Test Objective

To measure the core performance parameters by development of incore flux maps using incore movable detectors and thermocouple systems at any plant power level.

Prerequisites

The plant is in operational mode 1 or 2.

Test Methods

1. The plant will be at steady state conditions at each specified power level.

2. The incore movable detectors will be used to obtain core flux data.

3. The incore thermocouples will be used to obtain core temperature data.

4. Full core flux and thermocouple maps will be obtained.

5. Flux mapping and thermocouple measurements will be analyzed for determination of core performance parameters, such as radial and axial peak factors.

Acceptance Criteria

Core flux and thermocouple maps are obtained at applicable power levels and the data obtained is in accordance with design specifications.

14.2.12.6 Plant Process Controls System

14.2.12.6.1 Condenser Steam Dump System Test (SOV)

Test Objectives

To verify that the condenser steam bypass control valves operate properly under simulated and actual steam dumping conditions.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The steam bypass valves and control system will be tested by imposing simulated signals to verify that the valves will modulate in the proper sequence from the steam header pressure controller, load rejection controller, and the plant trip controller.

2. With the plant at no load T_{avg} temperature and pressure, a timing test for each steam bypass valve will be conducted.

Acceptance Criteria

1. Condenser steam bypass control valves operate in accordance with control logic.

2. Opening and closing times of the steam bypass valves are in accordance with design specifications.

14.2.12.6.2 Emergency Shutdown Panel and Alternate Shutdown Panel Test (PO)

Test Objectives

To demonstrate that plant conditions can be maintained and cooled down from the emergency shutdown panel and from the alternate shutdown panel.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The plant is undergoing hot functional testing with the reactor coolant system (RCS) temperature (T_{avg}) greater than 350°F.

Test Methods

1. Control will be transferred from the control room and plant conditions will be controlled from the emergency shutdown panel and from the alternate shutdown panel without assistance from the control room.

2. The potential for cold shutdown will be demonstrated by initiating the RHR system and reducing reactor coolant system (RCS) temperature (T_{avg}) by 50°F from the emergency shutdown panel and from the alternate shutdown panel without assistance from the control room.

Acceptance Criteria

1. Control can be transferred and plant conditions can be maintained and controlled from the emergency shutdown panel and from the alternate shutdown panel.

2. The RHR system can be initiated, controlled, and used to decrease the RCS temperature (T_{avg}) at least 50°F from the emergency shutdown panel and from the alternate shutdown panel.

14.2.12.6.3 Automatic Steam Dump Control Test (IST)

Test Objectives

To verify the operability of the steam dump controllers for the condenser steam bypass control valves during low power testing.

Prerequisites

The plant is in operational mode 2.

Test Methods

1. The response and stability of the controllers in the condenser steam dump system under automatic control (load rejection controller, turbine trip controller, and steam header pressure controller) will be verified by monitoring system parameters.

Acceptance Criteria

The operation and response of the steam dump controllers are in accordance with design specifications and control logic.

14.2.12.6.4 Shutdown from Outside the Control Room, and Verification of the Potential for Cold Shutdown (IST)

Test Objectives

To demonstrate that the plant can be safely shut down from outside the control room.

Prerequisites

1. Backup licensed plant operating personnel are available in the control room and other locations for operational support, if required, during the test.

2. The plant is in operational mode 1.

Test Methods

1. At 10 to 25 percent power level, a plant trip will be initiated from the reactor trip switchgear.

2. Control will be transferred from the control room and the plant will be maintained in hot standby with a minimum shift crew for at least 30 minutes without assistance from the control room from the emergency shutdown panel and from the alternate shutdown panel.

3. The reactor operator will verify proper control of the primary plant parameters from the emergency shutdown panel and from the alternate shutdown panel.

4. The potential for cold shutdown will be demonstrated by initiating the RHR system and reducing reactor coolant system (RCS) temperature (T_{avg}) by at least 50°F from the emergency shutdown panel and from the alternate shutdown panel without assistance from the control room.

Acceptance Criteria

1. The plant can be safely shut down, maintained in hot standby and controlled from the emergency shutdown panel and from the alternate shutdown panel.

2. The RHR system can be initiated, controlled, and used to decrease the RCS temperature (T_{avg}) at least 50°F from the emergency shutdown panel and from the alternate shutdown panel.

14.2.12.6.5 Verification of Plant Performance Following Turbine Trip Coincident With Loss-of-Offsite Power at Load (IST)

Test Objectives

To verify that the plant can sustain a trip from 10- to 30-percent power due to a turbine trip coincident with a loss-of-offsite power. Proper operation of the turbine-driven auxiliary feedwater pump will be verified with a loss of offsite power.

Prerequisites

The plant is in operational mode 1 at 10- to 30-percent power.

Test Methods

1. All offsite power sources will be isolated from the plant by preventing auto transfer of the 4 kV bus.

2. The turbine will be manually tripped, initiating a plant trip and starting the diesel generators. Emergency bus loads sequencing onto the diesel generators will be verified.

3. The parameters of the reactor and turbine auxiliaries will be monitored for a minimum of 30 minutes to verify stable plant conditions when powered by the emergency diesel generators.

4. The turbine-driven auxiliary feedwater pump will be verified to cold, quick start automatically and operate for at least 1/2 hour or until the plant stabilizes with loss of all offsite power.

Acceptance Criteria

1. The ability of the plant to sustain a turbine trip coincident with loss-of-offsite power at load has been demonstrated.

2. The turbine-driven auxiliary feedwater pump automatically, quick starts, and remains within design limits with respect to bearing/bearing oil temperatures and vibration. Pump room ambient conditions (temperature, humidity) do not exceed environmental qualification limits for safety-related equipment in the room.

14.2.12.6.6 Load Swing Test (IST)

Test Objectives

To verify the proper transient response of the plant and the automatic control systems during step and ramp load changes at various plant power levels and to demonstrate the ability of the charging system to respond to step load changes.

Prerequisites

1. Required plant control systems are in the automatic control mode.

2. The plant is in operational mode 1 with reactor power level established as required.

Test Methods

1. Design step and ramp load changes will be applied at each power level (approximately 30, 50, and 100 percent) during power ascension testing.

2. The primary and secondary plant parameters will be monitored as required to verify the proper response of the plant and its automatic control systems.

Acceptance Criteria

Plant parameters remain within design specifications throughout the application of each load change, and the automatic control systems re-establish stable operation at each new power level.

14.2.12.6.7 Large Load Reduction Test For Turbine Runback (IST)

Test Objectives

To verify the proper transient response of the plant and the automatic control systems during the load reduction as a result of a turbine runback and to demonstrate the ability of the charging system to respond to large step load reductions.

Prerequisites

The plant is in operational mode 1 at a steady state power level of approximately 75 percent power.

Test Methods

1. At a power level of approximately 75 percent, a 50-percent power decrease will be initiated by rapidly closing governor valve until the primary plant reaches the turbine desired power level. The rate of power change should be approximately 200 percent per minute.

2. The transient plant parameters will be monitored as required to verify the proper response of the plant and its automatic control systems.

3. When the lower power level is reached, the reactor control rods will be manually adjusted for plant operation at the new load.

Acceptance Criteria

1. The reactor and turbine do not trip during the test.

2. The automatic control systems return the plant to a stable operating condition, and the plant operating parameters are within design specifications.

14.2.12.6.8 Verification Of Plant Performance Following Plant Load Rejection/Trip From Power (IST)

Test Objectives

To verify the proper transient response of the automatic control systems following a net load rejection from 100 percent power and a plant trip from 100 percent power.

Prerequisites

1. The plant is in operational mode 1 near 100 percent rated thermal power as appropriate.

2. Plant trips at lower power levels have been performed during power ascension testing.

Test Methods

1. At 100 percent power, a net load rejection will be initiated by tripping the main transformer 345 kV power circuit breakers. At 100 percent power, a plant trip will be initiated by tripping the main turbine.

2. The plant parameters will be monitored as required to verify the proper operation of the plant and automatic control systems.

3. The response time of the reactor coolant system (RCS) hot leg resistance temperature detectors (RTDs) will also be verified during the plant trip from 100 percent power.

Acceptance Criteria

1. Plant response to the net load rejections and plant trip are in accordance with design specifications.

2. The response times of the RCS hot leg RTDs are within design specifications.

14.2.12.6.9 This section intentionally deleted from the FSAR.

14.2.12.7 Main Computer System

14.2.12.7.1 Computer Input and Printout Data Test (SOV)

This section has intentionally been deleted.

14.2.12.7.2 Computer Operability Test (SOV)

This section has intentionally been deleted.

14.2.12.7.3 Verification of Performance Calculation (SOV)

Test Objectives

To verify that the computer generated performance calculations and nuclear steam supply system (NSSS) and balance of plant (BOP) programs are accurate at various power levels.

Prerequisites

The plant is in operational mode 1 with reactor power level established as required.

Test Methods

1. Computer input signals from process sensors will be verified correct at various power levels.

2. It will be verified that the computer will correctly perform and report computer calculations to obtain plant operating characteristics from the primary and secondary plants. The accuracy of plant operating characteristics will be verified. Parameters to be verified include containment humidity and temperature monitors.

Acceptance Criteria

The plant operating characteristics calculated by the computer are accurate and in accordance with design specifications and tolerances.

14.2.12.8 Reactor Coolant System

14.2.12.8.1 Cold Hydrostatic Test Of The Reactor Coolant System (PO)

Test Objectives

To verify the mechanical integrity and leak tightness of the reactor coolant system (RCS).

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. Provisions shall be made to permit inspection for primary to secondary steam generator leakage.

Test Methods

1. The RCS temperature will be increased and maintained at a temperature that prevents the possibility of brittle fracture during testing.

2. The RCS will be slowly pressurized in increments to a hydrostatic test pressure in accordance with the applicable ASME Codes.

3. A visual inspection of the system piping and components within the hydrostatic test boundary will be conducted at each pressure plateau to ascertain system integrity.

4. The final test pressure will be held for a specified time period; pressure will then be reduced to and maintained at design pressure until a final detailed inspection of all piping, valves, flanges, welds and vessels is completed.

Acceptance Criteria

1. Leakage from welded joints, castings, or integral metal portions of the system is within acceptable limits.

2. Leakage from mechanical joints shall be recorded, repaired, and retested at operational pressure at some later date.

14.2.12.8.2 Reactor Coolant Pump Initial Performance Test (PO)

Test Objectives

To verify that the reactor coolant pumps (RCPs) are ready for hot functional testing and initial start-up.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The Reactor Coolant Pump Seal Injection and Bearing Cooling Water Test is completed.

Test Methods

1. During the initial filling and venting of the reactor coolant system (RCS), the RCPs will be jogged briefly to verify that they operate in accordance with design specifications.

2. The RCPs and reactor coolant lift oil pump will be tested to verify the pumps function in accordance with the control logic.

3. The operating parameters of the RCPS and support systems will also be monitored during hot functional testing.

Acceptance Criteria

1. The RCPs and lift oil pump function in accordance with the control logic.

2. The operating parameters of each RCP and support system meet the design specifications during cold and hot functional testing.

14.2.12.8.3 Reactor Coolant Pump Seal Injection And Bearing Cooling Water Test (PO)

Test Objectives

1. To verify the ability of the seal injection system to provide and monitor seal injection water flow to, and leakoff flow from the RCP.

2. To verify that the RCP bearing cooling water system prevents RCP bearings from over heating during operation.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each seal water supply and return valve will be tested to verify that the valve functions in accordance with the control logic.

2. The thermal barrier isolation valve and the bearing cooling water isolation valve will be tested to verify that the valves function in accordance with the control logic.

3. The seal injection filter high differential pressure alarm set point and the low flow alarm set point to each injection line will be verified.

4. The No. 1 seal leakoff high and low flow alarm setpoints and the bypass low flow alarm setpoint will be verified for each RCP.

5. During hot functional testing, the flow rate of seal water to, and leakoff from each RCP will be measured and adjusted, required, using the system throttle valve.

6. Flow rate and temperature of the bearing cooling water and bearing temperature will be measured.

Acceptance Criteria

1. The valves for the RCP seal injection system and cooling system function in accordance with the control logic.

2. The RCP seal injection system and cooling system operate in accordance with design specifications.

14.2.12.8.4 Reactor Coolant Loop Isolation Valves Initial Checkout (PO)

Test Objectives

To demonstrate proper operation of the reactor coolant loop isolation and bypass valves.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each cold leg isolation valve, hot leg isolation valve, and isolation bypass valve will be tested to verify that the valve functions in accordance with the control logic.

2. During loop isolation and bypass valve operation, the valve operating parameters will be obtained.

Acceptance Criteria

The isolation and bypass valves function in accordance with the control logic and design specifications.

14.2.12.8.5 Reactor Coolant Loop Isolation Valve Test (PO)

Test Objectives

To demonstrate that a loop can be isolated and returned to service.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The Reactor Coolant Loop Isolation Valves Initial Checkout Test has been completed.

Test Methods

1. During hot functional testing with the reactor coolant pump (RCP) in the loop undergoing testing secured, the loop isolation valves will be operated to determine opening and closing stroke times and valve motor currents.

2. Valve and temperature interlocks will be verified, with the cold leg isolation valve closed, in the loop under test. When the interlocks have been satisfied, the valve will be reopened returning the isolated loop to service.

Acceptance Criteria

The ability to isolate a loop and return it to service is demonstrated.

14.2.12.8.6 Testing Of Pressurizer Relief Tank and Power-Operated Relief Valves and Temperature Alarms (PO)

Test Objectives

To verify proper operation of the pressurizer relief tank (PRT) and the power-operated relief valves (PORVS).

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. Nitrogen supply is available.

Test Methods

1. The response of level instrumentation, alarms, and PRT spray valve trips will be tested during the filling and draining of the PRT.

2. The ability of the nitrogen supply system to maintain the required PRT pressure will be verified.

3. While the PRT is being filled, the time, PRT pressure, and level will be recorded to calculate the spray flow rate to the PRT by a timed change in level.

4. During hot functional testing, the PRT sparger will be checked to establish steam flow from the pressurizer.

5. The PORV stroke times will be tested at temperature.

Acceptance Criteria

The PRT, PORVS, and associated systems operate in accordance with design specifications and control logic.

14.2.12.8.7 Pressurizer Pressure and Level Control Test (PO)

Test Objectives

To verify the operation and set points of the pressurizer pressure and level control instrumentation.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The primary plant is at normal operating pressure and no load T_{avg}O temperature with a steam bubble and level established in the pressurizer.

Test Methods

1. The proper set points of the pressurizer pressure control system will be verified by varying reactor coolant pressure and observing the actions of the heaters, sprays, and alarms.

2. The proper operation of the pressurizer level control system will be verified by adjusting the pressurizer level from its low level alarm to its high level alarm and observing the actions of the chemical and volume control system and associated components.

3. The PORV setpoints and reset-points will be tested at temperature.

Acceptance Criteria

Operation and set points of the pressurizer level and pressure controllers are in accordance with design specifications.

14.2.12.8.8 Integrated Hot Functional Test (PO)

Test Objectives

To demonstrate the satisfactory performance of the reactor coolant and associated auxiliary systems and components during reactor coolant system (RCS) heatup, at normal operating pressure and temperature, and during RCS cooldown.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The capability of installed systems and equipment to bring the plant, without nuclear heat, from a cold condition to normal operating temperature and pressure and return the plant to a cold condition will be verified.

2. The capability of the installed auxiliary systems and equipment to maintain RCS parameters during hot functional testing will be verified.

Acceptance Criteria

1. Satisfactory heatup, hot operation, and cooldown is demonstrated.

2. Systems and components checked during hot functional testing function in accordance with design specifications and control logic.

14.2.12.8.9 System Vibration and Thermal Expansion Testing Prior to Hot Functional Testing (PO), During Hot Functional Testing (PO), and During Power Ascension Testing (IST)

Test Objectives

1. To verify that piping, restraints, components, and supports maintain vibration within acceptable levels during steady state and transient operating conditions for the systems and operating modes listed in Table 3.9B-1.

2. To verify unrestrained thermal growth of piping, restraints, components, and supports during various operating modes for the systems listed in Table 3.9B-1.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Monitor piping vibrations at selected test locations during steady state and transient operating conditions for the systems and operating modes listed in Table 3.9B-1.

2. Inspect pipe supports for binding of restraints and inspect piping and components for evidence of interference or restricted movement during various operating modes for the systems listed in Table 3.9B-1.

Acceptance Criteria

1. Piping vibration levels are within specified limits.

2. Piping, restraints, components, and supports demonstrate unobstructed motion within design limits during heatup and cooldown.

14.2.12.8.10 Pressurizer Continuous Spray Flow Test (PO)

Test Objectives

To verify the minimum continuous spray flow required to the pressurizer.

Prerequisites

The primary plant is at normal operating pressure and no load T_{avg} temperature.

Test Methods

1. The spray flow needle valves will be adjusted until the minimum continuous spray flow required to the pressurizer is achieved such that the following conditions are met:

   a. The temperature remains less than the maximum differential temperature allowed between the pressurizer and the spray line temperature.

   b. Spray line temperature is above the low temperature alarm set point.

2. This procedure will be repeated after fuel loading.

Acceptance Criteria

The required minimum continuous spray flow to the pressurizer is established.

14.2.12.8.11 This section intentionally deleted.

14.2.12.8.12 Reactor Coolant System Leak Rate Test (IST)

Test Objectives

To determine the integrated leakage rate of the reactor coolant system (RCS).

Prerequisites

The plant is in operational mode 3.

Test Methods

1. A visual inspection of the RCS will be conducted, looking for leaks at such places as the reactor coolant pump seals, valve packing glands, resistance temperature detector penetrations and other boundaries and components.

2. A leakrate test will be performed on the RCS with the system at normal no-load pressure and temperature by performing an inventory balance on the RCS.

Acceptance Criteria

The RCS leakage is in accordance with Technical Specification limits.

14.2.12.8.13 Pressurizer Heater and Spray Capability Test (IST)

Test Objectives

To verify the effectiveness of the pressurizer heaters and sprays.

Prerequisites

The plant is in operational mode 3.

Test Methods

1. The effectiveness of the pressurizer sprays will be evaluated by de-energizing the pressurizer heaters and initiating pressurizer spray to determine the rate of pressure reduction.

2. After re-establishing normal operating pressure, the pressurizer sprays will be isolated and the effectiveness of the pressurizer heaters will be evaluated by energizing the pressurizer heaters and determining the rate at which pressure increases.

3. Under simulated natural circulation conditions (i.e. one reactor coolant pump in operation not in a loop with pressurizer spray or surge line) pressure will be reduced by turning off pressurizer heaters and noting depressurization rate. After restoring pressure to normal, the heaters will be turned off and pressure reduced by use of auxiliary spray. The effects of changes in charging flow and steam flow on margin to saturation temperature will be observed.

Acceptance Criteria

1. The rate of change of pressurizer pressure, during pressurizer spray and heater tests, are within design specification limits.

2. Under simulated natural circulation conditions, test data will be recorded and will be available for simulator update as necessary, with no acceptance criteria applied.

14.2.12.8.14 Resistance Temperature Detector Bypass Loop Flow Verification (IST)

Test Objectives

To verify that the resistance temperature detector (RTD) bypass manifold transport times are in accordance with design specifications.

Prerequisites

1. The plant is in operational mode 3.

2. A portion of this test is performed prior to RCS cold hydro.

Test Methods

1. The lengths of piping of the hot and cold leg RTD bypass loop of each reactor coolant loop will be measured. The flow rate necessary to achieve a specified transport time for each RTD bypass loop will be calculated.

2. The RTD bypass flow rate of each reactor coolant loop will be measured at full flow conditions. The RTD bypass flow will be reduced by slowly closing one of the hot leg RTD bypass isolation valves. The flow alarm set point will be checked to see if it actuates at the specified flow rate. The hot and cold leg RTD bypass flows will be measured, and the transport times calculated and compared to the specified transport time.

Acceptance Criteria

1. The transport time in the hot and cold leg RTD bypass loops is in accordance with design specifications.

2. The low flow alarm actuates in accordance with design specifications.

14.2.12.8.15 Reactor Coolant System Flow Measurement (IST)

Test Objectives

To verify predicted reactor coolant system (RCS) flow rates prior to criticality and prior to escalation above 50, 75, 90, and 100 percent power with three loops operating.

Prerequisites

1. The plant is in operational mode 3.

2. Instrumentation used for measuring the parameters shall be available.

Test Method

Prior to criticality, loop elbow differential pressure will be used to measure the RCS flow rate. Prior to escalation above 50, 75, 90, and 100 percent power, secondary side calorimetric data will be used to verify RCS flow rate.

Acceptance Criteria

The measured RCS flow rates are within design flow limits

14.2.12.8.16 Reactor Coolant System Flow Coastdown Test (IST)

Test Objectives

To measure the reactor coolant system (RCS) flow rate decrease subsequent to reactor coolant pump (RCP) trips.

Prerequisites

1. The plant is in operational mode 3.

2. The RCS Flow Test is complete.

Test Methods

1. With all three RCPs in operation, the RCPs will be simultaneously tripped and the rate at which reactor coolant flow rate decreases will be measured.

2. The delay times associated with low flow trip, RCP bus undervoltage trip, and underfrequency trip will be measured.

Acceptance Criteria

The rate of reactor coolant flow decrease and associated trip delay times are in accordance with design specifications.

14.2.12.8.17 This section has intentionally been deleted from the FSAR.

14.2.12.8.18 Reactor Vessel Head Vent System Test (PO)

Test Objectives

To demonstrate that the valves associated with reactor vessel head vent system operate in accordance with their control logics and to demonstrate flow through the system valves.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The pressurizer relief tank is available to accept discharge from the reactor vessel head vent system.

Test Methods

1. Prior to hot functional testing, the reactor vessel head vent, vent isolation, and throttle valves will be opened and closed to verify they function in accordance with their control logics. The valves will be tested to fail to the closed position on a loss of power. Reactor vessel head vent and vent isolation valves will be stroke-timed in the open and closed directions.

2. The opening and closing of the system valves will be verified at reduced temperature and pressure.

Acceptance Criteria

Reactor vessel head vent, vent isolation, and throttle valves operate in accordance with their control logics and open and close under reduced temperature and pressure conditions.

14.2.12.9 Chemical and Volume Control System

14.2.12.9.1 Charging Pumps and Controls Test(PO)

Test Objectives

To verify the proper operation and control of the charging pumps and the charging pump auxiliary lube oil pumps.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The charging pumps, the auxiliary lube oil pumps, and associated valves will be tested to verify that the pumps and valves function in accordance with the control logic.

2. Operating parameters, including response times, will be obtained to evaluate the performance of the charging pumps and lube oil system during miniflow conditions.

Acceptance Criteria

The charging pumps and the auxiliary lube oil pumps and associated valves function in accordance with the control logic and design specifications.

14.2.12.9.2 Boric Acid Transfer System Test (PO)

Test Objectives

To verify the proper operation of the boric acid transfer system equipment and controls.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each boric acid transfer pump will be tested to verify that the pump functions in accordance with the control logic and design specifications.

2. The operability of the heaters, controls, level and temperature alarms for the boric acid tanks, and the boric acid batching tank, will be verified.

Acceptance Criteria

1. The boric acid transfer pumps function in accordance with the control logic and design specifications.

2. Proper operation of the heaters, controls, and alarms for the boric acid tanks and batching tank is demonstrated.

14.2.12.9.3 Chemical and Volume Control System Test (PO)

Test Objectives

To verify the operability of the chemical and volume control system (CVCS).

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. During hot functional testing, proper functioning of the volume control tank level system, diversion valves, and cover gas system will be verified.

2. Proper operation of excess letdown, purification demineralizers, reactor coolant pump seal water return, and chemical control and makeup will be verified.

3. Proper operation of heat exchangers, letdown orifices, and control valves in the charging and letdown flow paths will be verified.

4. The operation of the boron recovery degasifier, purification, and filtration system will be verified.

5. System alarms and set points will be verified.

Acceptance Criteria

The CVCS functions in accordance with design specifications.

14.2.12.9.4 This section has intentionally been deleted from the FSAR.

14.2.12.9.5 Failed Fuel Detection System Test (IST)

Test Objectives

To verify the operability of the failed fuel detection system.

Prerequisites

1. High and low radiation monitor channels have been energized for a minimum of 1 hour prior to testing.

2. The plant is in operational mode 1.

Test Methods

1. The reactor coolant letdown monitors will be tested to establish high and low voltage and alarm settings.

2. The reactor coolant letdown detectors will be tested to verify their response to a check source.

3. The reactor coolant letdown detectors will be read and reactor coolant letdown samples gross activity recorded at various power levels to establish initial baseline data.

Acceptance Criteria

1. The high and low voltage and alarm set points of the reactor coolant letdown monitor are within design specifications.

2. Initial baseline data has been obtained.

3. The reactor coolant letdown detector readings have been compared to the reactor coolant letdown sample activity.

14.2.12.10 Nuclear Vents and Drains System

14.2.12.10.1 Primary Drains Transfer System Test (SOV)

Test Objectives

To verify proper operation of the primary drains transfer system.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The nitrogen supply system is available.

Test Methods

1. Each primary drains transfer pump will be tested to verify that the pump functions in accordance with the control logic and design specifications.

2. Each discharge header isolation valve associated with the transfer pump, the primary drains tank vent header isolation valve, and each primary drains tank nitrogen supply valve will be tested to verify that the valve functions in accordance with the control logic.

3. Each primary drains transfer tank (PDTT) will be filled and the associated pump controls, tank pressure, and level controls will be operationally checked.

4. A capacity versus level calibration curve will be generated for each PDTT.

5. During hot functional testing, draining of primary coolant to the primary drains cooler will be performed to verify satisfactory cooler performance.

Acceptance Criteria

Primary drain transfer system components function in accordance with the control logic and design specifications.

14.2.12.10.2 Reactor Coolant Vent and Drain System Test (SOV)

Test Objective

To demonstrate system sump pump functions in accordance with the control logic.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1., are met.

Test Methods

1. Each sump pump, the associated discharge isolation valve and level indicator will be tested to verify the equipment functions in accordance with the control logic.

Acceptance Criteria

System sump pumps function in accordance with the control logic and design specifications.

14.2.12.10.3 Containment Drains and Unidentified Leak Rate Systems Test (SOV)

Objective

To verify containment sump pumps, containment isolation valves and unidentified leak rate (UIL) systems operate properly.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. A liquid waste drain (LWS) tank is available.

Test Methods

1. Containment sumps will be filled to allow pump controls and containment isolation valves to operate with discharge to a LWS tank.

2. A known leak rate will be introduced to the sumps to determine UIL system sensitivity and ability to operate sump pumps.

Acceptance Criteria

Containment sump system demonstrates proper pump and valve control capabilities and UIL system sensitivity and control capabilities operate within specification.

14.2.12.11 Residual Heat Removal System

14.2.12.11.1 Residual Heat Removal System Test (PO)

Test Objectives

To verify the proper operation of the residual heat removal (RHR) system pumps.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each RHR pump will be tested to verify the pump functions in accordance with the control logic.

2. Each RHR isolation valve will be tested to verify the valve functions in accordance with the control logic.

3. The operability of each RHR pump will be verified by measuring its operating parameters during recirculation and normal flow.

4. During RCS cooldown, the heat removal capability of the RHR system will be verified.

Acceptance Criteria

1. The RHR pumps and isolation valves function in accordance with the control logic.

2. The operating parameters of the RHR pumps are in accordance with design specifications.

3. The heat removal capability of the RHR system is within design specifications.

14.2.12.12 Safety Injection System

14.2.12.12.1 Low Head Safety Injection Pumps and Controls Test (PO)

Test Objectives

To verify proper operation of the low head safety injection (LHSI) pumps and controls during miniflow operation.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. An adequate water supply from the refueling water storage tank (RWST) is provided.

Test Methods

1. Each LHSI pump, the associated suction and discharge valves, and the minimum flow recirculation valve will be tested to verify that they function in accordance with the control logic.

2. The operating parameters of each LHSI pump will be measured during miniflow conditions.

Acceptance Criteria

1. The LHSI pumps and associated valves function in accordance with the control logic.

2. The operating parameters of the LHSI pumps are in accordance with design specifications.

14.2.12.12.2 Safety Injection Check Valve Test (PO)

Test Objectives

To verify proper operation of the safety injection system (S1S) check valves under hot operating conditions.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The reactor coolant system (RCS) is at normal operating pressure and temperature conditions during hot functional testing.

Test Methods

1. Proper operation of the high head safety injection and low head safety injection check valves will be verified.

2. During RCS cooldown, the operation of the accumulator check valves will be verified.

Acceptance Criteria

The SIS check valves function in accordance with design specifications.

14.2.12.12.3 Safety Injection Flow Test (PO)

Test Objectives

To demonstrate the flow capability of the safety injection accumulators and the high and low head safety injection pumps.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The Charging Pumps (high head safety injection (HHSI) pumps), and Controls Test and the Low Head Safety Injection System (LHSI) Pumps and Controls Tests are completed.

3. This test shall be performed with the reactor vessel head removed.

Test Methods

1. The safety injection accumulators will be discharged into the RCS. The rate of level and pressure decrease in each accumulator will be monitored.

2. The HHSI pumps will be operated with suction from the RWST. The branch line throttle valves will be adjusted, pump response times will be checked, and the HHSI flow capability through each HHSI flow path will be demonstrated.

3. The LHSI pumps will be operated with suction from the RWST. Pump response times will be checked. The LHSI flow capability through each LHSI flow path will be demonstrated.

Acceptance Criteria

1. The accumulator discharge (line losses) rates are in accordance with design specifications.

2. The high and low head safety injection flow and pressure data are in accordance with design specifications.

3. The high and low head safety injection pumps' response times are in accordance with design specifications.

14.2.12.12.4 Automatic Switchover to Recirculation Mode (PO)

Test Objectives

To verify the automatic safety injection realignment to the recirculation mode.

Prerequisites

1. The appropriate general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The applicable portions of the recirculation spray and safety injection systems and components have been tested and are available to support testing.

Test Methods

Decreasing refueling storage tank level will be simulated and the automatic realignment of the recirculation spray/safety injection system components will be verified.

Acceptance Criteria

The automatic safety injection realignment to the recirculation mode is in accordance with design specifications.

14.2.12.12.5 Hydrostatic Test Pump Test (SOV)

This section has intentionally been deleted.

14.2.12.12.6 Miscellaneous Safety Injection Motor-operated Valves Control and Alarm Test (PO)

Test Objectives

1. To verify that the valves associated with the nitrogen supply to the safety injection accumulators operate in accordance with their control logics.

2. To verify that the valves associated with the safety injection accumulators operate in accordance with their control logics.

3. To verify that the valves associated with the high head safety injection system operate in accordance with their control logics.

4. To verify that accumulator pressure and level alarms operate properly.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The reactor coolant system temperature is less than 200°F.

Test Methods

1. The valves associated with the accumulators and their nitrogen supply system will be individually opened and closed from each applicable control panel. ASME XI stroke times will be measured to satisfy preservice requirements. The valves will also be tested to the fail-safe position.

2. Changes in accumulator levels and pressures will be simulated and accumulator level and pressure alarms checked.

Acceptance Criteria

1. The valves associated with the accumulators and their nitrogen supply system operate in accordance with their control logics.

2. Accumulator pressure and level alarms are set correctly.

3. Valve stroke times and valve motor functions are within design limits.

14.2.12.12.7 Safety Injection Accumulator Discharge Isolation Valve Test (STP)

Test Objective

To dynamically stroke the safety injection (SI) accumulators discharge valves against maximum differential pressure.

Prerequisites

The reactor coolant system is depressurized.

Test Methods

Each of the SI accumulators will be filled and then pressurized with nitrogen to the maximum precharge pressure. The accumulators discharge isolation valves will be opened, one at a time, and proper valve operation will be observed. This test will be performed as a Special Test Procedure (STP).

Acceptance Criteria

SI accumulator discharge valves open against maximum differential pressure.

14.2.12.13 Containment Vacuum

14.2.12.13.1 Containment Vacuum System Test (SOV)

Test Objectives

To demonstrate the capability of the containment vacuum system (CVS) to establish and maintain a reduced pressure in containment.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The vacuum pumps and associated valves will be tested to verify that the equipment functions in accordance with the control logic and design specifications.

2. The containment air ejector will be verified that it can establish a vacuum in containment in accordance with design specifications.

Acceptance Criteria

The CVS is capable of establishing and maintaining a reduced pressure in accordance with design specifications.

14.2.12.14 Containment Leakage Monitor System

14.2.12.14.1 Containment Leakage Monitoring System Test (PO)

Test Objectives

To verify the capability of the containment leakage monitoring pressure instruments to measure containment atmospheric parameters during normal operation.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

The operation of system wide-range pressure instruments used during both normal operation and periodic containment integrated leak rate testing will be verified.

Acceptance Criteria

The operation of the containment leakage monitoring instruments is in accordance with design specifications.

14.2.12.15 Containment Depressurization System

14.2.12.15.1 Recirculation Spray System Pumps and Controls Test (PO)

Test Objectives

To verify that the recirculation spray system pumps and associated valves are capable of delivering water at the required flow and pressure.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The discharge lines shall be lined up to discharge to the containment sump.

Test Methods

1. The recirculation spray system pumps and associated valves will be tested to verify that they function in accordance with the control logic.

2. The operating parameters of the recirculation spray system pumps will be measured.

Acceptance Criteria

1. Recirculation spray pumps and associated valves operate in accordance with the control logic.

2. Pump operating parameters are in accordance with design specifications.

14.2.12.15.2 Quench Spray System Pumps and Controls Test (PO)

Test Objectives

To verify that the quench spray pumps and associated discharge valves are capable of delivering water at the required flow and pressure.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. Sufficient water level in the refueling water storage tank (RWST) is available for quench spray pump operation.

Test Methods

1. The quench spray pumps and their associated motor-operated discharge valves will be tested to verify that the equipment functions in accordance with the control logic.

2. The operating parameters of the quench spray pumps will be measured.

Acceptance Criteria

1. The quench spray pumps and their associated discharge valves operate in accordance with the control logic.

2. The operating parameters of the quench spray pumps are in accordance with design specifications.

14.2.12.15.3 Quench and Recirculation Spray Nozzles Air Flow Test (PO)

Test Objectives

To verify unobstructed flow through the quench spray and the recirculation spray header nozzles.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. Recirculation/quench spray header nozzles are installed and the ring nozzle plugs removed.

Test Methods

1. The spray nozzles on each quench spray and recirculation spray header will be verified to be unobstructed by passing air through the system.

2. Systems will be lined up to ensure overlap between air and water flowpaths.

Acceptance Criteria

The quench spray and the recirculation spray header nozzles are unobstructed.

14.2.12.15.4 Refueling Water Storage Tank Test (PO)

Test Objectives

To demonstrate proper operation of the refueling water storage tank (RWST) cooling and recirculation system and verify proper operation of instrumentation and alarms.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The RWST level and temperature indication and associated alarms will be verified by simulating signals.

2. Each refueling water cooling pump will be tested to verify that the pump functions in accordance with the control logic.

3. The operating parameters of the refueling water cooling pumps and the RWST coolers will be measured while recirculating water from the RWST through the RWST coolers.

Acceptance Criteria

1. Level and temperature instrumentation for the RWST operate in accordance with design specifications.

2. Refueling water cooling pumps function in accordance with the control logic.

3. Operating parameters of the refueling water cooling pumps and the RWST coolers are in accordance with design specifications.

14.2.12.15.5 Quench Spray Chemical Injection System Test (PO)

Test Objectives

(This system has subsequently been abandoned and is replaced by the containment sump pH control system.)

To verify proper operation of the quench spray chemical injection system.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The chemical addition tank (CAT) is adequately filled with demineralized water for chemical injection pump operation.

Test Methods

1. The operation of the various level alarms and indicators of the quench spray CAT will be verified.

2. The quench spray chemical injection pumps will be tested to verify that the pumps function in accordance with the control logic.

3. The operating parameters of the quench spray chemical addition pump and chemical injection pumps will be measured.

4. The quench spray chemical injection system valves will be tested to verify that the valves function in accordance with the control logic.

Acceptance Criteria

1. Proper operation of the quench spray CAT alarms and indicators is demonstrated.

2. The quench spray chemical addition pump operates in accordance with design specifications.

3. Quench spray chemical injection pumps function in accordance with the control logic and design specifications.

4. System valves function in accordance with the control logic.

14.2.12.16 Reactor Plant Sample System

14.2.12.16.1 Primary Sampling System Test (SOV)

Test Objectives

To verify that samples can be drawn from various points of the primary plant and associated systems.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The plant is at normal operating pressure and no load T_{avg} temperature during hot functional testing.

Test Methods

1. The sample valves will be throttled to establish design flow rates.

2. Each pressure control valve will be set and tested to verify the ability to maintain a specified outlet pressure.

3. The ability to obtain a sample of an acceptable temperature from the proper source will be verified.

4. During power ascension testing, samples will be drawn at each power level plateau and analyzed to verify that proper chemistry requirements are maintained.

Acceptance Criteria

1. The system is capable of drawing and cooling samples at design flow rates taken from various points of the primary plant and associated systems.

2. During power ascension testing, the primary plant chemistry requirements are maintained within design specifications.

14.2.12.16.2 Systems Sampling for Core Load (IST)

Test Objectives

To verify that a correct and uniform boron concentration is maintained in the reactor coolant system (RCS) prior to and during core loading.

Prerequisites

The core barrel is inserted in the reactor vessel in preparation for initial fuel loading.

Test Methods

1. Samples will be obtained from various locations within the RCS for boron analysis to verify proper concentration and uniformity or homogeneity. Sampling and analysis will commence prior to and will continue during core loading.

2. Appropriate RCS samples will be obtained every 8 hours until core loading is complete. Other samples will be obtained at 24 hour intervals during core loading operations.

3. Boron concentration adjustments will be made as necessary to maintain the boron concentration within design specifications throughout core loading.

Acceptance Criteria

Boron analysis results are maintained at acceptable levels throughout the core loading evolution.

14.2.12.16.3 Post-Accident Sampling System Test (PO)

Test Objectives

To verify that samples can be drawn from various points of the primary plant and associated systems and delivered to the post-accident sampling panels.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The plant is at normal operating pressure and no load T_{avg} temperature during hot functional testing.

Test Methods

1. The proper operation of each pressure regulating valve in each sampling line will be verified.

2. System pumps and power-operated valves will be tested to verify they function in accordance with their control logics and design specifications.

3. The ability to obtain a sample at specified flow rates at an acceptable temperature from the proper source will be verified.

Acceptance Criteria

The ability of the system to draw and cool samples at design flow rates taken from various points of the primary plant and associated systems is demonstrated.

14.2.12.17 Turbine Plant Sample System

14.2.12.17.1 Turbine Plant Sampling System Performance Test (SOV)

Test Objectives

To verify that samples can be drawn from various points of the applicable turbine plant systems.

Prerequisites

1. The applicable general prerequisites, as listed in 14.2.12.1.1 are met.

2. The plant is at normal operating pressure and no load T_{avg} temperature during hot functional testing.

Test Methods

1. The condenser hotwell sampling pump will be tested to verify the pump functions in accordance with the control logic and design specifications.

2. The proper operation of each pressure regulating valve in each sampling line will be verified.

3. The ability to obtain a sample at specified flow rates at an acceptable temperature from the proper source will be verified.

4. During power ascension testing, samples will be drawn at each power level plateau and analyzed to verify that proper chemistry requirements are maintained.

Acceptance Criteria

1. The ability of the system to draw and cool samples at design flow rates taken from various points of the turbine plant systems is demonstrated.

2. During power ascension testing, the turbine plant chemistry requirements are maintained within design specifications.

14.2.12.18 Primary Component Cooling Water System

14.2.12.18.1 Primary Component Cooling Pumps and Controls Test (PO)

Test Objectives

To verify the proper operation of the primary component cooling water (CCW) system pumps and controls.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The CCW pumps and valves will be tested to verify that the equipment functions in accordance with the control logic.

2. The operating parameters of each CCW pump will be measured.

3. An adequate flow to the components serviced by primary CCW will be verified during the respective system test.

4. During RCS cooldown, the existing temperatures, pressures, and flow through the CCW heat exchangers and pumps will be recorded together with RCS temperatures to verify proper functioning of the system.

Acceptance Criteria

1. The CCW pumps and valves operate in accordance with control logic.

2. Pump operating parameters are in accordance with design specifications.

3. The CCW heat exchanger heat removal capacity during RCS cooldown is demonstrated.

14.2.12.18.2 Containment Penetration Cooling System Test (IST)

Test Objectives

To verify adequate cooling of appropriate penetrations by the containment penetration cooling system.

Prerequisites

Power ascension testing is in progress.

Test Methods

Containment penetration temperatures will be monitored.

Acceptance Criteria

Containment penetration temperature readings are within design specifications.

14.2.12.19 Reactor Plant and Neutron Tanks Cooling System

14.2.12.19.1 Neutron Shield Tank Cooling Test (PO)

Test Objectives

To verify proper operation of the neutron shield tank (NST) cooling system during hot functional testing.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The plant is at normal operating pressure and no load T_{avg} temperature conditions during hot functional testing.

Test Methods

1. During hot functional testing, NST cooling water flow will be established by circulating cooling water through the shell side of the NST cooler.

2. Temperature parameters within the natural circulation portion of the system will be observed.

3. The NST cooling system alarms and makeup valve will be verified for proper operation.

Acceptance Criteria

The operating parameters of the NST cooling system are in accordance with design specifications.

14.2.12.20 Supplementary Leak Collection and Release System

14.2.12.20.1 Supplementary Leak Collection and Release System Test (PO)

Test Objectives

To demonstrate that the supplementary leak collection and release system (SLCRS) operates in accordance with design specifications.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each leak collection filter exhaust fan and normal exhaust fan will be tested to verify that the fan functions in accordance with the control logic and design specifications.

2. Each motor operated damper will be tested to verify that the control logic will properly operate the damper.

3. Each electric heating coil will be tested to verify that the coil functions in accordance with the control logic and design specifications.

4. Filter efficiency, leakage, and differential pressures will be verified.

5. Component response to system alarms including a high radiation alarm will be verified.

6. The system will be checked for balanced air flows to verify that minimum cooling requirements are met.

7. The capability of the system to maintain the required areas under a slightly negative pressure will be verified under various system configurations.

Acceptance Criteria

The SLCRS functions in accordance with control logic and design specifications.

14.2.12.21 Liquid Waste Disposal System

14.2.12.21.1 Waste Drain Tank Pumps and Controls Test (SOV)

Test Objectives

To verify the proper operation of the waste drain tank pumps and controls.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The blowdown evaporators and the BVPS-1 high level waste tanks are available.

3. A discharge from BVPS-1 shall not be in progress while testing the BVPS-2 discharge path.

Test Methods

1. Waste drain tank pumps will be tested to verify that the pumps function in accordance with the control logic and design specifications.

2. Each waste drain tank pump recirculation isolation valve and seal water supply valve will be tested to verify that the valve functions in accordance with the control logic.

3. Waste drain tank level indications and level alarms will be checked.

4. The system will be operated and flow rates and differential pressures will be checked.

Acceptance Criteria

1. Each waste drain tank pump, recirculation isolation valve, and seal water supply valve functions in accordance with the control logic and design specifications.

2. Level indications and alarms for the waste drain tank operate in accordance with design specifications.

3. The ability to transfer water will be demonstrated.

14.2.12.22 Solid Waste Disposal System

14.2.12.22.1 Solid Waste Disposal System Test (SOV)

Test Objectives

To demonstrate the capability of the system to remove spent resin from the ion exchangers and to process solid waste to an acceptable form.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. Powdered cement, caustic solution, drumming containers, building crane, TV camera, and controls are available.

3. Evaporator bottoms subsystems, filter sludge feed subsystem, and primary grade water are available.

Test Methods

1. Preliminary operation and testing of the solid waste disposal system will be accomplished initially using water. Once

operation is deemed satisfactory, testing with actual resin, caustic solution, and cement will be performed.

2. The transfer of resin and other process fluids utilizing the system pumps will be verified.

3. The system pumps and decanting pump will be tested to verify the pump functions in accordance with the control logic.

4. Remote operation of lifting, mixing, and removal of containers from the drumming station will be demonstrated.

Acceptance Criteria

1. The waste solidification process equipment is demonstrated acceptable in accordance with design specifications.

2. The operation of all material handling equipment and mixing equipment is in accordance with design specifications.

14.2.12.23 Gaseous Waste Disposal System

14.2.12.23.1 Gaseous Waste System Test (SOV)

Test Objectives

To verify the ability of the gaseous waste system to control the flow, temperature, and pressure of the waste gases.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each overhead gas compressor will be tested to verify that the compressor functions in accordance with the control logic and design specifications.

2. System pressure control valves and isolation valves will be tested to verify the valves function in accordance with the control logic.

3. Proper operation of system filters and chillers will be demonstrated.

4. The surge tank temperature and pressure alarms will be checked.

5. The ability to purge the system with nitrogen will be demonstrated.

Acceptance Criteria

1. Overhead gas compressors function in accordance with the control logic and design specifications.

2. System pressure control valves and isolation valves function in accordance with the control logic.

3. Proper operation of system filters and chillers is demonstrated.

4. The ability to purge the system with nitrogen is demonstrated.

14.2.12.23.2 Sweep Gas System and Alternate Purge Blower Test (SOV)

Test Objectives

To verify the adequate performance of the sweep gas system and the alternate purge blower.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The sweep gas blowers and the alternate containment purge blower will be tested to verify that the blowers function in accordance with the control logic and design specifications.

2. Negative pressure at all tanks, sumps, accumulators, and condensers serviced by the sweep blowers will be verified.

3. Flow rate through the sweep gas system and filter pressure drops will be verified.

Acceptance Criteria

1. The sweep gas blowers and the alternate containment purge blower function in accordance with control logic and design specifications.

2. Flow rates and system pressure drops are in accordance with design specifications.

14.2.12.24 Fuel Pool Cooling and Purification System

14.2.12.24.1 Fuel Pool Cooling System Test (PO)

Test Objectives

To demonstrate proper operation of the fuel pool cooling system.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, shall be met.

2. The Spent Fuel Pool Leak Test has been completed.

Test Methods

1. Fuel pool cooling pumps will be tested to verify the pumps function in accordance with the control logic and design specifications.

2. Fuel pool heat exchanger cooling water isolation valves will be tested to verify the valves function in accordance with the control logic.

3. Cooling water flows to the heat exchangers will be verified.

Acceptance Criteria

Proper operation of the fuel pool cooling system is demonstrated.

14.2.12.24.2 Spent Fuel Pool and Refueling Cavity Leak Test (PO)

Test Objectives

To determine if any leakage exists from the spent fuel pool and refueling cavity, and to verify the set points of the spent fuel pool and reactor cavity level instrumentation.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, shall be met.

2. The reactor vessel head has been removed and the refueling cavity seal has been installed and inspected.

Test Methods

1. The fuel pool and/or refueling cavity will be filled above the normal water level. Tell-tale drains will be visually inspected periodically during the entire filling operation for evidence of leakage.

2. Fuel pool and reactor cavity level and temperature instrumentation will be tested for alarm and reset points.

Acceptance Criteria

1. Leakage from the fuel pool liner or refueling cavity tell-tale drains is in accordance with design specifications.

2. Fuel pool and refuel cavity level and temperature alarms and indications function in accordance with design specifications.

14.2.12.24.3 Fuel Pool and Refueling Cavity Purification Systems Test (SOV)

Test Objectives

To demonstrate proper operation of the fuel pool and refueling cavity purification systems.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The Spent Fuel Pool and Reactor Cavity Leak Test has been completed.

Test Methods

1. The capability of each purification system to produce the required flow through the filters and ion exchanger will be verified. Pressure drops across the filters and ion exchanger will be recorded.

2. Proper operation of the fuel pool and refueling cavity skimmers will be demonstrated.

Acceptance Criteria

1. The flow rate developed by each purification system is in accordance with design specifications.

2. The differential pressures across the filters and ion exchanger are in accordance with design specifications.

3. Proper operation of the fuel pool and refueling cavity skimmers is demonstrated.

14.2.12.25 Main Steam System

14.2.12.25.1 Atmospheric Steam Dump Valves and Residual Heat Release Valve Test (PO)

Test Objectives

To demonstrate proper operation of the atmospheric steam dump valves and the residual heat release valve prior to and during hot functional testing.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The atmospheric steam dump valves and residual heat release valve will be tested to verify the valves function in accordance with the control logic.

2. The atmospheric steam dump and residual heat release valves will be stroke-timed.

3. During hot functional testing, the atmospheric steam dump valve controllers will be verified to modulate at set-point.

Acceptance Criteria

1. The atmospheric steam dump valves and the residual heat release valve function in accordance with the control logic and design specifications.

2. The atmospheric steam dump valves maintain the main steam system pressure requirements in the AUTO mode of operation.

14.2.12.25.2 Main Steam Line Safety Valve Test (PO)

Test Objectives

To verify proper operation of the main steam line safety valves including lift point verification at normal operating pressure and temperature.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The plant is at normal operating pressure and no load T_{avg} temperature conditions.

3. A jacking device shall be available to assist in safety valve lifting.

Test Methods

1. Using a pneumatic jacking device, main steam line safety valves will be lifted.

2. The pneumatic pressure and the recorded main steam line pressure at the lift point will be utilized to determine the actual set point of the safety valves.

3. After each safety valve actuation, the discharge piping will be observed for signs of valve leakage.

Acceptance Criteria

Valve set points are in accordance with Technical Specifications.

14.2.12.25.3 Main Steam Line Isolation Valve and Bypass Isolation Valve Test (PO)

Test Objectives

To demonstrate that each of the main steam line isolation valves (MSIVs) and bypass isolation valves respond to control signals.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. Closed signals to the valves are defeated.

3. Test stroke limits are indicated on the valves.

Test Methods

The MSIVs and bypass isolation valves will be tested to verify the valves function in accordance with the control logic.

Acceptance Criteria

The MSIVs and bypass isolation valves function in accordance with control logic.

14.2.12.25.4 Main Steam Line Isolation Valve and Bypass Isolation Valve Performance Test (PO)

Test Objectives

To verify operability and measure the stroking times of main steam line isolation valves (MSIVs) and bypass isolation valves at rated temperature and pressure conditions.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The performance of the MSIVs and the bypass isolation valves will be verified by observing the proper operation of the valves through a complete opening/closing cycle.

2. During each valve operation, the valve stroking time from when the control switch is operated until the valve stops moving will be measured.

Acceptance Criteria

The operation, stroke, and stroking times of the MSIVs and bypass isolation valves are in accordance with design specifications.

14.2.12.25.5 Plant Performance Following Main Steam Line Isolation Valve Closure At Power (IST)

Test Objectives

To determine plant transient response and to verify the ability to return the plant to a stable condition following main steam line isolation valve (MSIV) closure at power.

Prerequisites

The plant is in operational mode 1.

Test Methods

With the reactor producing 30 percent power, all MSIVs will be simultaneously closed. Response of the systems will be monitored following the transient. Main steam line isolation valve closure time will be checked.

Acceptance Criteria

Primary and secondary system controls function satisfactorily to return the plant to a stable condition.

14.2.12.25.6 Measurement of Steam Generator Moisture Carryover (SOV)

Test Objectives

To verify that the moisture content of the steam entering the main header, with the plant operating at specified power levels (Mode 1), shall not exceed one-quarter of one percent (0.25 percent).

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1 are met.

2. The plant is in operational mode 1.

3. Radioactive tracer available.

Test Methods

1. With the plant stable at specified power levels, the steam generators will be sampled for initial background radiation readings.

2. Radioactive tracer will be added to the water inventory of each steam generator using the chemical feed system.

3. Samples will be taken from specified sample points. These samples will be analyzed to determine percent carryover.

Acceptance Criteria

The moisture content of steam entering the main header does not exceed one-quarter of one percent (0.25 percent).

14.2.12.26 Steam Generator Nitrogen Blanket

14.2.12.26.1 Steam Generator Nitrogen System Test (SOV)

Test Objectives

To verify that a nitrogen blanket can be established on the steam generators.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

<u>Test Methods</u>

1. Operating parameters for the vacuum pump will be verified.

2. The nitrogen supply system will be operated to verify that a nitrogen blanket can be established on the steam generators.

<u>Acceptance Criteria</u>

1. The vacuum Pump operates in accordance with design specifications.

2. The ability to establish a nitrogen blanket on the steam generators is demonstrated.

14.2.12.27 Condensate System

14.2.12.27.1 Condensate System Test (SOV)

<u>Test Objectives</u>

To verify that the condensate system operates in accordance with design specifications.

<u>Prerequisites</u>

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

<u>Test Methods</u>

1. The condensate pumps will be tested to verify the pumps function in accordance with the control logic and design specifications.

2. System control valves will be tested to verify that the valves function in accordance with the control logic.

3. The hotwell level control system will be verified to function in accordance with the control logic.

<u>Acceptance Criteria</u>

1. The condensate pumps function in accordance with control logic and design specifications.

2. System valves operate in accordance with the control logic.

3. The hotwell level control system functions in accordance with the control logic.

14.2.12.27.2 Condenser Vacuum Test (SOV)

<u>Test Objectives</u>

To verify the ability of the hogging ejectors and air ejectors to establish and maintain the required vacuum in the main condenser.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. A vacuum will be drawn on each condenser shell by the hogging ejectors. The length of time it takes to reach the specified vacuum will be recorded.

2. The air ejectors will be started and the hogging ejectors shut down. The length of time it takes to reach the specified vacuum will be recorded.

3. Air leakage readings for each shell will be obtained with air ejectors in service.

Acceptance Criteria

The ability of the hogging ejectors and air ejectors to establish and maintain the required vacuum in the main condenser is demonstrated.

14.2.12.28 Condensate Polishing System

14.2.12.28.1 Condensate Polishing System Test (SOV)

Test Objectives

To verify the proper functioning of the condensate polishing system (CPS) and the powdered resin dewatering system (PRDS).

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. System pumps, valves, and the air compressor will be tested to verify that the equipment functions in accordance with the control logic and design specifications.

2. Proper operation of system alarms will be verified.

3. Differential pressures across the demineralizers and filters will be verified.

4. System operation in both the normal and regenerative mode will be verified.

Acceptance Criteria

The CPS and PRDS function in accordance with design specifications and control logic.

14.2.12.28.2 Condensate Polishing System Capability Test (SOV)

Test Objectives

To verify the capability of the condensate polishing system (CPS) during normal power operation, and to demonstrate that the CPS operates properly to maintain feedwater chemistry.

Prerequisites

The plant is in operational mode 1.

Test Methods

1. The CPS capability of maintaining full flow under normal operating conditions will be verified.

2. During normal flow conditions at the specified power levels, the influent and effluent of the demineralizers will be sampled and analyzed to verify that the CPS system can maintain proper feedwater chemistry.

Acceptance Criteria

1. The CPS operates to maintain full flow in accordance with design specifications during normal power operation.

2. The influent and effluent chemical parameters of the demineralizers are in accordance with design specifications.

14.2.12.29 Extraction Steam System

14.2.12.29.1 Extraction Steam System Test (SOV)

This section has intentionally been deleted.

14.2.12.30 Heater Drain System

14.2.12.30.1 Feedwater Heater Drain System Test (SOV)

Test Objectives

To verify the proper operation and control of the feedwater heater drain system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Heater drain and separator drain pumps will be tested to verify that the pumps function in accordance with the control logic and design specifications.

2. System valves will be tested to verify that the valves function in accordance with the control logic.

3. During power ascension testing, proper operation of the heater drain and separator drain pumps and the system control valves will be monitored.

Acceptance Criteria

1. Pump operating parameters are in accordance with design specifications.

2. System pumps and valves function in accordance with the control logic.

14.2.12.31 Feedwater System

14.2.12.31.1 Steam Generator Feedwater Pumps and Control Test (SOV)

Test Objectives

To verify proper operation of the start-up pump and main feedwater pumps and controls operating with recirculation flow.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The start-up and main feedwater pumps will be tested to verify that the pumps function in accordance with the control logic and design specifications.

2. Each pump recirculation valve and discharge valve will be tested to verify that the valve functions in accordance with the control logic.

Acceptance Criteria

1. Pump operating parameters are in accordance with design specifications.

2. The start-up and main feedwater pumps and associated valves function in accordance with the control logic.

14.2.12.31.2 Verification of Plant Operation Following Loss of Feedwater Heater at Load (IST)

Test Objectives

To demonstrate adequate response by the primary and secondary systems to a loss of feedwater heaters at loads of 50 and 90 percent power.

Prerequisites

The plant is in operational mode 1 with reactor power level established as required.

Test Methods

1. The bypass valve for all feedwater heaters, except the first point heaters, will be opened to demonstrate the largest loss in feedwater at 50 and 90 percent power.

2. The response of the primary and secondary systems will be monitored to verify that system operating parameters return to stable conditions during and after the transient.

3. The main control room indications will be observed to verify the proper detection of the transient.

Acceptance Criteria

1. The primary and secondary systems respond satisfactorily to a loss of feedwater heaters.

2. Loss of feedwater heaters is detected in the main control room.

14.2.12.32 Auxiliary Feedwater System

14.2.12.32.1 Motor-Driven Steam Generator Auxiliary Feedwater Pumps and Control Test (PO)

Test Objectives

1. To verify proper operation and controls of the motor-driven auxiliary feedwater pumps, valves, and the primary demineralized water storage tank makeup water and chemical feed systems.

2. To verify the absence of damaging water hammer following initiation of auxiliary feedwater with the steam generators at normal operating temperature.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The feedwater and auxiliary feedwater system pipe support installations inside containment have been checked and show no readily apparent defects prior to water hammer testing.

Test Methods

1. Each motor-driven auxiliary feedwater pump will be tested to verify the pump functions in accordance with the control logic and design specifications.

2. With the plant at normal operating pressure and no load T_{avg} temperature, the operating parameters of the motor-driven auxiliary feedwater pumps will be measured individually with flow to all three steam generators.

3. The performance of motor-driven auxiliary feedwater pump bearing oil coolers will be verified.

4. An endurance test of at least 48 hours will be performed on the motor-driven auxiliary feedwater pumps. Following this endurance run, the pumps will be shut down, cooled down, and then restarted and run for at least 1 hour.

5. Associated valves will be tested to verify that they will function in accordance with the control logic and design specifications.

6. The primary demineralized water storage tank makeup water and chemical feed systems will be tested to verify that they will function in accordance with the control logic and design specifications.

7. During hot functional testing with saturation conditions corresponding to 547°F reactor coolant system temperature, the main feedwater to the steam generators will be secured and the motor-driven auxiliary feedwater pumps will be permitted to auto start on 2 of 3 steam generators low-low level. The ensuing transient will be evaluated for water hammer effects.

Acceptance Criteria

1. The motor-driven auxiliary feedwater pumps, valves, and the primary demineralized water storage tank makeup water and chemical feed systems function in accordance with the design specifications and the control logic.

2. The motor-driven auxiliary feedwater pumps remain within design limits, and the pump room ambient conditions do not exceed environmental qualification limits for safety-related equipment in the room.

14.2.12.32.2 Turbine-Driven Auxiliary Feedwater Pump Test (PO)

Test Objectives

To verify proper operation and controls of the turbine-driven auxiliary feedwater pump.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The plant is at normal operating pressure and no load T_{avg} temperature during hot functional testing.

Test Methods

1. The turbine-driven auxiliary feedwater pump will be tested to verify that the pump functions in accordance with the design specifications and the control logic.

2. The associated steam inlet valves will be tested to verify the valves function in accordance with the control logic.

3. The turbine-driven auxiliary feedwater pump response time to an automatic start signal will be recorded followed by an endurance test of at least 48 hours with the pump in recirculation. Following this endurance run, the pumps will be shut down, cooled down, and then manually cold quick started and operated for at least 2 hours with motor-driven auxiliary feedwater pumps and the pump room ventilation secured.

4. The turbine-driven auxiliary feedwater pump will be verified to cold quick start automatically and operate for at least 1/2 hour or until the plant stabilizes, with loss of all offsite power.

Acceptance Criteria

1. Pump operating parameters are in accordance with design specifications.

2. The turbine-driven auxiliary feedwater pump and associated valves function in accordance with the control logic.

3. The turbine-driven auxiliary feedwater pump remains within design limits, and the pump room ambient conditions do not exceed environmental qualification limits for safety-related equipment in the room.

14.2.12.33 Steam Generator Level Control System

14.2.12.33.1 Automatic Steam Generator Water Level Control Test (SOV)

Test Objectives

To verify the performance of the automatic steam generator water level control (SGWLC) system.

Prerequisites

The plant is in operational mode 1 with reactor power level established as required.

Test Methods

1. The level control stability of the feedwater bypass valves will be demonstrated at approximately 10 percent power by going from manual to automatic control after establishing steam generator levels above and below normal.

2. Manual response of the feedwater bypass valves below 15 percent power and manual response of the main feedwater valves at approximately 30 percent power will be demonstrated.

3. Proper response of the steam generator water level control system will be demonstrated when transferring from feedwater bypass valves to the main feedwater valves at a nominal 20 percent power level and when returning back to the feedwater bypass valves.

4. Control of the steam generator water level will be verified by inducing a steam generator level transient during power ascension testing.

5. Steam flow transmitters will be calibrated against feedwater flow at 30, 50, 75 and 100 percent power levels. A cross-check verification of all signals indicating feedwater and steam flow will be performed.

Acceptance Criteria

1. The control system maintains steam generator water levels within design specifications.

2. Steam flow/feed flow channels are in accordance with design specifications.

14.2.12.33.2 Steam Generator Level Instrumentation System Test (PO)

Test Objectives

To establish a correlation for the wide and narrow range steam generator level instrumentation during various plant conditions.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. During steam generator fill and reactor coolant system heatup, data will be recorded from the wide and narrow range level instrumentation.

2. The proper set points of the steam generator level alarms will be verified.

3. The feedwater isolation valves, main flow control valves, and bypass feedwater control valves will be tested to verify that the valves function in accordance with the control logic, including stroke timing.

Acceptance Criteria

1. The narrow and wide range level instrumentation indications of each steam generator are within the design limits.

2. The steam generator level alarms actuate at the required water levels.

3. The feedwater isolation valves, main control valves, and bypass feedwater control valves function in accordance with the control logic.

14.2.12.34 Steam Generator Blowdown System

14.2.12.34.1 Steam Generator Blowdown System Test (SOV)

Test Objectives

To verify the operation of the steam generator blowdown system (SGBS) and associated equipment.

Prerequisites

The applicable general prerequisities, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Level alarms and control valves associated with the evaporators, reboilers, and system tanks will be verified.

2. System pumps will be tested to verify that the pumps function in accordance with the control logic and design specifications.

3. System control and isolation valves will be tested to verify that the valves function in accordance with the control logic.

4. The evaporators will be tested to verify that they function in accordance with the design specifications and control logic.

5. System heat exchangers and evaporator condensers will be tested to verify that they function in accordance with the design specifications.

6. Differential pressures across the ion exchangers, system filters, and strainers will be verified.

Acceptance Criteria

The SGBS and associated equipment functions in accordance with design specifications and the control logic.

14.2.12.35 Turbine Auxiliary Systems

14.2.12.35.1 Turbine Auxiliary Systems Functional Test (SOV)

Test Objectives

To verify proper operation of the turbine auxiliary systems.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.l.1, are met.

Test Methods

1. The turbine lube oil system pumps will be tested to verify that the pumps function in accordance with the control logic and design specifications.

2. The turbine lubricating oil purifier will be tested to verify that it functions in accordance with the control logic.

3. Proper operation of the oil purifier will be demonstrated by obtaining and analyzing oil samples.

4. Turbine lube oil system purifier feed pump discharge valve and the feed pump bypass valves will be tested to verify that they function in accordance with the control logic.

5. The turning gear will be tested to verify interlocks with the turbine lube oil system.

6. The turbine electrohydraulic system pumps will be tested to verify that the pumps function in accordance with the control logics and design specifications.

7. The turbine trip capability will be tested to verify that it functions in accordance with design specifications.

Acceptance Criteria

1. The turbine lube oil system pumps and valves function in accordance with the control logic.

2. Pump operating parameters are in accordance with design specifications.

3. The lube oil purifier functions in accordance with design specifications and the control logic.

4. The turning gear interlocks function in accordance with the control logic.

5. The turbine electrohydraulic system pumps and valves function in accordance with the control logics.

6. The turbine trip capability operates in accordance with design specifications.

14.2.12.36 Electrohydraulic Control System

14.2.12.36.1 Turbine Roll Test (SOV)

Test Objectives

To bring the turbine to synchronous speed.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Turbine instrumentation and controls will be tested to verify that they function in accordance with design specifications.

2. Turbine operating parameters will be checked to verify that they are in accordance with design specifications.

3. The automatic engagement of the turning gear will be verified.

Acceptance Criteria

1. Instrumentation and controls operate in accordance with design specifications.

2. Turbine operating parameters are in accordance with design specifications.

3. The turning gear automatically engages in accordance with design specifications.

14.2.12.36.2 Turbine Overspeed Trip Test (SOV)

Test Objectives

1. To operationally verify that the overspeed trip mechanism functions at the design set point.

2. To verify the proper operation of turbine steam control valves.

Prerequisites

1. The turbine has been on line at a minimum of 10 percent load and for at least eight hours.

2. The turbine is unloaded and running at full speed for the purpose of this test.

Test Methods

1. The turbine speed will be increased slowly and the trip set point of the overspeed trip mechanism will be verified.

2. If the turbine reaches maximum allowable rpm before tripping, the test will be stopped, the overspeed trip mechanism reset, and the test will be repeated.

3. The proper operation and response of the throttle valves, governor control valves, intercept valves, and reheat stop valves will be verified.

4. The electrohydraulic control (EHC) system will be monitored to verify proper operation.

Acceptance Criteria

1. The trip set point of the overspeed trip mechanism is at the design value.

2. Steam valves operate in accordance with design specifications.

3. The EHC system operates in accordance with design specifications.

14.2.12.36.3 Control System Response to a Turbine Runback Signal at Cold Conditions (PO)

Test Objectives

To verify the proper operation of the turbine electrohydraulic control (EHC) system upon the actuation of turbine runback signals.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Proper operation of turbine load reference reduction will be verified by actuating the overpower and overtemperature ΔT trip functions by injecting an appropriate analog test signal and recording the voltage signal going to the servo valve function generators.

2. The time necessary to drive the voltage from the 100 percent turbine power reference voltage to 0 percent reference voltage will be used to ensure proper runback rate.

Acceptance Criteria

The turbine EHC system responds to a turbine runback signal in accordance with design specifications.

14.2.12.37 Secondary Plant Miscellaneous Drains

14.2.12.37.1 Secondary Plant Miscellaneous Drain System Test (SOV)

Test Objectives

To verify the operability of the secondary plant miscellaneous drain system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each secondary plant miscellaneous drain valve will be tested to verify that valve functions in accordance with the control logic.

2. With the plant at normal operating pressure and no load T_{avg} temperature during hot functional testing, it will be verified that the secondary plant miscellaneous drain valves are properly removing moisture from corresponding drain points.

Acceptance Criteria

1. Secondary plant miscellaneous valves function in accordance with the control logic.

2. Proper functioning of the secondary plant miscellaneous drain valves is demonstrated.

14.2.12.38 Moisture Separators and Reheat System

14.2.12.38.1 Moisture Separator and Reheat Control System Test (SOV)

Test Objectives

To verify proper operation of the moisture separator and reheat control system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The steam supply valves providing reheater steam to the moisture separator will be tested to verify that they function in accordance with the control logic.

2. With the plant at a 50 percent power level, the turbine reheat control system will be tested to verify that it is capable of controlling the temperature and the rate of temperature change of steam to the low pressure turbine.

Acceptance Criteria

1. The steam supply valves to the moisture separator operate in accordance with the control logic.

2. The turbine reheat control system operates in accordance with the control logic.

14.2.12.39 Turbine Instrumentation System

14.2.12.39.1 Turbine Stretch Test (SOV)

Test Objectives

To check the start-up clearance measurements and the supervisory instrumentation monitoring system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Turbine clearance data will be obtained, as practicable, with the turbine on the turning gear and during station start-up/power ascension at each of the reactor power level plateaus.

2. The automatic turbine supervisory instruments monitoring rotor position, rotor eccentricity, vibration, casing expansion, and differential expansion will be tested to verify that they operate in accordance with design specifications.

Acceptance Criteria

1. Clearance data obtained is in accordance with design specifications.

2. Turbine supervisory monitoring parameters are in accordance with design specifications.

14.2.12.40 Auxiliary Steam System

14.2.12.40.1 Auxiliary Steam System Test (SOV)

Test Objectives

To verify the capability of the auxiliary steam system to supply systems and/or components which utilize auxiliary steam.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The BVPS-2 auxiliary boilers or BVPS-1 auxiliary steam are available.

Test Methods

1. The auxiliary steam condensate receiver pumps and drain pumps will be tested to verify the pumps function in accordance with design specifications and the control logic.

2. The auxiliary steam condensate receiver and transfer tanks will be tested to verify the level controls function in accordance with the control logic.

3. Proper operation of each auxiliary steam reducer station will be verified.

4. Proper operation of alarms and indicating lights will be verified.

Acceptance Criteria

System components function in accordance with design specifications and the control logic.

14.2.12.40.2 Auxiliary Boilers Test (SOV)

Test Objectives

To verify the proper operation of the auxiliary boilers.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1 are met.

Test Methods

1. The auxiliary boiler feedwater, chemical feed. chemical feed sump, fuel oil transfer, fuel oil supply and blowdown pumps will be tested to verify the pumps function in accordance with the design specifications and the control logic.

2. The auxiliary boiler combustion air fans will be tested to verify the fans function in accordance with the design specifications and the control logic.

3. System valves will be tested to verify the valves function in accordance with the control logic.

4. Proper operation of alarms and indicating lights will be verified.

5. The auxiliary boiler chemical feed tank, chemical feed sump, deaerator, blowdown tank, fuel oil day tank, and auxiliary boiler unit will be tested to verify the level switches function in accordance with the control logic.

6. The auxiliary boilers will be tested to verify the boilers function in accordance with design specifications and the control logic.

Acceptance Criteria

System components function in accordance with design specifications and the control logic.

14.2.12.41 Turbine Plant Component Water System

14.2.12.41.1 Turbine Plant Component Cooling Test (SOV)

Test Objectives

To verify the proper operational capability of the turbine plant cooling water (CCW) system

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The turbine plant CCW pumps will be tested to verify the pumps function in accordance with the design specifications and the control logic.

2. System valves will be tested to verify the valves function in accordance with the control logic.

3. An adequate flow to the components serviced by turbine plant CCW will be verified during the respective system test.

4. With the generator at or near full capacity, temperature through the turbine plant CCW heat exchangers will be verified.

Acceptance Criteria

1. The turbine plant CCW pumps function in accordance with design specifications and the control logic.

2. System valves function in accordance with the control logic.

3. The heat removal capacity of the heat exchangers is demonstrated.

14.2.12.42 Chilled Water System

14.2.12.42.1 Chilled Water System Test (SOV)

Test Objectives

To demonstrate the operability of the chilled water system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. System pumps will be tested to verify they function in accordance with the control logic and design specifications.

2. System valves will be tested to verify they function in accordance with the control logic.

3. The water chiller will be tested to verify it functions in accordance with the control logic.

4. At normal operating pressure and no load T_{avg} temperature, the cooling capacity of the chilled water system will be verified by measuring the operating parameters of the chiller.

Acceptance Criteria

1. System pumps function in accordance with the control logic.

2. System valves operate in accordance with the control logic.

3. The cooling capacity of the chilled water system is in accordance with design specifications.

14.2.12.43 Service Water System

14.2.12.43.1 Service Water System Test (PO)

<u>Test Objectives</u>

To verify the proper operation and control of the service water system (SWS).

<u>Prerequisites</u>

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

<u>Test Methods</u>

1. The operating parameters of the condenser water booster pumps, the chemical addition pumps, and the service water pumps will be measured while supplying water at the required rates.

2. System pumps, associated discharge valves, and the self-cleaning strainers will be verified to function in accordance with the control logic.

3. System valves which perform a safety function will be verified to function in accordance with the control logic.

4. Manual and self-cleaning strainers will be visually checked for proper operation.

<u>Acceptance Criteria</u>

1. The operating parameters of the service water pumps, the chemical addition pumps, and the condenser water booster pumps are in accordance with design specifications.

2. System pumps, valves, and self-cleaning strainers function in accordance with the control logic.

3. Proper functioning of the strainers is demonstrated.

14.2.12.43.2 Standby Service Water System Test (SOV)

<u>Test Objectives</u>

To verify the proper operation and control of the standby service water system (SSWS).

<u>Prerequisites</u>

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The operating parameters of the standby service water pumps and the wash water booster pump will be measured while supplying water at the required rate.

2. System pumps and associated discharge valves will be verified to function in accordance with the control logic.

3. The traveling water screen and the self-cleaning strainer will be verified to function in accordance with the control logic.

4. The self-cleaning strainer will be visually checked for proper functioning.

Acceptance Criteria

1. The operating parameters of the standby service water pumps and wash water booster pumps are in accordance with design specifications.

2. System pumps, valves, traveling water screen, and self-cleaning strainer function in accordance with the control logic.

3. Proper functioning of the strainer is demonstrated.

14.2.12.43.3 Service Water Cathodic Protection Test (SOV)

This section has intentionally been deleted.

14.2.12.44 Circulating Water System

14.2.12.44.1 Cooling Tower Pumps and Controls Test (SOV)

Test Objectives

To verify the proper operation of the cooling tower pumps and controls.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The cooling tower pump seal injection system including the seal injection pump, the seal injection strainer, and the strainer backwash valve will be tested to verify operation is in accordance with the control logic.

2. The seal water operating parameters from the seal injection pumps and the BVPS-1 filtered water system will be measured and the systems capability to maintain the required injection pressure to each cooling tower pump will be verified.

3. Cooling tower pumps and system valves will be tested to verify that they function in accordance with the control logic.

4. The cooling tower pump operating parameters will be measured to determine pump performance.

Acceptance Criteria

1. The operation of the cooling tower pump seal injection system is in accordance with the control logic.

2. Cooling tower pumps and associated valves function in accordance with the control logic.

3. The operating parameters of the cooling tower pumps and the seal injection pumps are in accordance with design specifications.

14.2.12.44.2 Cooling Tower Performance Test (SOV)

Test Objectives

To verify proper operation of the cooling tower at various station loads.

Prerequisites

The plant is in operational mode 3 or 1 as required.

Test Methods

1. During 100 percent power, the performance of the cooling tower will be demonstrated.

2. Atmospheric and operating data will be recorded at each power level.

3. The approach and range of the cooling tower will be determined from recorded data.

Acceptance Criteria

The operating parameters of the cooling tower are in accordance with design specifications.

14.2.12.44.3 Condenser Tube Cleaning System Test (SOV)

This section has intentionally been deleted.

14.2.12.45 Vacuum Priming System

14.2.12.45.1 Circulating Water Vacuum Priming System Test (SOV)

Test Objectives

To verify that the vacuum priming system can establish and maintain the required vacuum in the circulating water system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The vacuum priming and vacuum priming recirculation pumps will be tested to verify that the pumps function in accordance with the control logic.

2. System control valves will be tested to verify that the valves function in accordance with the control logic.

3. Each vacuum priming pump will be placed in operation to draw a vacuum on the circulating water system. The operating parameters of the vacuum priming and vacuum priming recirculation pumps will be measured. The system vacuum will be monitored and the time it takes to reach operating vacuum will be determined.

Acceptance Criteria

The circulating water vacuum priming system operates in accordance with the design specifications and the control logic.

14.2.12.46 Water Treating (Demineralized Water Distribution) System

14.2.12.46.1 Demineralized Water System Test (SOV)

Test Objectives

To demonstrate the proper operation of the demineralized water system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. System pumps will be verified to function in accordance with design specifications and the control logic.

2. System valves and the secondary plant demineralized water storage tank level control system will be verified to function in accordance with the control logic.

3. Proper functioning of the electric and steam heaters for the main and secondary plant demineralized water storage tanks will be verified.

4. Flows to the components serviced by the demineralized water system will be verified during the respective system test.

Acceptance Criteria

1. System pumps function in accordance with design specifications and the control logic.

2. System valves and the secondary plant demineralized water storage tank level control system function in accordance with the control logic.

3. Proper electrical and output temperature readings of the heaters are verified.

14.2.12.47 Water Treating (Condensate Chemical Feed) System

14.2.12.47.1 Secondary Plant Chemical Feed System Test (SOV)

Test Objectives

To verify the operability of the secondary plant chemical feed system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The operating parameters of the positive displacement chemical feed pumps and the wet lay-up pumps will be measured.

2. The ability to inject chemicals with the hand pumps is demonstrated.

Acceptance Criteria

The ability to inject chemicals into the secondary plant is demonstrated.

14.2.12.48 Main Plant - Carbon Dioxide

14.2.12.48.1 Main Plant Carbon Dioxide Fire Protection System Test (SOV)

Test Objectives

1. To verify the capability of the carbon dioxide (CO_2) fire protection system to deliver CO_2 to all main plant components protected by this system.

2. To verify that instrumentation and system controls function in accordance with design specifications.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The CO_2 low pressure storage unit is filled with CO_2. Its refrigeration unit is charged with refrigerant and is operable.

Test Methods

1. It will be verified that the refrigeration unit of the CO_2 storage tank will automatically cycle to maintain tank pressure.

2. A "puff" discharge test of a limited quantity of CO_2 will be performed to verify the automatic operation of the entire system. Manual operation of master and selector valves shall be verified.

3. Heat detectors will be tested by application of a heat source and smoke detectors will be tested by application of an aerosol smoke simulator to verify proper automatic actuation of the applicable zone control panel.

4. The applicable pneumatic devices will be tested to verify that they automatically close dampers on a CO_2 discharge. The applicable ventilation fans will be tested to verify that they automatically shut down upon receipt of a simulated CO_2 discharge signal.

Acceptance Criteria

The main plant CO fire protection system functions in accordance with design specifications and the control logic.

14.2.12.49 Turbine Building - Carbon Dioxide System

14.2.12.49.1 Turbine Building Carbon Dioxide Fire Protection System Test (SOV)

Test Objectives

1. To verify the capability of the carbon dioxide (CO_2) fire protection system to deliver CO_2 to all turbine plant components protected by this system.

2. To verify that instrumentation and system controls function in accordance with design specifications.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The CO_2 low pressure storage unit is filled with CO_2. Its refrigeration unit is charged with refrigerant and operable.

3. This test is performed during the pre-operational testing phase.

Test Methods

1. It will be verified that the refrigeration unit of the CO_2 storage tanks will automatically cycle to maintain tank pressure.

2. A "puff" discharge test of a limited quantity of CO_2 will be performed to verify the automatic operation of the entire system, and to demonstrate that each discharge opening is unobstructed. Manual operation of master and selector valves shall be verified.

3. Heat detectors will be tested by application of a heat source to verify proper automatic actuation of the applicable zone control panel.

4. Proper operation of the purge CO_2 superheater and steam vaporizer will be verified.

Acceptance Criteria

The turbine building CO_2 fire protection system functions in accordance with design specifications and the control logic.

14.2.12.50 Fire Protection - Water System

14.2.12.50.1 Fire Hydrant Flow and Pressure Test (SOV)

Test Objectives

To verify the proper functioning and flow parameters of the fire protection system (FPS) hydrants.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The Beaver Valley Power Station-Unit 1 FPS is available.

Test Methods

1. Each hydrant will be opened, and the system pressure and flow through each hydrant will be measured.

2. All yard fire protection valves shall be cycled open and closed to verify proper operation.

Acceptance Criteria

1. Hydrants operate properly, providing flow at the design rate and pressure.

2. Yard fire protection valves are verified as operable.

14.2.12.50.2 Wet Pipe and Deluge Sprinkler System Test (SOV)

Test Objectives

To verify the proper operation of the wet pipe and deluge sprinkler portion of the water fire protection system (FPS).

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The Beaver Valley Power Station - Unit 1 FPS is available.

Test Methods

1. Each wet pipe sprinkler subsystem will be tested for water flow by opening its drain connection and measuring the subsystem pressure and flow parameters

2. Each deluge sprinkler subsystem will be tested by opening its main drain valve and measuring the subsystem pressure and flow parameters.

3. Each deluge valve and alarm check valve will be tested to verify proper manual (mechanical and electrical) and automatic actuation.

4. Subsystems whose nozzles service an indoor facility shall not be tested by discharging water within the facility. Nozzles which service an outdoor facility will be tested by an actual discharge of water, and the spray pattern will be observed.

5. The system operating pressure will be observed at the highest point of the system for each pressure source.

6. Heat detectors will be tested by applying a heat source and ensuring proper operation of the respective deluge valve as applicable.

7. Nozzles serving indoor facilities will be air-flow tested. These tests will overlap the water flow tests.

Acceptance Criteria

1. Local and remote alarms operate in accordance with design specifications.

2. Deluge and alarm check valves operate in accordance with design specifications.

3. Spray patterns of outdoor nozzles are in accordance with design specifications.

4. Operating parameters of the system and each subsystem are in accordance with design specifications.

14.2.12.50.3 Booster Fire Pump Test (SOV)

Test Objectives

To verify proper operation of the booster fire pump.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

The operating parameters of the booster fire pump will be measured while discharging flow to the yard. The flow from the booster fire pump will be varied from minimum to full flow.

Acceptance Criteria

Pump operating parameters from minimum to full design flow are in accordance with design specifications.

14.2.12.51 Fire Detection System

14.2.12.51.1 Fire Detection System Test (SOV)

Test Objectives

To verify the proper operation of the fire detection system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. A "puff" discharge of smoke will be utilized to verify the proper operation of each smoke-sensitive, ionization type fire detector.

2. Proper operation of the annunciators and indicating lights will be demonstrated.

Acceptance Criteria

1. Proper operation of each fire detector is demonstrated.

2. Proper operation of annunciators and indicating lights is demonstrated.

14.2.12.52 Compressed Air Systems

14.2.12.52.1 Station Air Compressors Test (SOV)

Test Objectives

To determine adequate performance and proper operation of the air compressor units.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each station air compressor will be tested to verify that the compressor functions in accordance with design specifications and the control logic.

2. Each system control valve will be tested to verify that the control valve functions in accordance with the control logic.

Acceptance Criteria

1. The station air compressors function in accordance with design specifications and the control logic.

2. The system valves function in accordance with the control logic.

14.2.12.52.2 Instrument Air System Test (SOV)

Test Objectives

To determine adequate and proper operation of station instrument air filtering and drying equipment.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. Station air is available.

Test Methods

Instrument air filtering and drying equipment will be tested to verify that it functions in accordance with design specifications and the control logic.

Acceptance Criteria

The instrument air filtering and drying equipment functions in accordance with the control logic and design specifications.

14.2.12.52.3 Containment Instrument Air System Test (SOV)

Test Objectives

To verify the proper operation and air quality of the containment instrument air system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The containment air compressors will be tested to verify that the compressors function in accordance with the control logic and design specifications.

2. Each containment air control valve will be tested to verify that the control valve functions in accordance with the control logic.

3. Containment air filtering and drying equipment will be tested to verify that they function in accordance with the control logic and meet the air quality requirements of design specifications.

Acceptance Criteria

1. The containment air compressors, control valves, and filtering and drying equipment function in accordance with design specifications and the control logic.

2. Instrument air quality meets system cleanness classification acceptance criteria.

15.2.12.52.4 Containment Instrument Air Design Verification (SOV)

Test Objectives

To demonstrate that the containment air receiver has been adequately sized to provide air to engineered safety features of the primary plant following a loss of normal station power.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

With the plant in Mode 3 prior to initial criticality, the containment air compressors will be stopped. The rate of pressure decrease in the containment air receiver will be recorded.

Acceptance Criteria

The capacity of the containment instrument air receiver meets its intended function.

14.2.12.52.5 Response of Plant Air-Operated Valves to Loss of Instrument Air (SOV)

Test Objectives

To determine that the air-operated valves (AOVs) associated with the engineered safety features of the plant will operate properly when subjected to a loss of instrument air.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. During Hot Functional Testing, a partial and gradual loss of instrument air will be performed to verify that a loss of instrument air system will not result in the loss of safety functions of safety-related systems. Because loss of certain air operated valve functions may present unacceptable risks of equipment damage during Hot Functional Testing, some valves may be excluded from this test. These valves will be tested under cold conditions. For a gradual loss of air, baseline data will be taken to determine the pressures at which safety-related components begin moving to their fail-safe position.

2. The safety-related air-operated valves will be individually tested to verify that upon a sudden loss of instrument air, each valve responds by assuming its design fail-safe position.

3. An increase in supply system pressure up to the relief valve setting will be performed to verify no loss in the safety function of safety-related systems occur.

4. The service air system and instrument and control air system will be isolated from each other, and it will be demonstrated that a service air-instrument air cross-tie does not exist.

Acceptance Criteria

1. The loss of the instrument air system does not affect the design safety function of any safety-related system.

2. Proper valve movement to the design fail-safe position is demonstrated.

3. An increase in supply system pressure does not result in system pressure above the relief valve setting.

4. The service air system is not supplying the instrument and control air system inadvertently.

14.2.12.53 Main Generator System

14.2.12.53.1 Main Generator Test (SOV)

Test Objectives

To verify proper operation of the main generator.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Proper operation of the generator seal oil, hydrogen, and carbon dioxide systems will be verified.

2. A generator air test will be performed to verify the integrity of the generator prior to charging with hydrogen.

3. Prior to the initial start-up of the generator, the isolated phase bus duct cooling system, generator trip protection system, condition monitor, and signal system will be verified to be operational.

4. During hot functional testing, proper operation of the exciter and voltage regulator will be verified.

Acceptance Criteria

1. Proper operation of the main generator is demonstrated.

2. Leak integrity of the generator is verified.

15.2.12.53.2 Main Transformer Performance Test (STP)

Test Objectives

To verify proper cooling of the main transformer

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Obtain winding and ambient temperature data at 50 percent reactor power.

2. Obtain winding and ambient temperature data at 100 percent reactor power.

Note: This test will be performed as a special test procedure (STP).

Acceptance Criteria

The main transformer maintains the winding temperature rise to less than 55°C.

14.2.12.54 4160 V Station Service

14.2.12.54.1 This section has intentionally been deleted.

14.2.12.54.2 Emergency ac Power Distribution System Test (PO)

Test Objectives

To demonstrate the capability to supply 4,160 V ac power to the emergency buses.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The supply breaker installed at each emergency bus from its respective normal bus will be verified to function in accordance with the control logic.

2. The proper load shedding scheme will be verified for each emergency bus.

3. Each diesel generator will be automatically started by simulating an undervoltage from the emergency bus and the following will be verified:

    a. Proper voltage and frequency is attained in the specified time period.

    b. Signals to re-energize emergency loads occur in the proper sequence and the required time interval.

4. Emergency loads will be tested to verify that they can operate with the maximum and minimum design voltages.

5. The ability of each diesel generator to maintain proper voltage and frequency regulation under transient conditions will be verified.

6. The ability to synchronize and transfer emergency bus loads from each diesel generator to offsite power will be demonstrated. Each diesel generator will then be restored to the standby condition.

7. The proper operation of the remaining controls, instrumentation, interlocks, and protective devices of the system will be demonstrated.

Acceptance Criteria

1. The 4160 V supply breakers function in accordance with the control logic.

2. Each diesel generator automatically starts, comes up to rated frequency and voltage in the allotted time, loads in sequence and the allotted time, and maintains transient and steady state electrical parameters in accordance with design specifications.

3. Emergency loads are capable of operating at the minimum and maximum design voltages.

4. Each diesel generator is capable of properly shifting load to offsite power and being placed on standby.

5. The remaining 4160 V electrical controls, interlocks, instrumentation, and protective devices are verified to function properly.

14.2.12.54.3 Electrical ac Independence Test (PO)

Test Objectives

To verify the electrical ac independence and redundancy of the emergency diesel generators.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each diesel generator individually will be selected and placed on auto control, with the alternate diesel generator on local control.

2. A loss of offsite ac power will be simulated.

3. Power will be provided to the applicable emergency bus by the operable diesel. All dc and onsite ac power will be secured to the de-energized emergency bus and the following will be verified:

    a. The components associated with the load group on the nonoperable bus are de-energized.

    b. The components associated with the load group on the energized bus are operable and capable of performing their designed function.

Acceptance Criteria

1. The applicable emergency buses are properly energized and de-energized when required by the test procedure.

2. Components on the energized emergency bus are verified to be operable with the redundant emergency bus de-energized.

14.2.12.54.4 Emergency Bus Voltage Analysis Test (PO)

Test Objectives

To demonstrate the load-carrying capability of the BVPS-2 electrical distribution system and to corroborate the analytical techniques and assumptions used in determining minimum and maximum operating voltages.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. A minimum bus loading of 30 percent as required by NUREG-0800 Branch Technical Position PSB-1 will be established on the BVPS-2 electrical distribution system and load-carrying capability will be demonstrated while powered from the system station service transformer. Voltage levels will be monitored on a key string of buses down to the emergency 120VAC bus level.

2. With the BVPS-2 electrical distribution system loaded to a maximum practical test load and powered from the SSSTs, a large non-Class 1E and Class-1E motor will be started separately with bus voltages recorded during the transient and recovery periods. Test results will be compared against the BVPS-2 voltage analysis voltages for the same load conditions.

Acceptance Criteria

1. Load-carrying capability of the BVPS-2 electrical distribution system is demonstrated with voltage levels maintained at or above minimum levels.

2. Test results shall not be more than 3 percent lower than analytically derived voltages. Analysis shall ensure that starting and running voltages will remain above Class-1E equipment rated voltages.

14.2.12.55 Emergency Diesel Generator

14.2.12.55.1 Emergency Diesel Generator System Test (PO)

Test Objectives

To demonstrate proper operation of the emergency diesel generators and their auxiliary systems.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The diesel generator operating parameter alarms will be simulated and annunciation verified.

2. Each manual and auto start signal will be initiated and the auto start sequence logic and fail start logic will be verified.

3. The control logic for diesel generator starting air and fuel oil system will be verified.

4. The proper operation of the diesel generator auxiliary systems, including the starting air, cooling, oil heating, lubrication (prelube and normal) and fuel systems will be verified.

5. The exciter field will be flashed from the 125 V dc system, and the generator output voltage will be varied between design specification limits.

6. The diesel engine governor control will be varied to adjust the diesel engine speed between design set points.

7. Proper operation of the controls, interlocks, and protective devices for the electrical portion of the system will be demonstrated from each generator up to and including its respective emergency bus breaker.

8. The ability of the diesel generators' fuel oil supply system to transfer fuel from the storage tanks to the day tanks will be verified.

9. The ability of the diesel generators to start and achieve operation readiness will be verified by performing a series of tests to demonstrate reliability. Thirty-five consecutive valid tests without failure for each diesel generator will be demonstrated.

10. Proper operation of the diesel generator during load shedding (loss of largest single-load) will be demonstrated.

Acceptance Criteria

1. The operation and control of each diesel generator and its associated auxiliary systems are in accordance with design specifications.

2. The reliability of each diesel generator is demonstrated by fulfilling the requirements of the consecutive start validation testing.

3. The ability to transfer fuel oil from the respective storage tank to the day tank is demonstrated.

14.2.12.55.2 Emergency Diesel Generator Full Load Test (PO)

Test Objectives

To demonstrate the full-load-carrying capability of the emergency diesel generators.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The diesel generators will be operated as required for an interval of not less than 24 hours, of which 22 hours will be at a load equivalent to the continuous rating of the diesel generator and 2-hours at a load equivalent to the 2-hour rating of the diesel generator.

2. It will be verified that the generator output voltage and frequency operating parameter are maintained.

3. Proper operation of the cooling system will be verified.

4. Each diesel generator will be automatically started by simulating an undervoltage from the emergency bus to verify the capability of the diesel generator to start up at a full load temperature condition. The following will be verified.

   a. Proper voltage and frequency is attained in the specified time period.

   b. Emergency loads start in the proper sequence and the required time interval.

Acceptance Criteria

1. The diesel generators are capable of maintaining electrical output parameters within their design limits.

2. The diesel generator cooling systems and other mechanical auxiliary systems function properly and maintain operating parameters within the design limits.

3. Each diesel generator automatically starts under full load temperature conditions, comes up to rated frequency and voltage in the allotted time, and loads in the proper sequence and allotted time.

14.2.12.56 125 V dc Control

14.2.12.56.1 Class 1E Station Batteries, Inverters, and Chargers Test (PO)

Test Objectives

To verify the performance of the Class 1E 125 V dc emergency bus batteries, battery charging systems, and vital bus inverters.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The ability of the preferred power supply to supply the power requirements of the vital buses will be verified.

2. It will be verified that the loss of the preferred power supply can be detected, and that the proper transfer to the standby power sources can be accomplished.

3. A service test of battery capacity will be performed to verify the capability of the batteries to deliver the design requirements of the dc system.

4. Proper operation of the uninterruptible ac electric power system will be verified.

5. The design capacity of the chargers will be verified.

6. Power will be restored to the preferred power supplies. It will be verified that proper transfer from the alternate standby power source to the preferred power source can be accomplished.

7. The operation of the 125 V dc bus ground detectors will be verified.

8. Vital bus inverters will be full load tested using each power source to the inverter.

Acceptance Criteria

1. Battery charger and inverter outputs are in accordance with design parameters.

2. Loss of the preferred power supply is detected, and transfer to and from the standby power sources can be accomplished.

3. Each battery has adequate capacity to perform its design duty cycle.

4. Inverter output at full load is in accordance with design parameters.

14.2.12.56.2 Instrumentation, Annunciator Circuitry, and Emergency Lighting Supply Systems Test (SOV)

Test Objectives

To demonstrate the operation of 125 V dc instrumentation, annunciator circuitry, and the emergency lighting supply system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The emergency lighting supply system will be verified to function in accordance with the control logic and design specifications.

2. Proper operation of alarms panels will be verified.

3. Each 125 V dc switchboard breaker will be operated and the alarm indication will be verified.

Acceptance Criteria

1. The emergency lighting supply system functions in accordance with design specifications and the control logic.

2. The operation of the annunciator circuits is in accordance with design specifications, based upon 125 V dc control system alarms set points.

14.2.12.56.3 Non-Class lE 125 V dc Operability Test (SOV)

Test Objective

To verify the performance of the non-Class 1E 125 V dc charging systems and the uninterruptible power supply.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. It will be verified that the loss of the preferred power supply can be detected, and that the proper transfer to the standby power sources can be accomplished.

2. Proper operation of the uninterruptible ac electric power system will be verified.

3. The design capacity of the battery chargers will be verified.

4. Power will be restored to the preferred power supply and proper transfer from the alternate standby power source to the preferred power source will be verified.

5. The operation of the 125 V dc bus ground detectors will be verified.

Acceptance Criteria

1. The uninterruptible power supply operates properly to supply power to the essential buses.

2. The transfer switches work properly to maintain a steady source of uninterruptible power.

3. The battery charger capacity is in accordance with design specification.

14.2.12.57 Station Communications System

14.2.12.57.1 Plant Communications Test (SOV)

Test Objectives

To verify that all communication systems in the plant function properly to provide adequate communication coverage and audibility.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The telephone systems (Bell and Pax) will be tested by placing phone calls to designated management personnel, emergency locations, and on/offsite locations from site locations.

2. The ability to page from each location will be verified, and each line to the control room will be tested.

3. The actuation of the standby and evacuation alarms will be tested from various initiating points.

4. The mobile radio system will be checked by contacting the operator of a portable unit at various locations.

5. At 100-percent power level, audibility of the standby alarm and evacuation alarm will be verified.

Acceptance Criteria

The ability of the plant communication systems to provide adequate communication coverage and audibility is demonstrated.

14.2.12.58 Hot Water Heating System

14.2.12.58.1 Building Hot Water Heating System Test (SOV)

This section has intentionally been deleted.

14.2.12.59 Domestic Water System

14.2.12.59.1 Domestic Water System Test (SOV)

This section has intentionally been deleted.

14.2.12.60 Building and Yard Drains System

14.2.12.60.1 Essential Equipment Drains Test (SOV)

Test Objectives

To verify proper operation of the essential equipment drains.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. System pumps will be tested to verify that the pumps function in accordance with design specifications and the control logic.

2. Pump discharge flow paths will be verified to deliver water to the appropriate location.

3. Sump level alarms will be verified.

Acceptance Criteria

Proper operation of the essential equipment drains is demonstrated.

14.2.12.61 Radiation Monitoring System

14.2.12.61.1 Radiation Monitoring Systems Test (PO)

Test Objectives

To demonstrate the capability of the process and area radiation monitoring systems (RMSs) to detect, indicate, record, and annunciate radiation levels.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The proper operation of each radiation monitor, including indication, alarms, and initiation of required control functions will be verified.

2. Monitor response to check sources and sample flow rates will be recorded.

Acceptance Criteria

Radiation monitoring systems function in accordance with design specifications.

14.2.12.61.2 Effluent Radiation Monitor Test (IST)

Test Objectives

To verify the proper operation of the effluent monitors.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Prior to core load, the proper operation of each effluent monitor, including indication, alarms, and initiation of required control functions will be verified.

2. Monitor response to check sources and sample flow rates will be recorded.

3. During power ascension, effluent will be sampled and the effluent monitor performance will be verified through radiochemical analysis.

Acceptance Criteria

The installed effluent monitors function in accordance with design specifications and properly indicate the radioactive content of the effluent.

14.2.12.61.3 Plant Radiation Survey and Verification of Shielding Effectiveness (IST)

Test Objectives

To determine the effectiveness of the biological shielding and to verify the operability of area radiation monitors (ARMs).

Prerequisites

The plant is initially in operational mode 2 (≤5 percent power level). Parts of the test will be done in operational mode 1 (50 percent and 100 percent power levels).

Test Methods

1. Radiation surveys will be made during steady state plant conditions at various power levels (≤5 percent, 45-50 percent, 95-100 percent) to determine gamma and neutron dose rates at preselected points.

2. The response of ARMs will be compared with the survey instrument readings.

Acceptance Criteria

1. Radiation levels are within the limits for the zone designation of each area surveyed.

2. Radiation monitor response is consistent with the survey results.

14.2.12.62 Control Building Heating, Ventilation, and Air-Conditioning System

14.2.12.62.1 Control Building Heating, Ventilation, and Air-Conditioning System Test (PO)

Test Objectives

To determine that the control building heating, ventilation, and air-conditioning (HVAC) system functions properly during normal and abnormal conditions.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each air-conditioning unit, emergency makeup fan, motor-actuated damper, heating coil, roll filter, and condensing unit will be tested to verify the equipment functions in accordance with the control logic.

2. Fan capacities, equipment vibration, duct air flow balance, filter efficiency, and motor current will be monitored and recorded.

3. It will be verified that actuation of the smoke purge switch allows the ventilating system to go to the 100 percent outdoor air intake mode.

4. It will be verified that the air storage bottles and emergency air makeup fans provide air in the event of a containment isolation signal phase B (CIB) or high area radiation levels in the control room envelope.

5. Proper operation of annunciators and indicating lights will be verified.

6. It will be verified that the temperature and pressure in the main control room can be maintained within design specifications during normal operation and abnormal conditions.

Acceptance Criteria

System equipment operates in accordance with design specifications and the control logic.

14.2.12.63 Fuel, Safeguards, Cable Vault, and Main Steam Valve Building Heating, Ventilation, and Air-conditioning System

14.2.12.63.1 Engineered Safety Features Equipment Ventilation Test (PO)

Test Objectives

To demonstrate the adequate performance of heating, ventilation, and air-conditioning (HVAC) systems that serve spaces housing engineered safety features (ESF) equipment

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1 are met.

Test Methods

1. Air handling units, filters, and dampers for the HVAC systems that serve spaces housing ESF equipment will be tested to verify that the HVAC equipment functions in accordance with design specifications and the control logic.

2. The proper operation of alarms and indicating lights will be verified.

3. The system will be balanced to establish required flow rates.

4. Heating and cooling capabilities, filter efficiencies and differential pressures will be verified.

5. The ability to maintain areas served by this system within design temperature limits will be verified at selected power levels.

Acceptance Criteria

1. The HVAC equipment functions in accordance with design specifications and control logic.

2. Proper operation of alarms and indicating lights is demonstrated.

3. Air flows, temperature, filter efficiencies, and differential pressures are in accordance with design specifications.

14.2.12.63.2 Fuel Building, Decontamination Building, and Pipe Tunnel Area Heating, Ventilation, and Air-Conditioning Systems Test (SOV)

Test Objectives

To verify the performance of the HVAC systems of the fuel building, decontamination building, and pipe tunnel area.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Air handling units, fans, unit heaters, filters, and dampers for the HVAC systems serving the fuel and decontamination buildings and pipe tunnel area will be tested to verify that the equipment functions in accordance design specifications and the control logic.

2. The proper operation of alarms and, indicating lights will be verified.

3. The systems will be balanced to establish required flow rates.

4. Heating and cooling capabilities, filter efficiencies, and differential pressures will be verified.

5. The ability of the pipe tunnel ventilation system to maintain the pipe tunnel within design temperature limits will be verified at 50 percent and 100 percent power.

Acceptance Criteria

1. The HVAC equipment functions in accordance with the control logic and design specifications.

2. Proper operation of alarms and indicating lights is demonstrated.

3. Air flows, temperatures, filter efficiencies and differential pressures are in accordance with design specifications.

14.2.12.64 Containment Purge and Exhaust System

14.2.12.64.1 Containment Purge and Exhaust System Test (SOV)

Test Objectives

To verify the operability of the containment purge and exhaust system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. System fans will be tested to verify the fans function in accordance with design specifications and the control logic.

2. The system will be balanced to establish required flow rates.

3. Filter efficiencies and differential pressures will be verified.

4. System realignment in response to control signals will be verified.

Acceptance Criteria

The containment purge and exhaust system functions in accordance with design specifications and the control logic.

14.2.12.65 Control Rod Drive Mechanism Shroud Cooling System

14.2.12.65.1 Control Rod Drive Mechanism Shroud Cooling System Test (SOV)

Test Objectives

To demonstrate the proper operation of the control rod drive mechanism (CRDM) shroud cooling system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The control logic for the fans and cooling coil isolation valves will be verified.

2. The proper operation of the CRDM shroud cooling system alarms and indicating lights will be verified.

3. Each shroud cooling fan will be tested to verify operating parameters, and system flow rates will be verified.

4. During hot functional testing, CRDM shroud cooling air temperatures and cooling coil operating parameters will be monitored to verify cooling capabilities.

Acceptance Criteria

Proper operation of the CRDM shroud cooling system is demonstrated.

14.2.12.66 Containment Air Recirculation System

14.2.12.66.1 Containment Air Recirculation Fans Test (SOV)

Test Objectives

To demonstrate proper operation of the containment air recirculation fans.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each containment air recirculation fan and cooling water inlet valve will be tested to verify that it functions in accordance with design specifications and the control logic.

2. The system will be balanced to establish the required flow rates.

3. During the Integrated Leak Rate Test, the fans will be operated on slow speed and the operating parameters will be verified.

Acceptance Criteria

Fans and cooling water inlet valves function in accordance with design specifications and the control logic.

14.2.12.66.2 Containment Air Recirculation System Test (SOV)

Test Objectives

To verify the capability of the containment air recirculation system to maintain the containment temperature within Technical Specification limits.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

The containment air temperature will be recorded at 5-, 50-, and 100-percent reactor power levels using the installed containment air temperature sensor system.

Acceptance Criteria

The containment air temperatures are in accordance with Technical Specifications.

14.2.12.67 Deleted

14.2.12.68 Auxiliary Building Area Heating, Ventilation, Air-Conditioning Systems

14.2.12.68.1 Auxiliary and Waste Handling Building Heating Ventilation, and Air-Conditioning Systems Test (SOV)

Test Objectives

To demonstrate the proper operation of the heating, ventilation, and air-conditioning (HVAC) systems for the auxiliary and waste handling building.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. System fans, dampers, filters, and temperature control valves will be tested to verify the HVAC equipment functions in accordance with design specifications and the control logic.

2. Proper operation of alarms and indicating lights will be verified.

3. Air flows, cooling capabilities, and filter efficiencies will be verified.

Acceptance Criteria

Proper operation of the HVAC equipment for the auxiliary and waste handling building is demonstrated.

14.2.12.69 Secondary Plant Buildings, Primary and Alternate Intake Structures Heating, Ventilation, and Air-Conditioning Systems

14.2.12.69.1 Miscellaneous Safety-Related Heating, Ventilation, and Air-Conditioning Systems Test (PO)

Test Objectives

To demonstrate the proper operation of the heating, ventilation, and air-conditioning (HVAC) systems for miscellaneous safety-related areas, which include the emergency switchgear area, service building battery room, intake structure, and diesel generator room.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each fan and damper will be tested to verify the ventilation equipment functions in accordance with the control logic and design specifications.

2. Proper operation of the alarms and indicating lights will be verified.

3. Proper operation of filters will be demonstrated.

4. The ability of the systems to supply air flow to the areas served will be demonstrated.

Acceptance Criteria

The miscellaneous safety-related HVAC systems function in accordance with design specifications and the control logic.

14.2.12.69.2 Miscellaneous Secondary Plant Heating, Ventilation, and Air-Conditioning System Test (SOV)

Test Objectives

To demonstrate the proper operation of the heating, ventilation, and air-conditioning (HVAC) systems for miscellaneous secondary plant areas which include the normal switchgear room, turbine building elevator machinery room, alternate intake structure, service building equipment room, and cooling tower pump house.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each fan and damper will be tested to verify the HVAC equipment functions in accordance with design specifications and the control logic.

2. Proper operation of the alarms and indicating lights will be verified.

3. Proper operation of filters will be demonstrated.

4. The ability of the systems to supply air flow to the areas served will be demonstrated:

Acceptance Criteria

The miscellaneous secondary plant HVAC systems function in accordance with design specifications and the control logic.

14.2.12.70 Condensate Polishing Building Heating, Ventilation, and Air-Conditioning Systems

14.2.12.70.1 Condensate Polishing Building Heating, Ventilation and Air-Conditioning System Test (SOV)

Test Objectives

To demonstrate the proper operation of the heating, ventilation, and air-conditioning (HVAC) system for the condensate polishing building.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each fan and damper will be tested to verify that the HVAC equipment functions in accordance with design specifications and the control logic.

2. Proper operation of the alarms and indicating lights will be verified.

3. Air flows, differential pressures, cooling and heating capabilities, and filter efficiency will be verified.

Acceptance Criteria

The condensate polishing building HVAC system functions in accordance with the control logic and design specifications.

14.2.12.71 Loose Parts Monitoring System

14.2.12.71.1 Loose Parts Monitoring System Test (SOV)

Test Objectives

To obtain baseline data and verify the proper operation of the loose parts monitoring system (LPMS).

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. During cold shutdown with the plant in a quiet state, the online sensitivity of the loose parts monitoring system will be checked by impacting in the vicinity of the sensors with a known weight and energy.

2. The final alarm setpoints will be determined and set based on LPMS data recorded and analyzed prior to initial startup and at various power levels up to 100 percent.

3. Alarm and control logic will be verified using installed test devices.

Acceptance Criteria

The loose parts monitoring system is able to automatically detect a loose part weighing between 0.25 lb and 30 lb with an impact energy of 0.5 ft-lb during normal plant operation.

14.2.12.72 Seismic Monitoring System

14.2.12.72.1 Seismic Instrumentation Test (SOV)

This section has intentionally been deleted.

14.2.12.73 Heat Tracing System

14.2.12.73.1 QA Category I Heat Tracing System Test (PO)

Test Objectives

To verify the QA Category I heat tracing system operates properly and has the capacity to maintain system temperatures within design specification.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each of the affected systems will be filled and vented.

2. Each heat tracing circuit will be tested to verify thermostatic controls energize and de-energize heating elements at specified temperatures.

3. Each heat tracing circuit's overtemperature and undertemperature alarm points will be verified to alarm at the proper temperature.

4. The heat tracing for each system will be energized and operated for a minimum of 24 hours. At the end of this period, temperatures of the heat traced portions of the applicable systems will be verified to be within design specification.

5. The redundant heat tracing for each system will be tested in a similar manner.

Acceptance Criteria

1. The QA Category I heat tracing system maintains temperatures within design specification.

2. Each of the QA Category I heat tracing circuit's alarms and control points are within design specification.

14.2.12.73.2 Non-QA Category I Heat Tracing System Test (SOV)

Test Objectives

To verify proper operation of the non-QA Category I heat tracing system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Each heat tracing circuit will be tested to verify thermostatic controls energize and de-energize heating elements at the specified temperatures.

2. Each heat tracing circuit's overtemperature and undertemperature alarm points will be verified to alarm at the proper temperature.

3. The heat tracing for each system will be energized and operated for a minimum of 24 hours. At the end of this period, temperatures of the heat traced portions of the applicable systems will be verified to be within design specification.

4. The redundant heat tracing for each system will be tested in a similar manner.

Acceptance Criteria

1. The non-QA Category I heat tracing system maintains temperatures within design specifications.

2. Each of the non-QA Category I heat tracing circuit's alarm and control points are within design specification.

14.2.12.74 Electric Fault Recording System

14.2.12.74.1 Electric Fault Recording Test (SOV)

Test Objectives

To verify proper operation of the electric fault recorder.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The normal operating mode of the fault recorder will be observed, including automatic tape shifting.

2. A simulated fault will be initiated and proper operation of the electric fault recorder will be verified.

Acceptance Criteria

The electric fault recorder functions in accordance with design specifications.

14.2.12.75 Post-Design Basis Accident Hydrogen Control System

14.2.12.75.1 Post-Design Basis Accident Hydrogen Control System Test (PO)

Test Objectives

To determine the availability and proper operation of the post-design basis accident (DBA) hydrogen control system.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. System valves will be tested to verify the valves function in accordance with the control logic.

2. The containment atmosphere purge blower will be tested to verify the blower functions in accordance with the control logic and design specifications.

3. Proper operation of the analyzers will be verified with a calibrated gas sample.

4. System leakage will be verified to be in accordance with design specifications.

Acceptance Criteria

The post-DBA hydrogen control system functions in accordance with design specifications and the control logic.

14.2.12.76 Containment

14.2.12.76.1 Containment Type C Leak Rate Test (PO)

Test Objectives

To measure the leakage rate of containment isolation valves.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. All valves to be tested will be closed by their normal closure method.

2. Containment isolation valves will be leak tested by local pressurization.

3. Leakage rates will be recorded.

Acceptance Criteria

The leakage rate for the containment isolation valves combined with the leakage rate for Type B tests is less than the limit specified in the Technical Specifications.

14.2.12.76.2 Containment Type B Leak Rate Test for the Electrical Penetrations (PO)

Test Objectives

To measure the leakage rate of electrical penetrations.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

Electrical penetrations Type 1 through 10 will be tested by pressurizing the volume between the double O-ring seals.

Acceptance Criteria

The leakage rate for the electrical penetration combined with the leakage rate for all other penetrations and valves subject to Type B and C tests is less than the limit specified in the Technical Specifications.

14.2.12.76.3 Containment Type B Leak Rate Test for the Personnel Air Lock (PO)

Test Objectives

To measure the leakage rate of the personnel air lock.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The personnel air lock will be tested by pressurizing the volume between the inner and outer doors with air.

2. The space between the personnel air lock double O-ring seals on each door, the 18-inch manway, and the shaft seals will be locally tested and the leakage recorded.

Acceptance Criteria

The leakage rate for the personnel air lock is in accordance with the Technical Specifications limits.

14.2.12.76.4 Containment Type B Leak Rate Test for the Equipment Hatch (PO)

Test Objectives

To measure the leakage rate of the equipment hatch.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The volume between the double O-rings of the equipment hatch cover to barrel, bolt flange to equipment hatch cover, and emergency air lock doors including shaft seals will be pressurized and the leakage rate recorded.

2. The volume of the emergency escape hatch will be pressurized and the leakage rate recorded.

Acceptance Criteria

The leakage rate for the equipment hatch and emergency air lock are in accordance with Technical Specification limits.

4.2.12.76.5 Containment Type B Leak Rate Test for Fuel Transfer Tube Flange (PO)

Test Objectives

To measure the leakage rate of the fuel transfer tube blind flange.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

The volume between the gaskets of the fuel transfer tube blind flange will be pressurized and the leakage rate recorded.

Acceptance Criteria

The leakage rate for the fuel transfer tube blind flange combined with the leakage rate for all other penetrations and valves subject to Type B and C tests is less than the limit specified in the Technical Specifications.

14.2.12.76.6 Containment Structural Integrity Test (PO)

Test Objectives

To verify the structural integrity of the containment building by visual inspection.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

A general visual inspection of the accessible interior and exterior surfaces of the containment structure will be performed to uncover any evidence of structural deterioration which may affect either the Containment Structural Acceptance Test or the Type A Containment Leak Rate Test.

Acceptance Criteria

The structural integrity of the containment building is verified.

14.2.12.76.7 Containment Type A Leak Rate Test (Integrated Leak Rate Test) (PO)

Test Objectives

To measure the containment overall integrated leak rate.

Prerequisites

The containment penetrations are aligned as required for this test.

Test Methods

1. The reactor containment will be pressurized to the specified pressure.

2. After a stabilization period, readings will be taken for an adequate period of time so that an accurate leakage rate can be determined.

3. A verification test will be performed to check the accuracy of the test results.

Acceptance Criteria

The measured containment leakage rate is less than the limit specified in the Technical Specifications.

14.2.12.76.8 Miscellaneous Containment Isolation Valves Controls Test (PO)

Test Objectives

To verify operability and measure the stroke times of various safety-related containment isolation valves that are in nonsafety-related systems.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The valves will be tested to verify that they function in accordance with their control logics.

2. During each valve operation, the valve stroke time will be recorded.

Acceptance Criteria

The operation and stroke times of all valves are in accordance with their control logics and design specifications.

14.2.12.76.9 Personnel Airlock Operability Test (PO)

Test Objectives

To verify that the personnel airlock operates in accordance with design requirements.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The personnel airlock will be tested to verify the airlock functions in accordance with control logic and design requirements.

2. The personnel airlock operates when the containment is sub-atmospheric.

Acceptance Criteria

The personnel airlock functions at sub-atmospheric conditions.

14.2.12.76.10 Equipment Hatch Emergency Airlock Operability Test (PO)

Test Objectives

To verify that the equipment hatch emergency airlock operates in accordance with design requirements.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1 are met.

Test Methods

1. The equipment hatch emergency airlock will be tested to verify that the airlock functions in accordance with control logic and design requirements.

2. The equipment hatch emergency airlock operates when the containment is sub-atmospheric.

Acceptance Criteria

The equipment hatch emergency airlock functions at sub-atmospheric conditions.

14.2.12.76.11 Containment Penetration Valves Integrity Test (PO)

Test Objectives

To obtain Base Line Leakage Rates for containment penetration valves excluded from the Containment Type C Leak Rate Test (Section 14.2.12.76.1).

Prerequisites

The applicable general prerequisites as listed in Section 14.2.12.1.1, are met.

Test Methods

1. All valves to be tested will be closed by their normal closure method.

2. Valves will be leak tested by local pressurization with water.

3. Leakage rates will be recorded.

Acceptance Criteria

The leakage rate for each containment penetration valve is less than the previously determined acceptable limits. The leakage rates will be recorded as the base line leakage for each valve.

14.2.12.77 Fuel Handling Tools

14.2.12.77.1 Fuel Handling Test (PO)

Test Objectives

To demonstrate operability of the fuel handling equipment.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. Proper operation of specialized tools, such as the rod cluster control changing fixture, control rod drive shaft unlatching tool, and new and spent fuel assembly handling tools will be verified.

2. System interlocks and alarms will be demonstrated to operate in accordance with the control logic.

3. A dummy fuel assembly will be utilized to demonstrate the ability to transfer an assembly from the spent fuel pit to its core location.

Acceptance Criteria

Proper operation of the fuel handling equipment is demonstrated.

14.2.12.77.2 Cranes and Lifting Equipment Test (PO)

Test Objectives

To demonstrate the operability of plant cranes and hoists.

Prerequisites

The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The plant cranes and hoists will be static load tested to 125 percent of the design load.

2. Movement of the plant cranes and hoists at 100 percent of rated load will be demonstrated.

3. Proper operation of interlocks and alarms will be verified.

Acceptance Criteria

The operation of plant cranes and hoists are in accordance with design specifications.

14.2.12.78 Boron Recovery System

14.2.12.78.1 Boron Recovery System Test (SOV)

Test Objectives

To verify the proper operation of the boron recovery system equipment and controls.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

2. The boron recovery system is capable of accepting flow from the CVCS or the PDTTs and returning flow to the CVCS or the coolant recovery tanks on BVPS-1.

3. The auxiliary steam supply system or other source of steam shall be available.

4. The gaseous waste disposal system or an alternate means of disposing of degasifier effluent condensibles and gases shall be available.

Test Methods

1. Each degasifier circulation pump will be tested to verify that the pump functions in accordance with control logic and design specifications.

2. System heat exchangers and condensers will be tested to verify that they function in accordance with design specifications.

3. Operation of the boron recovery degasifiers, cesium ion exchangers and coolant recovery filtration system and associated controls and alarms will be verified.

Acceptance Criteria

The boron recovery system and associated equipment function in accordance with design specifications and control logic.

14.2.12.79 Sewage Treatment System

14.2.12.79.1 Sewage Treatment System Test (SOV)

This section has intentionally been deleted.

14.2.12.80 Fire Protection - Halon

14.2.12.80.1 Halon System Test (SOV)

Test Objectives

To verify that the halon system operates properly and delivers acceptable concentrations of halon to the computer room and communications room.

Prerequisites

1. The applicable general prerequisites, as listed in Section 14.2.12.1.1, are met.

Test Methods

1. The halon system will be operated in the manual and automatic modes to verify that all alarms, valves, and controls function in accordance with design specifications and control logic.

2. Halon 1301 cylinders will be replaced with test cylinders of Halon 122 and both the computer room and communications room will be full discharge tested to verify proper halon concentrations.

Acceptance Criteria

1. The halon system alarms, valves, and controls function in accordance with design specifications and control logic.

2. The halon discharge concentrations for both the computer room and communications room are 5 percent to 7 percent at 70°F. Corrections for temperature variations will be made per NFPA 12A-1980, Table 2-5.2. The concentration shall be maintained in this range for 10 minutes following initial discharge.

3. Upon completion of testing the halon 1301 storage cylinder weights and pressures will be in accordance with design specification limits.

14.2.12.81 Site Security System

14.2.12.81.1 Site Security System Test (SOV)

This section has intentionally been deleted.

14.2.13 Snubber Preservice Examination and Preoperational Testing

Test Objective

To verify the capability of all mechanical and hydraulic snubbers, except those installed in a nonsafety-related system for which their failure or failure of the system in which they are installed would have no adverse affect on any safety-related system.

Test Methods

1. Service life evaluation shall be performed to ensure that service life of each snubber (particularly elastomers) will not expire prior to the end of the first inservice inspection.

2. Snubber visual examination will be performed to ensure that installed snubbers are not seized, frozen, or jammed. Manual stroking of snubbers either in place or detached will be limited to snubber sizes that can be manually handled.

3. Preoperational testing will be performed to verify thermal movement of snubbers for systems whose operating temperature exceeds 250°F. Thermal movements will be checked before, during, and after hot functional testing to verify that:

   a. At specified temperature plateaus during initial system heatup and cooldown and prior to proceeding to the next temperature plateaus to ensure that the snubber expected setting meets the acceptance standards. If maximum operating temperature is not attained, the hot position setting may be extrapolated from lower intermediate range temperature/position readings;

   b. There is a swing clearance at each heatup and cooldown temperature plateau.

4. For systems operating at 250°F or below, cold setting is verified to meet acceptance standard.

5. Tests performed at manufacturer's facility to requirements of snubber design specifications fulfill the preservice testing requirements.

6. If the period between initial preservice examination and the completion of hot functional test exceeds 6 months, reexamination shall be performed to verify that:

   a. There are no visible signs of damage or impaired operability as a result of storage, handling, or installation;

   b. Adequate swing clearance is provided to allow snubber movement;

   c. If applicable, the fluid is at the recommended level and is not leaking from the snubber system.

Acceptance Criteria

1. Snubber service life shall be concurrent with or extend beyond the end of the first inservice inspection period.

2. Visual examination results shall be evaluated utilizing the following acceptance standards:

   a. There are no visual signs of damage or impaired operability;

b. Snubber load rating, location, orientation, position, setting, and configuration are according to design drawings and specification;

c. Snubbers are not seized, frozen, or jammed;

d. Adequate swing clearance is provided to allow snubber movement;

e. Fluid level indication is at recommended level and not leaking from hydraulic snubber system;

f. Structural connections such as pins, fasteners, and other connecting hardwares are installed correctly;

g. Snubber hot and cold positions are within settings specified;

h. Fluid port of hydraulic snubbers is covered.

3. Snubber parameters for testing shall be in accordance with the values specified by design specifications.

4. Snubbers whose examination conforms to visual examination and operability testing requirements shall be acceptable for service.

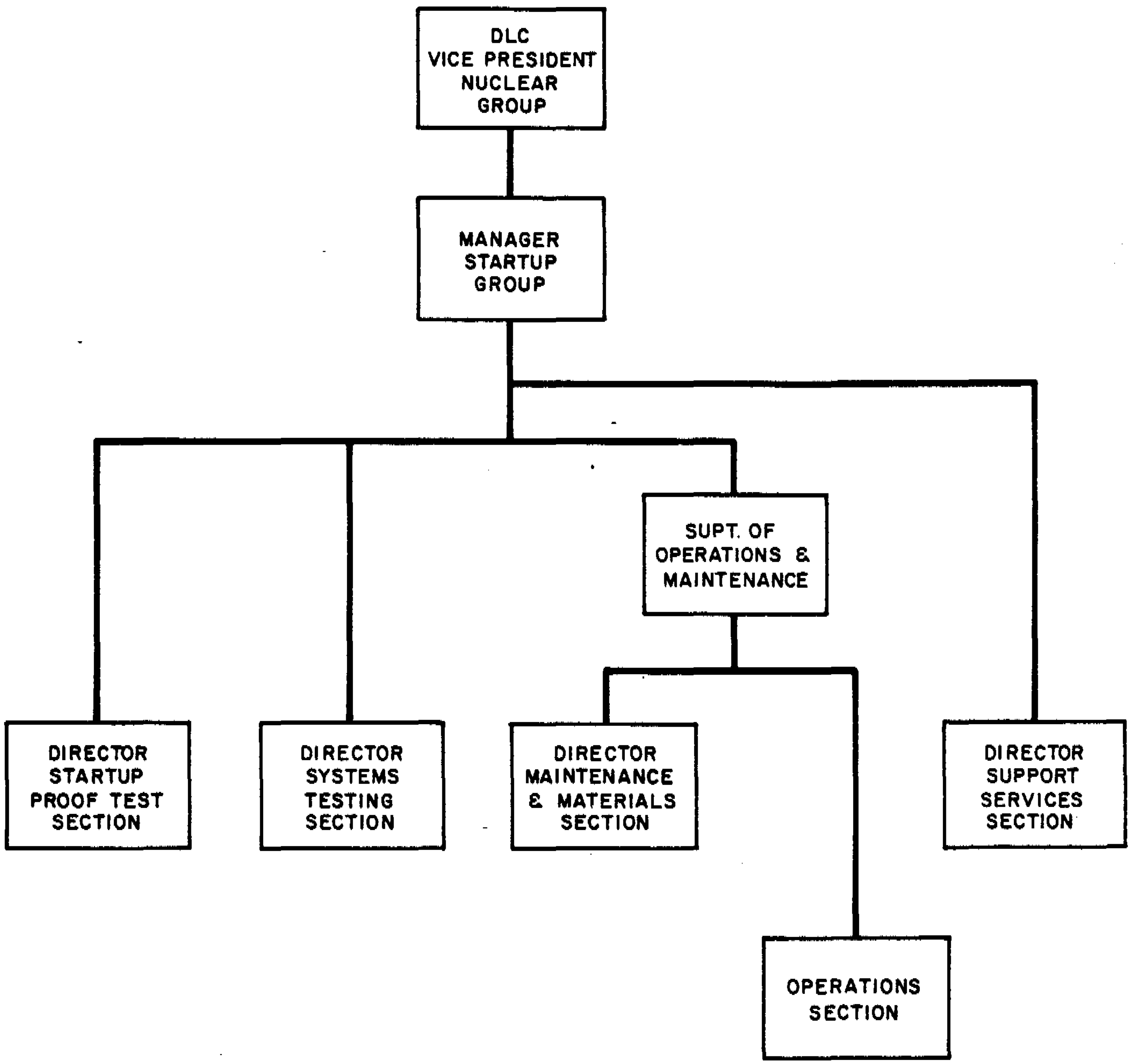

FIGURE 14.2-1
BVPS-2 STARTUP GROUP
BEAVER VALLEY POWER STATION-UNIT 2
FINAL SAFETY ANALYSIS REPORT