December 28, 2022 Docket No. 52-050

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Submittal of the NuScale Standard Design Approval Application Part 2 – Final Safety Analysis Report, Chapter 14, "Initial Test Program and Inspections, Tests, Analyses, and Acceptance Criteria," Revision 0

REFERENCES:
1. NuScale letter to NRC, "NuScale Power, LLC Submittal of Planned Standard Design Approval Application Content," dated February 24, 2020 (ML20055E565)
2. NuScale letter to NRC, "NuScale Power, LLC Requests the NRC staff to conduct a pre-application readiness assessment of the draft, 'NuScale Standard Design Approval Application (SDAA),'" dated May 25, 2022 (ML22145A460)
3. NRC letter to NuScale, "Preapplication Readiness Assessment Report of the NuScale Power, LLC Standard Design Approval Draft Application," Office of Nuclear Reactor Regulation dated November 15, 2022 (ML22305A518)
4. NuScale letter to NRC, "NuScale Power, LLC Staged Submittal of Planned Standard Design Approval Application," dated November 21, 2022 (ML22325A349)

NuScale Power, LLC (NuScale) is pleased to submit Chapter 14 of the Standard Design Approval Application, "Initial Test Program and Inspections, Tests, Analyses, and Acceptance Criteria," Revision 0. This chapter supports Part 2, "Final Safety Analysis Report," (FSAR) of the NuScale Standard Design Approval Application (SDAA) (Reference 1). NuScale submits the chapter in accordance with requirements of 10 CFR 52 Subpart E, Standard Design Approvals. As described in Reference 4, the enclosure is part of a staged SDAA submittal. NuScale requests NRC review, approval, and granting of standard design approval for the US460 standard plant design.

From July 25, 2022 to October 26, 2022, the NRC performed a pre-application readiness assessment of available portions of the draft NuScale FSAR to determine the FSAR's readiness for submittal and for subsequent review by NRC staff (References 2 and 3). The NRC staff reviewed draft Chapter 14. The NRC did not identify readiness issues with the chapter.

Enclosure 1 contains SDAA Part 2 Chapter 14, "Initial Test Program and Inspections, Tests, Analyses, and Acceptance Criteria," Revision 0.

This letter makes no regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions, please contact Mark Shaver at 541-360-0630 or at mshaver@nuscalepower.com.

I declare under penalty of perjury that the foregoing is true and correct. Executed on December 28, 2022.

Sincerely,

Carrie Fosaaen
Senior Director, Regulatory Affairs
NuScale Power, LLC

Distribution: Brian Smith, NRC
Michael Dudek, NRC
Getachew Tesfaye, NRC
Bruce Bavol, NRC
David Drucker, NRC

Enclosure 1: SDAA Part 2 Chapter 14, "Initial Test Program and Inspections, Tests, Analyses, and Acceptance Criteria," Revision 0

Enclosure 1:

SDAA Part 2 Chapter 14, “Initial Test Program and Inspections, Tests, Analyses, and Acceptance Criteria,” Revision 0

NuScale US460 Plant
Standard Design Approval Application

Chapter Fourteen

Initial Test Program and Inspections, Tests, Analyses, and Acceptance Criteria

Final Safety Analysis Report

Revision 0

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CHAPTER 14 INITIAL TEST PROGRAM AND INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA

14.0 Verification Programs

Verification programs include the initial test programs for the NuScale Power, LLC (NuScale) Power Plant US460 standard design. The Initial Test Programs are comprised of preoperational tests, initial fuel loading, initial criticality, low-power tests, and power-ascension tests. The verification programs ensure that the as-built facility configuration and operation comply with the approved plant design and applicable regulations.

The verification programs also include Inspections, Tests, Analyses, and Acceptance Criteria. The methodology associated with developing Inspections, Tests, Analyses, and Acceptance Criteria is described in Section 14.3.

The initial test program tests structures, systems, components, and design features for both the nuclear portion of the facility and the balance-of-plant. The Initial Test Program contains information that

- addresses the major phases of the test program including preoperational tests, initial fuel loading, initial criticality, low-power tests, and power-ascension tests, including scope and general plans for demonstrating that due consideration has been given to matters that normally require advance planning.
- demonstrates that an adequate number of qualified personnel support the program.
- demonstrates the adequacy of administrative controls to govern the conduct of the program.
- allows plant staff the ability to train using the plant's operating procedures.
- demonstrates and verifies the adequacy of plant operating and emergency procedures to the extent practicable during the period of the Initial Test Program.
- allows for the verification of functional requirements.
- demonstrates sequence of testing such that the safety of the plant does not depend on untested structures, systems, and components.

14.1 Specific Information to be Addressed for the Initial Plant Test Program

The Initial Test Program establishes procedures and controls used to conduct tests and evaluate the results of tests as described in Section 14.2. The Initial Test Program is used to satisfy relevant requirements of the following regulations:

- 10 CFR 30.53 as it relates to testing radiation detection equipment and monitoring instruments
- 10 CFR 50.34(b)(6)(iii) as it relates to providing information associated with preoperational testing and initial operations
- Criterion XI of Appendix B to 10 CFR Part 50 as it relates to test programs to demonstrate that systems, structures, and components perform satisfactorily
- Option A or Option B of Appendix J to 10 CFR Part 50 as it relates to preoperational leakage rate testing
- 10 CFR 52.79 as it relates to preoperational testing and initial operations
- Subpart A, Subpart B, and Subpart C of 10 CFR Part 52 as they relate to the Inspections, Tests, Analyses, and Acceptance Criteria that the applicant must submit

14.2 Initial Plant Test Program

14.2.1 Summary of Initial Test Program and Objectives

The Initial Test Program (ITP) consists of a series of preoperational and startup tests conducted by the Startup organization. Preoperational testing is conducted for each NuScale Power Module (NPM) following completion of construction testing but before fuel load. Completion of preoperational testing for each NPM is necessary to ensure the NPM is ready for fuel loading and startup testing.

Startup tests of an NPM are performed following the completion of preoperational testing. Startup testing includes the following:

- initial fuel loading and pre-critical testing
- initial criticality testing
- low-power testing
- power-ascension testing

Startup testing is performed to confirm the design bases of the NPM and to demonstrate to the extent practicable the NPM operates in accordance with design and is capable of responding to anticipated transients and postulated accidents as described in Section 15.0.

The objectives of the ITP are to

- provide assurance that structures, systems, and components (SSC) operate in accordance with their design.
- provide assurance that construction and installation of equipment in the facility is completed in accordance with the design.
- demonstrate to the extent practicable the validity of analytical models used to predict plant responses to anticipated transients and postulated accidents, and to demonstrate to the extent practicable the correctness and conservatism of assumptions used in those models.
- familiarize the plant operating and technical staff with operation of the facility.
- perform testing to the extent practicable using plant conditions to simulate actual operating, abnormal operating occurrences, and emergency conditions to which the SSC may be subjected.
- verify to the extent practicable by trial use the facility operating procedures, that surveillance procedures and emergency procedures are adequate.
- verify that interfaces and system and component interactions are in accordance with the design.
- complete and document the ITP testing required to satisfy preoperational and startup testing requirements and Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) testing requirements.

Preoperational and startup testing is performed on SSC

- relied upon for safe shutdown and cooldown of the NPM under normal conditions and for maintaining a safe condition for an extended shutdown period.
- relied upon for safe shutdown and cooldown of the NPM under transient and postulated accident conditions and for maintaining a safe condition for an extended shutdown period following such conditions.
- relied upon for establishing conformance with safety limits or limiting conditions for operation that are included in the technical specifications (TS).
- assumed to function or for which credit is taken in the accident analyses as described in Chapter 15.
- used to process, store, control, or limit the release of radioactive materials.
- relied upon to maintain their structural integrity during normal operation, anticipated transients, simulated test parameters, and design-basis event conditions to avoid damage to safety-related SSC.
- identified as risk-significant in the Probabilistic Risk Assessment.

The ITP is implemented consistent with the requirements of Criterion XI of 10 CFR 50 Appendix B. Implementation of the ITP ensures testing required to demonstrate an SSC perform satisfactorily in service are identified and performed in accordance with written test procedures that incorporate the requirements and acceptance limits in the applicable design documents.

Leak rate testing of the NPM and related systems and components penetrating the containment pressure boundary is described in Section 6.2. Leak rate testing test abstracts are presented in Section 14.2.12.

The methodology associated with the development of the ITAAC necessary to demonstrate the facility is constructed and is operated in conformity with the Final Safety Analysis Report (FSAR) and the applicable Nuclear Regulatory Commission (NRC) regulations is presented in Section 14.3.

The design's compliance with the proposed technical resolution of unresolved safety issues and medium- and high-priority generic safety issues identified in NUREG-0933 are addressed in Section 1.9.3. Operating experience insights are addressed in Section 1.9.4 and Section 14.2.8. Compliance with technically relevant portions of the Three Mile Island requirements are addressed in Section 1.9.3.

14.2.1.1 Construction Organization Testing

The objective of construction testing is to verify, on a system basis, the system is constructed and installed in accordance with design requirements. Construction tests include but are not limited to

- flushing.
- cleaning.
- hydrostatic pressure tests.

- wiring continuity and separation checks.

The testing and installation of digital instrumentation and controls (I&C) systems are described in Section 7.2.1, and includes factory acceptance testing and site acceptance testing (SAT) completed as part of construction and installation tests performed before, and as a prerequisite of, preoperational tests. Factory acceptance tests are performed during the digital I&C system testing phase described in Section 7.2.1. Site installation and checkout activities are performed as part of the integrated SAT during the system installation phase as described in Section 7.2.1. Software integration and testing is governed by the Digital I&C Software Master Test Plan described in Section 7.2.1.

14.2.1.2 Preoperational Test Phase Objectives

Preoperational tests are performed to demonstrate that SSC operate in accordance with design requirements so initial fuel loading, initial criticality, and subsequent power operation can be safely undertaken. The objectives of the preoperational test phase

- demonstrate SSC perform their functions in accordance with their design during the preoperational test phase.
- verify and demonstrate expected operation following a loss of power sources and in degraded modes for which the systems are designed to remain operational.
- test the backup power supply system (BPSS) to ensure backup sources of alternating current (AC) electrical power are available when the normal AC power sources are not available.
- verify and demonstrate the operational readiness of valves and dynamic restraints before relying on those components to perform their safety functions.
- perform inspections or testing for flow-induced vibration loads on components that must maintain their structural integrity.
- obtain baseline test and operating data on equipment and systems for future reference.
- operate equipment for a sufficient period of time to achieve normal equilibrium conditions (e.g., temperatures and pressures) so design, manufacturing, and installation defects can be detected and corrected.
- ensure to the extent practicable plant systems operate properly on an integrated basis.
- evaluate normal, abnormal, and emergency operating procedures to the extent practicable.
- demonstrate equipment performance.
- test, as appropriate, manual operation and automatic operation of systems and their components.

- test the proper functioning of controls, permissives, interlocks, and equipment protective devices for which malfunction or premature actuation could shutdown or defeat the operation of systems or equipment.
- provide the plant operating staff with the opportunity to obtain practicable experience in the operation and maintenance of equipment and systems including instrument calibrations and functional tests of components.
- demonstrate equipment performance is satisfactory to proceed to initial fuel loading and initial criticality.

Test abstracts associated with preoperational testing are included in Section 14.2.12.

14.2.1.3 Startup Test Phase Objectives

14.2.1.3.1 Initial Fuel Loading and Pre-Critical Tests

This phase of testing is performed in order to ensure initial fuel loading of an NPM can be accomplished in an orderly and safe manner. A description of the fuel loading process is presented Section 14.2.10. The objectives of the initial fuel loading and pre-critical tests are the following:

- conduct initial fuel loading cautiously to preclude inadvertent criticality
- establish and follow specific safety measures, such as
  - ensuring the applicable TS requirements and other prerequisites are satisfied.
  - continuous monitoring of the neutron flux throughout core loading so changes in the multiplication factor are observed.
  - verifying fuel and control components are properly installed.
- establish the required shutdown margin exists, without achieving criticality
- establish the functionality of plant systems and components, including reactivity control systems and other systems and components necessary to ensure the safety of plant personnel and the public in the event of errors or malfunctions
- confirm the proper operation of plant systems and design features that could not be completely tested during preoperational testing
- confirm interdependent effects among the safety features of the design are acceptable

14.2.1.3.2 Initial Criticality

The objectives associated with the initial criticality phase of the startup testing program are to achieve initial criticality in a safe and controlled manner as follows. In order to meet this objective, the following are performed.

- The initial approach to criticality is performed in a deliberate and orderly manner using the same rod withdrawal sequences and patterns used during subsequent startups.
- The neutron flux levels are continuously monitored and periodically evaluated. A neutron count rate of at least 1/2 counts per second is registered on the startup channels before startup begins, and the signal to noise ratio is known to be greater than 2.
- The systems required for startup or protection of the plant, including the reactor protection system and engineered safety features (ESFs), are operable and in a state of readiness.
- The control rod or poison removal sequence is accomplished using approved plant procedures.
- The reactor achieves initial criticality by boron dilution. Control rods are withdrawn before dilution begins.
- The control rod insertion limits defined in the TS are observed and followed.
- Criticality predictions for boron concentration and control rod positions are provided.
- The reactivity addition sequence is prescribed, and plant procedures require a cautious approach to achieving criticality to prevent passing through criticality in a period shorter than approximately 30 seconds (<1 decade per minute).

A description of the process followed to achieve initial criticality is provided in Section 14.2.10.

14.2.1.3.3 Low-Power Testing

Following criticality, low-power testing is performed. The objectives associated with performing low-power testing

- confirm the design and validate analytical models.
- verify the correctness of assumptions used in the safety analyses.
- confirm the functionality of plant systems and design features that could not be completely tested during the preoperational test phase because of the lack of an adequate heat source for the reactor coolant and main steam system (MSS).

14.2.1.3.4 Power-Ascension Testing

Following low-power testing, power-ascension testing is performed. Power-ascension testing is performed to bring the reactor to full power with testing at power levels of approximately 25 percent, 50 percent, 75 percent, and 100 percent. The objectives associated with performing power-ascension testing are to

- achieve reactor full power in a safe and controlled manner.
- demonstrate the plant operates in accordance with its design bases during normal steady-state conditions and, to the extent practicable, during and following anticipated transients.
- validate models used to predict plant response.
- demonstrate the ability of major or principal plant control systems to automatically control process variables within design limits.
- demonstrate the facility's integrated dynamic response is in accordance with design for plant events such as reactor scram, turbine trip, and loss of feedwater heaters (FWHs) or pumps.

14.2.2 Organization and Staffing

COL Item 14.2-1: An applicant that references the NuScale Power Plant US460 standard design will describe the site-specific organizations that manage, supervise, or execute the Initial Test Program, including the associated training requirements.

14.2.3 Test Procedures

14.2.3.1 Initial Test Program Procedures

Test procedures are developed and reviewed by individuals with the appropriate technical background and expertise. After the test procedures are developed, they are reviewed by plant management personnel who upon acceptance designate the procedures as final.

Input from the principal design organization is utilized to establish the test objectives and acceptance criteria for the system. Operating experience, as discussed in Section 14.2.8, is used in the development of test procedures.

Test procedure testing and acceptance criteria are founded upon the information contained in design specifications, design documents, the FSAR, and regulatory documents. A test procedure is prepared for each specific system test to be performed during the test program.

Preoperational and startup testing procedures include checklists and signature blocks to control the sequence and performance of testing. The administrative controls associated with test procedure development address the following:

- test procedure format

- application, to the extent practicable, of normal plant operating procedures, emergency operating procedures, and surveillance procedures in support of test procedure development
- test procedure review and approval
- test procedure change and revision

The content of each test procedure addresses

- objectives.
- detailed step-by-step procedures specifying how testing is to be performed.
- special precautions.
- test instrumentation.
- test equipment calibration.
- initial test conditions, including provisions to perform testing under environmental conditions as close as practicable to those the equipment experiences in both normal and accident situations.
- methods to direct and control test performance.
- acceptance criteria by which testing is evaluated. Acceptance criteria account for measurement errors and uncertainties associated with normal operation as well as operation during transients and accidents. Acceptance criteria are biased conservatively. In some cases the acceptance criteria are qualitative. Where applicable, quantitative values, with appropriate tolerances, are used as acceptance criteria.
- test prerequisites including as necessary prerequisite statements to ensure that nonstandard arrangements are restored to their normal status after the test is completed (e.g., electric jumper cable use does not invalidate electrical separation; jumper cables are removed following testing; valve configurations and instrument settings are returned to their normal orientations and settings).
- identification of the data to be collected and the method of documentation.
- actions to take if unanticipated errors or malfunctions occur while testing.
- remedial actions to take if acceptance criteria are not satisfied.
- actions to take if an unexpected or unanalyzed condition occurs.

14.2.3.2 Graded Approach to Testing

The ITP allows for the application of a graded approach to testing. The graded approach to testing is founded in the requirements of General Design Criterion 1, “Quality Standards and Records,” of Appendix A to 10 CFR Part 50 that requires, in part, SSC be tested to quality standards commensurate with the importance of the safety functions to be performed. Criterion XI of Appendix B to 10 CFR Part 50 also includes a graded approach for SSC in the Quality Assurance Program. The administrative requirements that govern the conduct of the test program (e.g., test program objectives, organizational elements, personnel qualifications, evaluation and approval of test results, and test records retention) contain provisions that allow for testing of SSC in a manner commensurate with the safety significance of the SSC within its scope. These provisions provide a systematic approach to the “defense-in-depth” concept. This concept dictates the plant be designed, constructed, and tested to

- provide for safe normal operation,
- ensure, in the event of errors, malfunctions, and off-normal conditions, the reactor protection systems and other design features mitigate the event or limit consequences to defined and acceptable levels, and
- ensure adequate safety margin exists for events of extremely low probability or arbitrarily postulated hypothetical events without substantial reduction in the safety margin for the protection of public health and safety.

Application of the graded approach to testing provides reasonable assurance the SSC being tested perform satisfactorily while accomplishing the testing in a cost-effective manner. The administrative requirements that govern the conduct of the test program allow for the preparation of documentation (i.e., procedures and records) associated with testing to be prepared commensurate with the safety significance of the SSC being tested.

During the SSC classification process, the subject matter expert identifies functions of the system. Each of these functions is compared to safety functional requirements and regulatory functional requirements to establish a functional hierarchy. This hierarchy establishes a relationship among the systems and ties it to a set of plant functions as described in Section 17.4 to identify a classification for the functions. The functions are categorized as A1 (safety-related, risk-significant), A2 (safety-related, not risk-significant), B1 (nonsafety-related, risk-significant), or B2 (nonsafety-related, not risk-significant). This safety significance evaluation is the basis for the graded approach in the ITP.

The hierarchy in preoperational testing is

- testing of active, safety-related system functions (A1 or A2 functions).
- testing of active, nonsafety-related functions that require ITAAC verification (B1 and B2).
- testing of active nonsafety-related functions that do not require ITAAC verification (B1 and B2).

The preoperational test abstracts contained in Table 14.2-1 through Table 14.2-62 define the test scope for each system by listing the associated active system functions and their safety categorization. The test abstract also provides system functions tested by another test abstract, thereby providing an "inventory" of all testable system functions.

Table 17.4-1 contains a list of A1 and B1 system functions. Active, safety-related A1 functions are tested by the safety-related module protection system (MPS) logic testing found in Table 14.2-56. The remaining safety-related functions categorized as A2 are also tested by the MPS test abstract. The graded approach provides for testing of A2 functions to the same rigor as A1 functions.

As indicated by Table 14.2-56, active, safety-related functions are one of the following types:

- provides safety-related instrument information signals to MPS
- removes electrical power to the control rod drive
- removes electrical power to the pressurizer (PZR) heaters
- removes electrical power to the trip solenoids of safety-related valves
- closes safety-related valves

The MPS test abstract also describes testing of the safety-related containment isolation valve (CIV) response time and MPS safety-related sensor response time.

Section 14.3 provides guidance regarding the development of ITAAC. The successful completion of ITAAC constitutes the basis for the NRC determination to allow operation of a facility licensed under 10 CFR 52. The ITAAC are verified by an inspection, test, or analysis, or a combination thereof. Some ITAAC are verified by successful completion of preoperational testing.

Each ITAAC is identified by its unique ITAAC number, for example, ITAAC 03.01.02. If an ITAAC is verified by the successful completion of a preoperational test, the acceptance criteria of the associated test in Section 14.2 contain a bracketed reference to the verified ITAAC. An example annotation is [ITAAC 03.01.02] in Table 14.2-15 where 03.01.02 is the number of the verified ITAAC.

Credit is taken for the logic testing performed for the nonsafety-related module control system (MCS) described in Section 7.2.1, and the nonsafety-related plant control system (PCS) described in Section 7.2.1. Therefore, if the component is controlled by MCS or PCS, the component-level logic testing in the preoperational test is limited to the testing of component-level design features described below (if the design feature is applicable to the system) unless the preoperational test verifies an ITAAC. The component tests are standardized to provide the same level of test detail across systems. This graded approach does not affect system-level tests that require integrated system operation. The standardized component tests are:

- remote operation of equipment
- manual control of variable-speed pump or fan
- automatic start of standby pump or fan
- automatic operation of pump recirculation valve
- pump start does not create a water hammer
- remote operation of valve or damper
- valve or damper fails to its safe position on loss of air
- valve or damper fails to its safe position on loss of electrical power to its solenoid
- damper or fan responds to fire or smoke alarm
- equipment response to automatic signals to protect plant equipment

- automatic operation of tank or basin level control valve
- local grab sample can be obtained from a system grab sample device
- automatic bus transfer via bus tie breaker
- system instrument calibration
- each instrument can be monitored in the MCR (test not required if the instrument calibration verified the MCR display)

14.2.3.3 Testing of First-of-a-Kind Design Features

First-of-a-kind (FOAK) tests are new, unique, or special tests to verify design features reviewed for the first time by the NRC. The NuScale Power Plant contains design features that are new and unique and not tested previously; therefore, testing of these design features is treated as FOAK. For the FOAK tests, the testing frequency is specified in the test abstract. The Comprehensive Vibration Assessment Program (CVAP) is an FOAK program. The program is implemented consistent with the requirements of the “NuScale Comprehensive Vibration Assessment Program Technical Report," TR-121353-P, and the “NuScale Comprehensive Vibration Assessment Program Measurement and Inspection Plan Technical Report,” TR-121354-P. The CVAP is addressed in Section 3.9.2.

The following ITP test abstracts describe the on-site CVAP testing of FOAK design features:

- Table 14.2-65: Steam Generator Flow-Induced Vibration Test #65
- Table 14.2-102: NuScale Power Module Vibration Test #102

The test results for the CVAP testing of the first NPM inform the required CVAP testing on subsequent NPMs as described in TR-121353-P. Other ITP testing of FOAK design features is performed for each NPM, except as described below.

Table 14.2-40: Emergency Core Cooling System Test #40 includes a one-time in-situ system performance test of the emergency core cooling system (ECCS). The test demonstrates valve and containment response to manual emergency safety feature actuation of the ECCS at hot functional test pressure and temperature.

Section 5.4.3 contains a description of the decay heat removal system (DHRS) one-time in-situ RCS heat removal test. The test is performed per test abstract Table 14.2-41: Decay Heat Removal System Test # 41.

Table 14.2-104 provides a summary of the ITP testing (i.e., preoperational and startup testing) for new design features. Each test is performed for all NPMs.

Section 1.5.1 contains a description of testing programs that have been completed or are currently in progress for design features for which applicable data or operational experience did not previously exist. The section describes tests specific to fuel design, steam generator (SG), and control rod assemblies (CRAs).

14.2.3.4 Generic Component Testing

Component testing is generally executed after a system transfers from the construction organization to the startup organization. Generic component testing executes standardized tests for a family of related component types, independent of the component's system assignment. Each generic component test procedure is completed and approved before the component is required as a prerequisite to a preoperational test performance. The completion of generic component testing is listed as a prerequisite in each preoperational test procedure as applicable.

14.2.4 Conduct of the Test Program

The ITP activities are controlled by administrative procedures contained within the Startup Administrative Manual.

COL Item 14.2-2: An applicant that references the NuScale Power Plant US460 standard design will develop the Startup Administration Manual that will contain the administrative procedures and requirements that control the activities associated with the Initial Test Program. The applicant will provide a milestone for completing the Startup Administrative Manual and making it available for Nuclear Regulatory Commission inspection.

Administrative controls are established to ensure designated construction-related inspections and tests are completed before initiating preoperational testing. In addition, controls are established to ensure completion of preoperational testing before initiating startup testing. Administrative controls address adherence to approved test procedures during the conduct of the test program and the methods for effecting changes to approved test procedures.

The controls used to ensure test prerequisites associated with each major phase of testing, as well as individual system or component testing are met, include requirements for performing inspections and checks, identification of test personnel, completing data forms or check sheets, and identification of dates of completion.

The controls provided to implement plant modification and repairs ensure that the required modifications and repairs are made. Retesting is conducted following modifications or repairs. Reviews of proposed facility modifications by designated design organizations are conducted before performing the modification or repair.

Controls are established to ensure retesting required for modifications or maintenance remains in compliance with ITAAC commitments.

The documentation associated with the conduct of the test plan is captured and auditable.

14.2.5 Review, Evaluation, and Approval of Test Results

Administrative procedures control the review and approval of preoperational and startup test results for each phase of the test program. These procedures include approval of test data for each major test phase before proceeding to the next test phase as well as approval of test data at each power test plateau (during the power-ascension phase) before increasing the power level. Test exceptions or results that do not meet acceptance criteria are identified to the responsible design organization as well as plant operations and plant technical staff. Corrective actions and retests, as required, are performed.

These administrative procedures address the following:

- notification of responsible design organizations when test acceptance criteria are not met
- methods and schedules for approval of test data for each major phase
- methods used for initial review of individual parts of multiple tests
- technical evaluation of test results by qualified personnel and approval of such results by personnel in designated management positions
- provisions to allow design organizations to participate in the resolution of design-related problems that result in, or contribute to, a failure to meet test acceptance criteria
- provisions to retain test reports, including test procedures and results, as part of the plant historical records

14.2.6 Test Records

Initial Test Program reports, test procedures, and results are retained as part of the plant's historical record in accordance with 10 CFR 50.36, "Technical Specifications," 10 CFR 50.71, "Maintenance of Records, Making of Reports," and 10 CFR 50 Appendix B, Criterion XVII, "Quality Assurance Records." The test reports include test results associated with the testing of SSC identified in the ITP. A summary of the startup testing is included in a startup report. This summary includes the following information:

- description of the method and objectives for each test
- comparison of applicable test data with the related acceptance criteria, including the systems' responses to major plant transients (such as reactor scram and turbine trip)
- design- and construction-related deficiencies discovered during testing, system modifications, the corrective actions required to correct those deficiencies, and the schedule for implementing the identified modifications and corrective actions
- justification for acceptance of systems or components that are not in conformance with design predictions or performance requirements
- conclusions about system or component adequacy
- identity of test observers and recorders

- type of observation
- identifying numbers of test or measuring equipment
- results of tests

14.2.7 Test Programs Conformance with Regulatory Guides

The ITP conforms to Regulatory Guide (RG) 1.68, “Initial Test Programs for Water-Cooled Nuclear Power Plants,” except for aspects that address specific SSC design features not in the design.

The following list of regulatory guides provides information used to supplement the information, recommendations, and guidance presented in RG 1.68 relative to testing of SSC:

- RG 1.20 - Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing
- RG 1.29 - Seismic Design Classification for Nuclear Power Plants
- RG 1.41 - Preoperational Testing of Redundant On-Site Electric Power Systems to Verify Proper Load Group Assignments
- RG 1.45 - Guidance on Monitoring and Responding to Reactor Coolant System Leakage
- RG 1.68.1 - Initial Test Program of Condensate and Feedwater Systems for Light-Water Reactors
- RG 1.68.2 - Initial Startup Test Program to Demonstrate Remote Shutdown Capability for Water- Cooled Nuclear Power Plants
- RG 1.68.3 - Preoperational Testing of Instrument and Control Air Systems
- RG 1.69 - Concrete Radiation Shields and Generic Shield Testing for Nuclear Power Plants
- RG 1.79 - Preoperational Testing of Emergency Core Cooling Systems for Pressurized Water Reactors
- RG 1.118 - Periodic Testing of Electric Power and Protection Systems
- RG 1.140 - Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants
- RG 8.38 - Control of Access to High and Very High Radiation Areas of Nuclear Power Plants

Refer to Section 1.9 for information related to the conformance with each of these regulatory guides.

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

The operational experience gained from pressurized-water and other reactor designs is factored into the design and testing.

Operations and technical staff review the following documents for information that can be included in the ITP:

- NRC licensee event reports
- NRC generic communications (i.e., bulletins, circulars, generic letters, administrative letters, information notices, and regulatory issue summaries)
- Institute of Nuclear Power Operations issuances

The administrative procedures control the review of reactor operating experience and its incorporation into the ITP.

14.2.9 Trial Use of Plant Operating Procedures, Emergency Procedures, and Surveillance Procedures

Plant emergency, operating, and surveillance test procedures are, to the extent practicable, developed, trial tested, and corrected during the ITP before fuel load to establish their adequacy. Trial testing of procedures is accomplished by training plant operators to these procedures to the extent practicable during the ITP. Following completion of trial testing these procedures are used as part of the ITP.

The administrative procedures control the trial use of approved plant operating procedures, emergency operating procedures, and surveillance procedures.

14.2.10 Initial Fuel Loading, and Initial Criticality

Approved startup tests control startup testing for initial fuel loading, pre-critical tests, initial criticality, low-power tests, and power-ascension tests in a controlled, deliberate, and safe manner. Technical specification compliance is met before initiation of startup testing. Startup test procedures are prepared based upon test abstracts provided in Section 14.2.12.

Startup tests procedures contain general provisions, precautions, prerequisites, and measures consistent with the requirements of RG 1.68.

14.2.10.1 Initial Fuel Loading and Pre-Criticality Testing

As part of the startup test program, initial fuel loading and pre-criticality testing is performed by first implementing the prerequisite and precautionary measures contained in test procedures and identified below:

- TS compliance is met
- successful completion of all ITAAC

- identification of actions to be taken in the event of unanticipated errors or malfunctions
- completion of a review of preoperational test results (The Startup Administrative Manual contains administrative procedures to control the verification process for successful completion of preoperational tests required for fuel load.)
- review and status of design changes
- review of retests performed because of preoperational test deficiencies
- review of test exceptions

14.2.10.2 Initial Fuel Loading

Initial fuel loading is conducted to preclude inadvertent criticality. Specific safety measures are followed including

- ensuring applicable TS are met,
- performing continuous monitoring of the neutron flux throughout core loading so changes in the multiplication factor are observed,
- establishing requirements for periodic data taking, and
- independently verifying fuel and control components are properly installed.

Predictions of core reactivity are prepared in advance of the initial fuel loading to aid in evaluating the measured responses to specified loading increments. Comparative data on neutron detector responses from previous loadings of essentially identical core designs may be used in lieu of these predictions. Criteria and requirements for actions to be taken if the measured results deviate from expected values are established before the initial fuel loading. In addition, before initial fuel loading the required shutdown margin is confirmed.

To provide further assurance of safe loading, requirements for the functionality of plant systems and components are established, including reactivity control systems and other systems and components necessary to ensure the safety of plant personnel and the public in the event of errors or malfunctions. The initial core loading is directly supervised by a senior licensed operator having no other concurrent duties, and the loading operation is conducted in strict accordance with detailed approved procedures.

14.2.10.3 Initial Criticality Testing

Control rods are withdrawn in the normal sequence to a configuration that does not violate the zero power rod insertion limits. Initial criticality is achieved in a deliberate, orderly, and controlled fashion using boron dilution. Core neutron flux is continuously monitored during the approach to critical. Changes in reactivity are continuously monitored, and inverse multiplication plots are maintained and interpreted.

The following conditions exist before initial criticality.

- A minimum crew is required to support initial criticality, including a senior reactor operator with no other concurrent duties who is in charge of the operation.
- Critical rod position and boron concentration predictions are identified so anomalies can be noted and evaluated.
- Systems needed for startup are aligned and in proper operation.
- Emergency systems are operable and in readiness.
- TS compliance is met.
- Nuclear instruments are calibrated.
- Neutron count rate of at least 1/2 counts per second registers on startup channels before the startup begins.
- Signal to noise ratio is greater than two.
- Conservative startup rate limit (greater than approximately a 30-second period) is established.
- High flux trips are set at the lowest value.
- The Radiation Monitoring Program as it pertains to operation of radiation barriers, airborne radiation monitors, and air sampling is implemented. Baseline surveys are performed before withdrawing control rods for the approach to critical.

14.2.10.4 Low-Power Testing

Following initial criticality, low-power tests (at less than 5 percent power) are conducted to confirm the design, validate the analytical models to the extent practicable, and verify the correctness or conservatism of assumptions used in the safety analyses for the facility. Low-power tests are also used to confirm the functionality of plant systems and design features not completely tested during the preoperational test phase because of the lack of an adequate heat source from the RCS and MSS.

Low-power testing is performed in a controlled manner in accordance with written procedures. The minimum crew required to support low-power testing is available in addition to a senior reactor operator with no other concurrent duties who is in charge of low-power testing operations. Low-power testing procedures include instructions and precautions necessary for conducting tests, such as adherence to TS requirements, testing sequence, measurements to be taken, and test conditions as well as actions to be taken in the event of unanticipated errors or malfunctions. These procedures provide direction for restoration to normal following the test.

Section 14.2.12 contains a list of low-power tests.

COL Item 14.2-3: An applicant that references the NuScale Power Plant US460 standard design will identify the specific operator training to be conducted during low-power testing related to the resolution of Three Mile Island Action Plan Item I.G.1, as described in NUREG-0660, NUREG-0694, and NUREG-0737.

14.2.10.5 Power-Ascension Tests

Power-ascension testing is performed following the successful completion of low-power testing. Power-ascension testing is performed to bring the reactor to full power and while doing so performing major testing at power levels of approximately 25 percent, 50 percent, 75 percent, and 100 percent. The purpose of the testing is to demonstrate the plant operates in accordance with its design bases during normal steady state conditions and, to the extent practicable, during and following anticipated transients. Testing is also intended to demonstrate the validity of analytical models by comparing measured responses with predicted responses. Predicted responses are developed using real or expected values of attributes such as beginning of life core reactivity coefficients, flow rates, pressures, temperatures, and response times of equipment, as well as the actual status of the plant (not those values or plant conditions assumed for conservative evaluations of postulated accidents).

Tests and acceptance criteria are prescribed to demonstrate the ability of control systems to automatically control process variables within design limits. Such tests are expected to provide assurance that the facility's integrated dynamic response is in accordance with the design for plant events such as reactor trip, turbine trip, and loss of FWHs or pumps. The testing performed is sufficiently comprehensive to establish the facility can operate in the operating modes for which it is designed. Testing is conducted in operating modes or plant configurations analyzed, and are bounded by the range of assumptions used in analyzing postulated accidents as described in the FSAR.

Power-ascension testing is performed in a controlled manner in accordance with written procedures. The minimum crew required to support power-ascension testing is available in addition to a senior reactor operator with no other concurrent duties who is in charge of power-ascension testing operations. Power-ascension testing procedures include instructions and precautions necessary for conducting tests such as adherence to TS requirements, testing sequence, measurements taken and test conditions as well as actions taken in the event of unanticipated errors or malfunctions. These procedures provide direction for restoration to normal following the test.

Section 14.2.12 contains a list of power-ascension tests.

The completed power-ascension testing program is reviewed at each plateau. Test results are evaluated and the required approvals are received before ascending to the next power level or test condition.

14.2.11 Test Program Schedule and Sequence

Testing schedules are developed taking into account development and approval of plant procedures for use as part of the ITP.

Testing schedules are developed so SSC required to prevent or mitigate the consequences of postulated accidents are tested before fuel loading.

Approved test procedures are available for NRC review approximately 60 days before their intended use or at least 60 days before fuel loading for fuel loading and startup test procedures. The NRC is notified of test procedure changes before performance.

Test procedures are essentially identical for each NPM. Structures, systems, and components identification numbering is specific to each NPM.

For individual startup tests, test requirements are completed in accordance with plant TS requirements associated with SSC functionalities before changing plant modes.

Testing required to be completed before fuel load intended to satisfy the requirements for completing ITAAC is identified and documented as such.

Vibration testing is performed in accordance with the CVAP as described in the "NuScale Comprehensive Vibration Assessment Program Technical Report," TR-121353-P. Test results are verified following power-ascension testing. Section 3.9.2 contains information pertaining to the CVAP.

The sequential schedule for individual startup tests establishes that, insofar as practicable, test requirements are completed before exceeding 25 percent power for the plant SSC relied upon to prevent, limit, or mitigate the consequences of postulated accidents. The schedule establishes, insofar as practicable, the sequencing of testing is accomplished as early in the test program as feasible and the safety of the plant is not dependent on the performance of untested systems, components, or features. Startup test data are reviewed and approved before moving onto the next power plateau. Startup testing is discussed in Section 14.2.1.

The plant is comprised of up to six NPMs. A schedule is developed for startup of each NPM. Preoperational and startup testing schedule considerations include

- preoperational test schedule duration is the longest for the first NPM because the first NPM requires testing of systems common to other NPMs.
- preoperational and startup test schedule duration should decrease for each successive NPM because of increase in personnel experience and refinement of test procedures.
- scheduling such that overlapping test program schedules do not result in significant divisions of responsibilities or dilute staff provided to implement the test program.
- plant safety must not be dependent on the performance of untested SSC during the startup test program.

Section 1.1.4 contains information pertaining to phased construction and testing activities due to addition of individual NPMs.

COL Item 14.2-4: An applicant that references the NuScale Power Plant US460 standard design will provide a schedule for the Initial Test Program.

14.2.12 Individual Test Descriptions

Individual test abstracts are provided in Table 14.2-1 through Table 14.2-102. Table 14.2-103 provides a list of the test abstracts. Each abstract identifies each test by title, and identifies test objectives, prerequisites, test methods, and acceptance criteria. Detailed preoperational and startup test procedures are developed using these test abstracts.

The test abstracts identify pertinent precautions for individual tests, as necessary (e.g., minimum flow requirements or reactor power level that must be maintained).

Table 14.2-1: Test # 01 Pool Cooling and Cleanup System

Preoperational test is required to be performed once.		
The pool cooling and cleanup system (PCWS) comprises three subsystems, pool cooling, pool cleanup, and pool surge control described in Section 9.1.3 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The PCWS supports pool cleanup by providing fuel pool water for purification of the ultimate heat sink (UHS).	nonsafety-related	01.02.01
2. The PCWS supports pool cleanup by providing reactor pool water for purification of the UHS.	nonsafety-related	01.02.01
3. The PCWS supports pool cleanup by providing water from the dry dock for UHS inventory control.	nonsafety-related	01.02.02 Component level tests
4. The PCWS supports the UHS by providing surge control for UHS operations.	nonsafety-related	01.02.02
5. The PCWS supports the UHS by providing a reactor inspection dry dock makeup and drain capability.	nonsafety-related	01.02.02
6. The PCWS supports pool surge control, reactor pool cooling and fuel pool cooling by providing a flowpath to cross-connect pool surge control, reactor pool cooling, and fuel pool cooling subsystems.	nonsafety-related	Component level tests
01.00.XX Prerequisites 01. Verify instrument calibration is complete, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify a pump curve test is complete and approved for the PCWS pumps. 03. Verify a UHS leakage test is complete. 04. For system level test 01.02.02, the dry dock gate can be in the open or closed position.		
01.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each PCWS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each PCWS air-operated valve fails to its safe position on loss of air.	1) Place each valve in its non-safe position. Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each PCWS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	1) Place each valve in its non-safe position. Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each PCWS pump can be started and stopped remotely.	1) Align the PCWS to allow for pump operation. Start and stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops.
05. Verify a local grab sample can be obtained from each PCWS grab sample device.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is successfully obtained from each device.

Table 14.2-1: Test # 01 Pool Cooling and Cleanup System (Continued)

06. Verify each PCWS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each PCWS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
01.02.XX System Level Tests		
01.02.01.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the pool cooling subsystem provides design flow rate to the UHS when aligned for pool cleanup. 2. Verify the pool cooling subsystem provides design flow rate to the UHS following a pool cleanup isolation.	1) a. Place fuel pool cooling in service to flow through a pool cleanup filter and demineralizer and return flow to the fuel pool. AND b. Place reactor pool cooling in service to flow through a different pool cleanup filter and demineralizer and return flow to the reactor pool. 2) Simulate a high water temperature upstream of one of the pool cleanup filters.	1) a. The MCR indication for PCWS pump flow satisfies the design flow rate specified in Table 9.1.3-1. b. The MCR indication for PCWS demineralizer flow satisfies the design flow rate specified in Table 9.1.3-2. 2) a. PCWS flow to the pool cleanup filters and demineralizers stop. b. The PCWS flow is bypassed to the fuel pool. c. The PCWS flow is bypassed to the reactor pool. d. The MCR indication for PCWS pump flow satisfies the design flow rate specified in Table 9.1.3-1.
01.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify PCWS automatic control for dry dock fill and drain.	Align the PCWS for fill and drain of the dry dock. Fill the dry dock to a level that allows operation of the dry dock evacuation pump. 1) Start a PCWS dry dock evacuation pump. 2) Simulate the following PCWS conditions: a. Dry dock low level b. PCWS surge control and storage tank high level 3) Open PCWS surge and control tank main discharge line isolation valve. 4) Simulate a high dry dock level.	1) Verify inventory addition to the PCWS surge and control tank. 2) a. Pump is stopped and return line to pool surge control tank isolation valve is closed. b. Pump is stopped and return line to PCWS surge control and surge tank isolation valve is closed. 3) Verify inventory addition to the dry dock. 4) PCWS surge control and surge tank main discharge line isolation valve is closed.

Table 14.2-2: Test # 02 Ultimate Heat Sink

There are no preoperational tests for the UHS.		
The UHS is described in Section 9.2.5. The only active functions for the UHS are to provide PAM Type D instrument signals to the safety display and indication system (SDIS). Safety Display and Indication Test 59.02.02 discusses testing of PAM Type D displays.		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The UHS supports the DHRS by accepting the heat from the DHRS heat exchanger.	safety-related	98.03.01
02.00.XX Prerequisites: N/A		
02.01.XX Component Level Tests		
None		

Table 14.2-3: Test # 03 Pool Leakage Detection System

There are no preoperational tests for the pool leakage detection system (PLDS).		
The PLDS is described in Section 9.1.3. Leakage from the UHS drains via gravity to the radioactive waste drain system (RWDS). Test 20.02.02 tests the MCR alarm when the RWDS sump fill rate exceeds the PLDS leakage rate setpoint.		
System Function	**System Function Categorization**	**Function Verified by Test #**
None	N/A	N/A
03.00.XX Prerequisites: N/A		
03.01.XX Component Level Tests		
None		

Table 14.2-4: Test # 04 Reactor Component Cooling Water System

Preoperational test is required to be performed once each for the shared or common components. The module-specific portions of the test must be completed once for each NPM.		
The reactor component cooling water system (RCCWS) is described in Section 9.2.2 and the function verified by this test is:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The RCCWS supports the following systems by providing cooling water. • control rod drive system (CRDS) • CVCS • containment evacuation system (CES) • process sampling system (PSS)	nonsafety-related	04.02.01
04.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify an RCCWS flow balance is performed. 03. Verify a pump curve test is completed for the RCCWS pumps.		
04.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each RCCWS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each RCCWS air-operated valve fails to its safe position on loss of air.	1) Place each valve in its non-safe position. Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each RCCWS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	1) Place each valve in its non-safe position. Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each RCCWS pump can be started and stopped remotely.	1) Align the RCCWS to allow for pump operation. Start and stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
05. Verify the RCCWS standby pump automatically starts to protect plant equipment.	1) Align the RCCWS to allow for pump operation. Place a pump in service. Initiate a simulated RCCWS pump low header pressure signal.	1) MCR display and local, visual observation indicate the standby pump starts. Audible and visible water hammer are not observed when the pump starts.
06. Verify RCCWS demineralized makeup water level control valve automatically operates to maintain RCCWS expansion tank level.	1) Initiate simulated expansion tank high level signal.	1) MCR display and local, visual observation indicate the following: The demineralized makeup water level control valve is fully closed.
07. Verify a local grab sample can be obtained from an RCCWS grab sample device.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is successfully obtained.
08. Verify each RCCWS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each RCCWS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.

Table 14.2-4: Test # 04 Reactor Component Cooling Water System (Continued)

04.02.XX System Level Test 04.02.01.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify RCCWS cooling water flow rates satisfy design flow.	Module 1 Test 1) Align RCCWS to provide flow to all module 1 heat exchangers listed below: • control rod drive mechanism (CRDM) cooling coils • CVCS non-regenerative heat exchanger • CES vacuum pump • CES condenser • PSS analyzer cooler • PSS temperature control unit 2) Repeat module 1 test for modules 2 through 6.	1) The RCCWS cooling flow to each heat exchanger under test meets the flow rate acceptance criteria contained in the RCCWS flow balance report.

Table 14.2-5: Test # 05 Chilled Water System

Preoperational test is required to be performed once.		
The chilled water system (CHWS) is described in Section 9.2.8 and the function verified by this test is:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The CHWS supports the following systems by providing cooling water: • Reactor Building HVAC system (RBVS) • normal control room HVAC system (CRVS) • Radioactive Waste Building (RWB) HVAC system (RWBVS) • liquid radioactive waste system (LRWS) • gaseous radioactive waste system (GRWS)	nonsafety-related	05.02.01 05.02.02
05.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify a CHWS flow balance is performed. 03. Verify a pump curve test is completed for the CHWS pumps. 04 Chiller performance is verified by either an Air Conditioning, Heating, and Refrigeration Institute (AHRI) certification or a chiller performance capacity test witnessed at the factory with all test documentation provided.		
05.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each CHWS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify the speed of each CHWS variable-speed pump can be manually controlled.	1) Align the CHWS to provide a flow path to operate a selected pump. Vary the CHWS pump speed from minimum to maximum from the MCR.	1) MCR display indicates the speed of each pump obtains both minimum and maximum pump speeds. Audible and visible water hammer are not observed when the pump starts.
03. Verify automatic operation of CHWS pumps and CHWS chiller to protect plant equipment.	Align the CHWS to allow for chiller operation. Place a pump in service. Initiate a simulated signal for the following system conditions. 1) Loss of chilled water flow. 2) Loss of site cooling water system (SCWS) cooling flow to the operating chiller.	MCR display and local, visual observation indicate the following: 1) Operating pump stops 2) Operating chiller stops
04. Verify each CHWS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each CHWS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.

Table 14.2-5: Test # 05 Chilled Water System (Continued)

05.02.XX System Level Tests 05.02.01.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify CHWS cooling water flow rates satisfy design.	1) Align the CHWS to provide flow to all heat exchangers cooled by the CHWS chiller: • RBVS air handling units (AHUs) • RBVS fan coil units • CRVS AHUs • CRVS fan coil units • RWBVS AHU • RWBVS fan coil units • LRWS degasifier condenser • GRWS gas coolers 2) Open all CHWS flow control valves.	1) The CHWS cooling flow to each heat exchanger under test meets the minimum flow rate acceptance criteria contained in the CHWS flow balance report.
05.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify CHWS cooling water flow rates satisfy design flow.	1) Align the CHWS to provide flow to the CRVS AHUs and the CRVS fan coil units cooled by the CHWS standby chiller. 2) Open all CHWS flow control valves.	1) The CRVS standby CHWS cooling flow to each heat exchanger meets the minimum flow rate acceptance criteria contained in the CHWS flow balance report.

Table 14.2-6: Test # 06 Auxiliary Boiler System

Preoperational test is required to be performed once unless specified otherwise in the test method.		
The auxiliary boiler system (ABS) is described in Section 10.4.7 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
None		
The ABS functions verified by other tests are:		
1. The auxiliary boiler supports the condensate polisher resin regeneration system (CPS) by supplying chemicals for neutralization.	nonsafety-related	Table 14.2-27 Component Level Tests
2. The ABS supports the turbine generator by supplying gland seal steam.	nonsafety-related	07.02.01
3. The ABS supports the air cooled condenser system (ACCS) by supplying steam to the condenser deaerator during startup.	nonsafety-related	07.02.01
06.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
06.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each auxiliary boiler remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each auxiliary boiler air-operated valve fails to its safe position on loss of air.	1) Place each valve in its non-safe position. Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each auxiliary boiler air-operated valve fails to its safe position on loss of electrical power to its solenoid.	1) Place each valve in its non-safe position. Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each auxiliary boiler feedwater (FW) pump can be started and stopped remotely.	Align the ABS to allow for pump operation. 1) Start and stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops. Audible and visible water hammer are not observed when the pump starts.

Table 14.2-6: Test # 06 Auxiliary Boiler System (Continued)

05. Verify the ABS automatically responds to mitigate a release of radioactivity.	1) For the first NPM being tested, initiate a real or simulated signal for each of the following radiation trasmitters: • auxiliary boiler skid vent • auxiliary boiler to superheater ski BPDS outlet • auxiliary boiler to superheater skid vent • auxiliary steam to BPDS • TGB auxiliary steam header 2) For each additional module, initiate a real or simulated high radiation signal to the specific valve being tested for each of the following radiation transmitters: • auxiliary boiler skid vent • auxiliary boiler to superheater skid BPDS outlet • auxiliary boiler to superheater skid vent • auxiliary steam to BPDS • TGB auxiliary steam header	1) MCR display verifies the following valves are closed: a. Auxiliary boiler superheater skid outlet isolation. b. Auxiliary boiler skid to superheater skid isolation. c. Main steam to auxiliary boiler header isolation. 2) MCR display verifies the Main steam to auxiliary boiler header isolation for the module being tested is closed. [ITAAC 03.09.08] (items 1 and 2) [ITAAC 02.07.03] (items 1 and 2)
06. Verify each ABS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each ABS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
06.02.XX System Level Test		
Test Objective	**Test Method**	**Acceptance Criteria**
None		

Table 14.2-7: Test # 07 Air Cooled Condenser System

Preoperational test is required to be performed once each for the shared or common components. The module-specific portions of the test must be completed once for each NPM.		
The Air Cooled Condenser System (ACCS) is described in Section 10.4.1 and the functions verified by this test and power ascension testing are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The demineralized water system (DWS) and condensate storage tank support the ACCS by providing makeup water to maintain water level in the condensate collection tank (CCT).	nonsafety-related	Component-Level Test 94.03.01
2. The ACCS supports the FWS by removing heat from the steam turbine exhaust and turbine bypass.	nonsafety-related	07.02.01
3. The ABS supports the turbine generator by supplying gland seal steam.	nonsafety-related	07.02.01
4. The ABS supports the ACCS by supplying steam to the condenser deaerator during startup.	nonsafety-related	07.02.01
07.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
07.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each ACCS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each ACCS air-operated valve fails to its safe position on loss of air.	1) Place each valve in its non-safe position. Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each ACCS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	1) Place each valve in its non-safe position. Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each ACCS fan can be started and stopped remotely.	1) Align the ACCS to allow for fan operation. 2) Start and stop each ACCS fan from the MCR.	1) MCR display and local, visual observation indicate each ACCS fan starts and stops.
05. Verify the fan speed of each variable speed fan can be controlled manually.	1) Vary the speed of each fan from the MCR and local control panel (if design has local fan control).	1) MCR display indicates the speed of each fan varies from minimum to maximum fan speed.
06. Verify each ACCS pump can be started and stopped remotely.	1) Align the ACCS to allow for pump operation. 2) Start and stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops. Audible and visible water hammer are not observed when the pump starts. 2) ACCS pump cavitation is not observed.

Table 14.2-7: Test # 07 Air Cooled Condenser System (Continued)

07. Verify automatic operation of the ACCS level control valves to maintain CCT level.	1) Initiate a CCT low level signal. 2) Initiate a CCT high level signal.	MCR displays and local, visual observation verifies the following: 1) The makeup level control valve is open. 2) The reject level control valve is opened.
08. Verify a local integrated grab sample can be obtained from each ACCS grab sample device.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is obtained.
09. Verify each ACCS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each ACCS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
07.02.XX System Level Tests		
07.02.01.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the condenser air removal system (CARS) can maintain main condenser vacuum pressure.	Place the ABS in automatic control to supply gland seal steam. Place the FWS in automatic control to condense the gland seal steam in the gland exhaust condenser. Place the ACCS in automatic control to provide cooling to the main condenser. 1) Place the ACCS in service to establish vacuum in the main condenser. 2) Open the steam supply isolation valves to provide steam to the condenser deaerator (DEA).	1) Maintain main condenser design vacuum pressure. 2) The ABS is capable of providing steam to the condenser deaerator as indicated by steam flow. 3) The ABS is capable of supplying gland seal steam to the turbine generator at design pressures.

Table 14.2-8: Test # 08 Site Cooling Water System

Preoperational test is required to be performed once each for the shared or common components. The module-specific portions of the test must be completed once for each NPM.		
The SCWS is described in Section 9.2.7 and the functions verified by this test and power ascension testing are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The SCWS supports the following systems by providing cooling water. • turbine generator system (TGS) • RCCWS • ACCS • PSS • CHWS • instrument and control air system (IAS) • PCWS • FWS	nonsafety-related	08.02.01
08.00.XX Prerequisites 01. Verify an instrument calibration is completed with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify an SCWS flow balance is performed and the system flow balance records have been approved. 03. Verify a pump curve test is completed and approved for the SCWS pumps.		
08.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each SCWS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each SCWS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each SCWS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify the SCWS automatically responds to mitigate a release of radioactivity	1) Initiate a real or simulated high radiation signal for the SCWS blowdown line	1) MCR display verifies the SCWS blowdown isolation valve is closed. [ITAAC 03.09.11]
05. Verify each SCWS cooling tower fan can be started and stopped remotely.	Align the SCWS to allow for cooling tower fan operation. 1) Start and stop each cooling tower fan from the MCR.	1) MCR display and local, visual observation indicate each cooling tower fan starts and stops.
06. Verify each SCWS pump can be started and stopped remotely.	Align the SCWS to allow for pump operation. 1) Start and stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
07. Verify the SCWS standby pump automatically starts to protect plant equipment.	Align the SCWS to allow for pump operation. 1) Place a pump in service. Initiate a simulated start signal.	1) MCR display and local, visual observation indicate the standby pump starts. Audible and visible water hammer are not observed when the pump starts.
08. Verify a local grab sample can be obtained from an SCWS grab sample device.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is successfully obtained.

Table 14.2-8: Test # 08 Site Cooling Water System (Continued)

09. Verify each SCWS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each SCWS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
08.02.XX System Level Test **08.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify SCWS cooling water flow rates satisfy design flow.	The operation of two SCWS pumps may be required to provide sufficient flow to meet acceptance criteria in the SCWS flow balance report. 1) For the first NPM tested: Align the SCWS to provide flow to all of the first module and common heat exchangers cooled by SCWS listed below: **Module Heat Exchangers** TGS coolers PSS coolers **Common Heat Exchangers** CHWS chillers IAS coolers PSS chillers PCWS heat exchangers ACC liquid ring vacuum pump skid heat exchangers RCCWS heat exchangers 2) Subsequent NPM tests The scope of each subsequent test includes one or more additional modules. The scope also includes previously tested modules to verify that the flow rate still meets the flow rate acceptance criteria contained in the SCWS flow balance report. The testing continues until all heat exchangers cooled by SCWS have been tested in a single test.	1) The SCWS cooling flow to each heat exchanger under test meets the minimum flow rate acceptance criteria contained in the SCWS flow balance report.

Table 14.2-9: Test # 09   Potable Water System

The potable water system (PWS) is described in Section 9.2.4. The PWS is a site-specific system, and the testing of the PWS is the responsibility of the applicant. COL Item 14.2-5: An applicant that references the NuScale Power Plant US460 standard design will provide a test abstract for the potable water system pre-operational testing.		
System Function	**System Function Categorization**	**Function Verified by Test #**
As described in Section 9.2.4	nonsafety-related	Provided by applicant
09.00.XX Prerequisites Provided by applicant		
09.01.XX Component Level Tests		
Provided by applicant		
09.02.XX System Level Tests		
Provided by applicant		

Table 14.2-10: Test # 10 Utility Water System

Preoperational test is required to be performed once.		
The utility water system (UWS) is described in Section 9.2.9 and the functions verified by this test and power ascension testing are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The UWS supports the SCWS by providing makeup water to maintain water level in the SCWS cooling tower basins.	nonsafety related	08.01.01 94.03.01
2. The UWS supports the following systems by providing makeup water: • DWS • fire protection system (FPS) • PWS • CHWS • RXB • Turbine Generator Building (TGB) • RWB • Annex Building • CRB	nonsafety-related	component-level tests
10.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify a pump curve test is completed for the UWS pumps.		
10.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each UWS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each UWS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each UWS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each UWS pump can be started and stopped remotely.	Align the UWS to allow for pump operation. 1) Start and stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
05. Verify UWS flow capability by automatic start of a UWS pump while in standby mode.	Align the UWS to allow for pump operation. Place a pump in service. 1) Initiate a simulated pump trip.	1) MCR display and local, visual observation indicate the standby pump starts. Audible and visible water hammer are not observed when the pump starts.
06. Verify a local grab sample can be obtained from each UWS grab sample device.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is obtained.

Table 14.2-10: Test # 10 Utility Water System (Continued)

07. Verify each UWS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each UWS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
10.02.XX System Level Tests		
None		

Table 14.2-11: Test # 11 Demineralized Water System

Preoperational test is required to be performed once.		
The DWS is described in Section 9.2.3 and the function verified by this test is:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The DWS supports the following systems by providing makeup water. • CVCS • boron addition system (BAS) • LRWS • PCWS • RCCWS • PSS • FWS • ABS • CRVS • ACCS • CES • RBVS • RWBVS • condensate polishing system • Annex Building (ANB) • balance-of-plant drain system (BPDS) • Turbine Building HVAC system (TBVS) • annex building HVAC system • RXB • RWB • feedwater treatment system (FWTS)	nonsafety-related	component-level tests
11.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify a pump curve test is completed for the DWS pumps.		
11.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each DWS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control)	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each DWS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each DWS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify the DWS automatically responds to mitigate a release of radioactivity	1) Initiate a real or simulated high radiation signal for each or the following: a. North Reactor Building demineralized water distribution header b. South Reactor Building demineralized water distribution header	1) MCR display verifies the following valves are closed. a. North Reactor Building demineralized water distribution header isolation valve b. South Reactor Building demineralized water distribution header isolation valve [ITAAC 03.09.09]

Table 14.2-11: Test # 11 Demineralized Water System (Continued)

05. Verify the DWS pump can be started and stopped remotely.	Align the DWS to allow for pump operation. 1) Start and stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
06. Verify DWS flow capability by automatic start of a DWS pump while in standby mode.	Align the DWS to allow for pump operation. Place a pump in service. 1) Initiate a simulated pump trip.	1) MCR display and local, visual observation indicate the standby pump starts. Audible and visible water hammer are not observed when the pump starts.
07. Verify a local grab sample can be obtained from each DWS grab sample device.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is obtained.
08. Verify each DWS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each DWS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
11.02.XX System Level Tests		
None		

Table 14.2-12: Test # 12 Nitrogen Distribution System

Preoperational test is required to be performed once.		
The nitrogen distribution system (NDS) is described in Section 9.3.1 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The NDS supports the following systems by providing nitrogen: • CVCS • CES • RXB	nonsafety-related	component-level tests
2. The NDS supports the LRWS by providing nitrogen for purging of the LRWS.	nonsafety-related	component-level tests 30.02.01
3. The NDS supports the GRWS by providing nitrogen for purging of the GRWS.	nonsafety-related	component-level tests 31.02.01
12.00.XX Prerequisites 01.Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
12.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each NDS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each NDS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each NDS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify a local grab sample can be obtained from a NDS grab sample device.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is successfully obtained.
05. Verify each NDS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each NDS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
12.02.XX System Level Tests		
None		

Table 14.2-13: Test # 13 Service Air System

Preoperational test is required to be performed once.		
The service air system (SAS) is described in Section 9.3.1 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
Has no specific system function, and all functionality is supported through supported systems testing.	N/A	N/A
13.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
13.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each SAS remotely operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control)	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each SAS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each SAS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each SAS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each SAS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
13.02.XX System Level Tests		
None		

Table 14.2-14: Test # 14 Instrument Air System

Preoperational test is required to be performed once.		
The IAS is described in Section 9.3.1 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
Has no specific system function, all functionality is supported through supported systems testing.	N/A	N/A
14.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify performance testing of air compressor skids have been completed by the manufacturer or a site acceptance test is completed in accordance with manufacturer instructions. NOTE: Component Level Test 14.01.05 is only required to be tested with the first module.		
14.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each IAS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each IAS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each IAS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each IAS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each IAS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
05. Verify the speed of each IAS variable-speed compressor can be manually controlled.	Align the system to provide a flow path to operate a selected compressor. 1) Vary the compressor speed from minimum to maximum from the MCR.	1) MCR display indicate the speed of each compressor obtains both minimum and maximum compressor speeds.
14.02.XX System Level Tests		
None		

Table 14.2-15: Test # 15 Control Room Habitability System

Preoperational test is required to be performed once.		
The control room habitability system (CRHS) is described in Section 6.4 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The CRHS supports the CRB by providing clean breathing air to the CRE and maintaining a positive control room pressure during high radiation or loss of offsite power conditions.	nonsafety-related	15.02.01 15.02.02 15.02.03
2. The CRHS supports the CRB by providing high pressure, clean breathing air in air bottles for use.	nonsafety-related	15.02.01 15.02.02
3. The CRVS supports the CRB by providing isolation of the CRE from the surrounding areas and outside environment via isolation dampers.	nonsafety-related	15.02.01
4. The plant protection system (PPS) supports the CRHS by providing actuation and control signals.	nonsafety-related	15.02.01
5. The CRVS supports the PPS by providing instrument information signals relating to isolation of the CRE and activation of the CRH system.	nonsafety-related	15.02.01
6. The CRVS supports the CRB by isolating the CRVS outside air intake from the environment and operating CRVS in recirculation mode to prevent exposure to smoke and toxic gas, or when radiation is detected downstream of the charcoal filtration unit.	nonsafety-related	15.02.01 (radiation detection) 16.02.03 (smoke/toxic gas)
7. The PPS supports the CRVS by providing actuation and control signals to the CRE isolation dampers.	nonsafety-related	15.02.01
15.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify a CRHS air balance is performed and the CRHS air balance records have been approved. [This prerequisite is not required for component-level tests.] 03. Verify CRHS air bottlers are pressurized to their design working pressure. [This prerequisite is not required for component-level tests.] 04. Component Level Tests 01. and 02. must be performed under preoperational test conditions that approximate design-basis temperature, differential pressure, and flow conditions to the extent practicable, consistent with preoperational test limitations.		

Table 14.2-15: Test # 15 Control Room Habitability System (Continued)

15.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each CRHS remotely-operated valve can be operated remotely.	Place the CRHS air bottles in service. Place CRVS in service to supply air to the CRE. 1) Operate each valve from the MCR.	1) MCR workstation display, safety display instrument display and local, visual observation indicate each valve fully opens and fully closes under preoperational temperature, differential pressure, and flow conditions. [ITAAC 03.01.02]
02. Verify each CRHS solenoid-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place the CRHS air bottles in service. Place CRVS in service to supply air to the CRE. 1) Place each valve in its non-safe position. Isolate electrical power to its solenoid.	1) MCR display, safety display instrument display and local, visual observation indicate each valve fails to its safe position under preoperational temperature, differential pressure, and flow conditions. [ITAAC 03.01.03]
03. Verify each CRHS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each CRHS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.

15.02.XX System Level Tests 15.02.01		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify PPS provides actuation signals for CRHS and CRVS. 2. CRHS realigns to provide breathable air to the CRE under accident conditions. 3. CRVS realigns to isolate outside air dampers and CRE under accident conditions.	Place the CRVS in automatic operation. Place the CRHS air bottles in service. Place CRVS in service to supply air to the CRE. Start CRVS filter unit. 1) Initiate each of the following real or simulated CRHS actuation signals: a. High radiation signal downstream of the CRVS filter unit. b. Loss of AC power.	1) MCR workstation display and local, visual observation indicate the following: a. The CRVS filter unit bypass, inlet, and outlet dampers close. b. The CRVS filter unit fan stops. c. The CRVS control room envelope isolation dampers close. d. The CRHS air supply isolation valves open. e. CRHS pressure relief isolation valves open. f. CRVS filtration unit stops. g. CRVS general exhaust fan stops. h. CRVS battery room exhaust fans stop. [ITAAC 03.09.02] (items 1.a. through 1.h.) 2) PPS generates alarms in the MCR for the following: a. High radiation. b. Loss of AC power.

Table 14.2-15: Test # 15 Control Room Habitability System (Continued)

15.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify emergency pressurized air bottles have sufficient volume to provide 72 hours of breathable air through both the main and backup supply flow path to the CRE described in Section 6.4.2.	Align air bottles for testing. Assume 25 percent of the bottles are unavailable and use 1/6 of the remaining bottles to simulate a test conduct of 72 hours (12 hours/72 hours). 1) Initiate a real or simulated CRHS actuation signal to isolate the CRE. Conduct a CRE test for 12 hours. 2) At the end of 12 hours isolate the main supply flow path and align the manual backup flow path to the CRE. Align air bottles for testing. Assume 25 percent of the bottles are unavailable and use the remaining bottles.	1) a. The CRE described in Section 6.4.2 maintains a positive pressure relative to the adjacent areas as specified in Table 6.4-1 as indicated by the CRE differential pressure transmitters. [ITAAC 03.01.05] b. The CRHS minimum flow rate for the main flow path is maintained as specified in Table 6.4-1 for the duration of the test. c. The CRHS flow rate for the manual backup flow path is maintained as specified in Table 6.4-1.
15.02.03.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. The air exfiltration from the CRE does not exceed the air exfiltration flow rate identified in the CRHS exfiltration/infiltration analysis.	1) Perform an air exfiltration test of the CRE at 1/8 in. wg. of positive pressure with respect to surrounding areas by performing tracer gas testing in accordance with ASTM E741.	1) The measured air exfiltration flow rate does not exceed the unfiltered inleakage flow rate assumed in the dose analysis identified in Table 6.4-1. [ITAAC 03.01.01]

Table 14.2-16: Test # 16 Normal Control Room HVAC System

Preoperational test is required to be performed once.		
The CRVS is described in Sections 6.4.3 and 9.4.1 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The CRVS supports the CRB by providing cooling, heating and humidity control to maintain a suitable environment for the safety and comfort of plant personnel.	nonsafety-related	16.02.01 16.02.02
2. The CRVS supports the systems located in the CRB by providing cooling, heating and humidity control to maintain a suitable environment for the operation of system components.	nonsafety-related	16.02.01 16.02.02
3. The CRVS supports the CRB by isolating the CRVS outside air intake from the environment and operating the CRVS in recirculation mode to prevent exposure to smoke and toxic gas, or when radiation is detected downstream of the charcoal filtration unit.	nonsafety-related	16.02.03(smoke/toxic gas) 15.02.01 (radiation)
4. The CRVS supports the CRB by maintaining the CRB at a positive ambient pressure relative to the RXB and the outside atmosphere to control the ingress of potentially airborne radioactivity from the RXB or the outside atmosphere to the CRB.	nonsafety-related	16.02.01(CRB positive pressure) 17.02.01(RXB negative pressure)
5. The PPS supports the CRVS by providing actuation and control signals to the outside air isolation dampers.	nonsafety-related	16.02.03
6. The CRVS supports the CRB by protecting personnel from exposure to radiation during a design-basis accident, when power is available, by removing radioactive contamination from outside air via charcoal filtration, as required by radiation dose analyses.	nonsafety-related	16.02.04
The CRVS functions verified by other tests are:		
1. The CRVS supports the CRB by isolating the CRVS outside air intake when radiation is detected downstream of the charcoal filtration unit.	nonsafety-related	15.02.01
2. The CRVS supports the CRB by providing isolation of the CRE from the surrounding areas and outside environment via isolation dampers.	nonsafety-related	15.02.01

Table 14.2-16: Test # 16 Normal Control Room HVAC System (Continued)

3. The CRVS supports the PPS by providing instrument information signals relating to isolation of the CRE and activation of the CRHS.	nonsafety-related	15.02.01
16.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify a CRVS air balance is performed and the CRVS air balance records have been approved. [This prerequisite is not required for component-level tests.] 03. Verify CRVS high-efficiency particulate air (HEPA) and charcoal adsorbers have been installed and tested and the test records have been approved. [This prerequisite is not required for component-level tests.] 04. Verify CRVS control room isolation dampers have been leak tested and the test records have been approved. [This prerequisite is not required for component-level tests.] 05. Component Level Test 16.01.07 must be performed under preoperational test conditions that approximate design-basis temperature, differential pressure, and flow conditions to the extent practicable, consistent with preoperational test limitations. 06. Verify CRVS air filtration unit heater testing specified in RG 1.140 C.4.g is completed and the test records have been approved.		
16.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each CRVS remotely-operated damper can be operated remotely.	1) Operate each damper from the MCR and local control panel (if design has local damper control).	1) MCR display and local, visual observation indicate each damper fully opens and fully closes.
02. Verify CRVS dampers automatically close on associated smoke or fire signals.	1) Open each damper actuated by a smoke or fire signal. Initiate an alarm signal for each damper.	1) MCR display and local, visual observation indicate each damper closes.
03. Verify each required CRVS fan stops on actuation of its associated fire or smoke alarm.	1) Initiate an alarm signal for each fan.	1) MCR display and local, visual observation indicate each fan stops.
04. Verify each CRVS pressurization fan starts automatically on the actuation of its associated fire or smoke alarm.	1) Initiate an alarm signal for each fan.	1) MCR display and local, visual observation indicate each pressurization fan starts.
05. Verify the fan speed of each CRVS variable-speed fan can be manually controlled.	1) Vary the speed of each fan from the MCR and local control panel (if design has local fan control).	1) MCR display indicates the speed of each fan varies from minimum to maximum fan speed.
06. Verify the standby CRVS main supply AHU starts automatically on the stop of the operating CRVS main supply AHU.	1) Place an AHU in service. Place the standby AHU in automatic control. Stop the operating AHU.	1) MCR display and local, visual observation indicate the standby AHU starts.
07. Verify each CRVS CRE isolation damper fails to its safe position on loss of electrical power to its solenoid.	1) Place each damper in its non-safe position. Isolate electrical power to its solenoid.	1) Each CRVS CRE isolation damper fails to its closed position on loss of electrical power under preoperational temperature, differential pressure, and flow conditions while the CRVS is supplying flow to the CRE. [ITAAC 03.02.01]
08. Verify each CRVS remotely operated fan can be operated remotely.	1) Operate each fan from the MCR and local control panel (if design has local fan control).	1) MCR display and local, visual observation indicate each fan starts and stops.

Table 14.2-16: Test # 16 Normal Control Room HVAC System (Continued)

09. Verify each CRVS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each CRVS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
16.02.XX System Level Tests **16.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify CRB design temperatures and humidity monitored by the MCR are maintained at design temperature and humidity conditions during normal operation. 2. Verify The CRVS maintains a positive pressure in the CRB relative to the outside environment while the CRVS is operating in normal alignment. 3. Verify the CRVS maintains the air flow to the battery rooms to maintain hydrogen concentration to less than 1 percent by volume.	Place the CRVS in automatic operation. 1) Record the CRB temperatures and humidity indications monitored by the MCR. 2) Measure the CRB pressure relative the outside environment. 3) Measure the air flow rate to the battery rooms.	1) The temperature and humidity of rooms and areas monitored by the MCR satisfy the design temperature and humidity requirements. 2) The CRVS maintains a positive pressure of greater than or equal to 0.125 inches water gauge in the CRB relative to the outside environment, while operating in the normal operating alignment. [ITAAC 03.02.02] 3) Measured flow to the battery rooms is equal to or greater than the flow specified by the air flow balance. [ITAAC 03.02.03]
16.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify CRB design temperatures and humidity monitored by the MCR are maintained at design temperature and humidity conditions while cooling to the CRV main supply AHU is supplied by the CHWS standby chiller.	Align the CHWS standby chiller to cool each CRVS main supply AHU. 1) Place the CRVS in automatic operation.	1) The temperature and humidity of rooms and areas monitored by the MCR satisfy the design temperature and humidity requirements.
16.02.03.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify PPS actuates CRVS outside air dampers when toxic gas or smoke is detected in the makeup air ductwork.	Place the CRVS in automatic operation. 1) Initiate a simulated high smoke or toxic gas signal for the makeup air ductwork upstream of the CRVS filter unit.	1) Outside air dampers close to isolate makeup air.
16.02.04.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the CRVS automatically responds to mitigate the consequences of high radiation in the outside air.	Place the CRVS in automatic operation. 1) Initiate a real or simulated high radiation signal for the outside air ductwork upstream of the CRVS filter unit.	1) Outside air is diverted through the CRVS filter unit by closing the CRVS filter unit bypass dampers and opening the CRVS filter unit isolation dampers. 2) The CRVS filter unit fan starts. [ITAAC 03.09.01] (items 1 and 2)

Table 14.2-17: Test # 17 Reactor Building HVAC System

Preoperational test is required to be performed once.		
The RBVS is described in Section 9.4.2 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The RBVS supports the RXB by providing cooling, heating and humidity control to maintain a suitable environment for the safety and comfort of plant personnel.	nonsafety-related	17.02.01 17.02.02 90.03.01
2. The RBVS supports the systems located in the RXB by providing cooling, heating and humidity control to maintain a suitable environment for the operation of system components.	nonsafety-related	17.02.01 17.02.02 90.03.01
3. The RBVS supports the RXB by maintaining the RXB at a negative ambient pressure relative to the outside atmosphere to control the movement of potentially airborne radioactivity from the RXB to the environment.	nonsafety-related	17.02.01 17.02.03
4. The CRVS supports the CRB by maintaining the CRB at a positive ambient pressure relative to the RXB and the outside atmosphere to control the ingress of potentially airborne radioactivity from the RXB or the outside atmosphere to the CRB.	nonsafety-related	17.02.01 (RXB negative pressure) 16.02.01 (CRB positive pressure)
5. The RWBVS supports the RWB by maintaining the RWB at a negative ambient pressure relative to the outside atmosphere to control the movement of potentially airborne radioactivity from the RWB to the environment.	nonsafety-related	17.02.03 (off-normal RBVS exhaust alignment) 18.02.01 (normal RBVS exhaust alignment)
17.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify an RBVS air balance is performed and the RBVS air balance records have been approved. [This prerequisite is not required for component-level tests.] (Note: The RBVS is designed to move air from areas that are not contaminated or are expected to have low levels of contamination to areas that are likely to be more contaminated.) 03.RBVS HEPA and charcoal adsorbers have been installed and tested. [This prerequisite is not required for component-level tests.] 04. Verify spent fuel pool exhaust charcoal and HEPA filter unit heater bank testing specified in RG 1.140 C.4.g is completed and the test records have been approved.		
17.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each RBVS remotely-operated damper can be operated remotely.	1) Operate each damper from the MCR and local control panel (if design has local damper control).	1) MCR display and local, visual observation indicate each damper fully opens and fully closes.

Table 14.2-17: Test # 17 Reactor Building HVAC System (Continued)

02. Verify each RBVS damper fails to its safe position on loss of electrical power, if is designed to do so.	Place each damper in its non-safe position. 1) Isolate electrical power to the damper.	1) MCR display and local, visual observation indicate each damper fails to its safe position.
03. Verify RBVS dampers automatically close on associated smoke or fire signals.	Open each damper actuated by a smoke or fire signal. 1) Initiate an alarm signal for each damper.	1) MCR display and local, visual observation indicate each damper closes.
04. Verify each required RBVS fan stops on actuation of its associated fire or smoke alarm.	1) Initiate an alarm signal for each fan.	1) MCR display and local, visual observation indicate each fan stops.
05. Verify the fan speed of each RBVS variable-speed fan can be manually controlled.	1) Vary the speed of each fan from the MCR and local control panel (if design has local fan control).	1) MCR display indicates the speed of each fan varies from minimum to maximum fan speed.
06. Verify each standby RBVS air handling unit starts automatically on the stop of the operating RBVS AHU.	1) Place an AHU in service. Place the standby AHU in automatic control. Stop the operating AHU.	1) MCR display and local, visual observation indicate the standby AHU starts.
07. Verify each standby RBVS fan coil unit (FCU) starts automatically on the stop of the operating RBVS fan coil unit.	1) Place an FCU in service. Place the standby FCU in automatic control. Stop the operating FCU.	1) MCR display and local, visual observation indicate the standby FCU starts.
08. Verify each RBVS remotely-operated fan can be started and stopped remotely.	1) Start and stop each fan from the MCR and local panel (if design has local fan control).	1) MCR display and local, visual observation indicate each fan started and stopped.
09. Verify each RBVS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each RBVS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
17.02.XX System Level Tests **17.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify RXB design temperatures and humidity monitored by the MCR are maintained at design temperature and humidity conditions during normal operation. 2. Verify the RBVS maintains a negative pressure in the RXB relative to the outside environment while the RBVS is operating in normal alignment. 3. Verify The RBVS maintains a negative pressure in the RWB relative to the outside environment while the RBVS is operating in normal alignment. 4. Verify the RBVS maintains the air flow to the battery rooms to maintain hydrogen concentration to less than 1 percent by volume.	Place the RBVS supply, general area exhaust and spent fuel pool exhaust in automatic operation. Place the RWBVS in automatic operation. 1) Record the RXB temperatures and humidity indications monitored by the MCR. 2) Measure the RXB pressure relative the outside environment. 3) Measure the RWB pressure relative the outside environment. 4) Measure the air flow rate to the battery rooms.	1) The temperature and humidity of rooms and areas monitored by the MCR satisfy the design temperature and humidity requirements. 2) MCR display indicates the RBVS maintains a negative pressure in the RXB relative to the outside environment while operating in the normal operating alignment. [ITAAC 03.03.01] 3) MCR display indicates the RBVS maintains a negative pressure in the RWB relative to the outside environment while operating in the normal operating alignment. [ITAAC 03.03.02] 4) Measured flow to the battery rooms is equal to or greater than the flow specified by the air flow balance. [ITAAC 03.03.03]

Table 14.2-17: Test # 17 Reactor Building HVAC System (Continued)

17.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify design temperatures of the following rooms can be controlled using AHUs with installed direct expansion coils. a. I&C equipment rooms b. Battery rooms c. Battery charger rooms	1) Place the RBVS air handling units with installed direct expansion coils in automatic operation.	1) The temperature and humidity of rooms and areas monitored by the MCR satisfy the design temperature and humidity requirements.
17.02.03.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify RBVS automatic alignment on a simulated spent fuel pool hi-hi radiation level. 2. Verify The RBVS maintains a negative pressure in the RXB relative to the outside environment while the RBVS is operating in accident alignment. 3. Verify The RWBVS maintains a negative pressure in the RWB relative to the outside environment while the RBVS is operating in accident alignment.	Place the RBVS general area exhaust, RBVS spent fuel pool exhaust, and RWBVS exhaust in automatic operation. 1) Place the RBVS supply in automatic operation. 2) Place the RWBVS supply system in automatic operation. 3) Simulate a Hi-Hi radiation signal in the spent fuel pool exhaust upstream of the spent fuel pool charcoal filter units.	1) The RBVS general area exhaust isolation dampers for the modules and dry dock areas are closed. 2) The RBVS diverts spent fuel pool exhaust flow to charcoal adsorbers and additional HEPAs in the spent fuel pool charcoal filter units. [ITAAC 03.09.03] (items 1 and 2) 3) The RBVS and SFP exhaust fans speed is adjusted to maintain the design negative pressure in the RXB and RWB relative to the outside environment while the RBVS is operating in the off-normal alignment.

Table 14.2-18: Test # 18 Radioactive Waste Building HVAC System

Preoperational test is required to be performed once.		
The RWBVS is described in Section 9.4.3 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The RWBVS supports the RWB by providing cooling, heating and humidity control to maintain a suitable environment for the safety and comfort of plant personnel.	nonsafety-related	18.02.01
2. The RWBVS supports the systems located in the RWB by providing cooling, heating and humidity control to maintain a suitable environment for the operation of system components.	nonsafety-related	18.02.01
3. The RWBVS supports the RWB by maintaining the RWB at a negative ambient pressure relative to the outside atmosphere to control the movement of potentially airborne radioactivity from the RWB to the environment.	nonsafety-related	18.02.0 (normal RBVS exhaust alignment) 17.02.03 (off-normal RBVS exhaust alignment)
18.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify an RWBVS air balance is performed and the RWBVS air balance records have been approved. [This prerequisite is not required for component-level tests.]		
18.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each RWBVS remotely-operated damper can be operated remotely.	1) Operate each damper from the MCR and local control panel (if design has local damper control).	1) MCR display and local, visual observation indicate each damper fully opens and fully closes.
02. Verify each RWBVS damper fails to its safe position on loss of electrical power, if it is designed to do so.	Place each damper in its non-safe position. 1) Isolate electrical power to the damper.	1) MCR display and local, visual observation indicate each damper fails to its safe position.
03. Verify RWBVS dampers automatically close on associated smoke or fire signals.	Open each damper actuated by a smoke or fire signal. 1) Initiate an alarm signal for each damper.	1) MCR display and local, visual observation indicate each damper closes.
04. Verify each required RWBVS fan stops on actuation of its associated fire or smoke alarm.	1) Initiate an alarm signal for each fan.	1) MCR display and local, visual observation indicate each fan stops.
05. Verify the fan speed of each RWBVS variable-speed fan can be manually controlled.	1) Vary the speed of each fan from the MCR and local control panel (if design has local fan control).	1) MCR display indicates the speed of each fan varies from minimum to maximum fan speed.
06. Verify the standby RWBVS main supply AHU starts automatically on the stop of the operating RWBVS main supply AHU.	Place an AHU in service. Place the standby AHU in automatic control. 1) Stop the operating recirculation AHU.	1) MCR display and local, visual observation indicate the standby AHU starts.
07. Verify each standby RWBVS FCU starts automatically on the stop of the operating RWBVS FCU.	Place an FCU in service. Place the standby FCU in automatic control. 1) Stop the operating FCU.	1) MCR display and local, visual observation indicate the standby FCU starts.

Table 14.2-18: Test # 18 Radioactive Waste Building HVAC System (Continued)

08. Verify each RWBVS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each RWBVS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
18.02.XX System Level Test **18.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the RWB design temperatures and humidity monitored by the MCR are maintained at design temperature and humidity conditions during normal operation. 2. Verify the RWBVS maintains a negative pressure in the RWB relative to the outside environment while the RWBVS is operating in normal alignment.	1) Place the RWBVS in automatic operation. 2) Place the RBVS in automatic operation.	1) The temperature and humidity of rooms and areas monitored by the MCR satisfy the design temperature and humidity requirements. 2) MCR display indicates the RWBVS maintains a negative pressure in the RWB relative to the outside environment while operating in the normal operating alignment.

Table 14.2-19: Test # 19 Turbine Building HVAC System

Preoperational test is required to be performed once.		
The TBVS is described in Section 9.4.4 and the function verified by this test is:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The TBVS supports the systems located in the TGB by providing cooling, heating and humidity control to maintain a suitable environment for the operation of system components.	nonsafety-related	19.02.01
19.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
19.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each air conditioning unit and condensing unit operates to maintain room temperature.	1) Start air conditioning and condensing unit.	1) Air conditioning unit and condensing unit operates to maintain room temperature.
02. Verify TBVS dampers automatically close on associated smoke or fire signals.	Open each damper actuated by a smoke or fire signal. 1) Initiate an alarm signal for each damper.	1) MCR display and local, visual observation indicate each damper closes.
03. Verify each required TBVS fan stops on actuation of its associated fire or smoke alarm.	1) Initiate an alarm signal for each fan.	1) MCR display and local, visual observation indicate each fan stops.
04. Verify each TBVS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each TBVS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
19.02.XX System Level Tests **19.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the TGB battery and battery charger room design temperatures are maintained at design temperature and humidity conditions during normal operation.	1) Place the turbine bypass system battery and battery charger room ventilation units in automatic operation.	1) The temperature and humidity of TGB battery and battery charger rooms satisfy the temperature and humidity requirements.

Table 14.2-20: Test # 20 Radioactive Waste Drain System

Preoperational test is required to be performed once.		
The RWDS is described in Section 9.3.3 and the functions verified by this test or another preoperational test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The RWDS supports the RWB by collecting radioactive waste in drain sumps and tanks and transfers it to the LRWS for processing.	nonsafety-related	20.02.01
2. The RWDS supports the RXB by collecting radioactive waste in drain sumps and tanks and transfers it to the LRWS for processing.	nonsafety-related	20.02.01
3. The RWDS supports the UHS by providing detection and monitoring of leakage through the UHS liner and the dry dock liner.	nonsafety-related	20.02.02
4. The LRWS supports the RWDS by receiving and processing the effluent from the RWB radioactive waste drain sumps.	nonsafety-related	20.02.01 30.02.02
5. The LRWS supports the RWDS by receiving and processing the effluent from the RXB radioactive waste drain sumps.	nonsafety-related	20.02.01 30.02.02
20.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
20.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each RWDS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each RWDS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each RWDS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify the RWDS automatically responds to mitigate a release of radioactivity.	1) Initiate a real or simulated high radiation signal for the RCCWS water drain tank.	1) MCR display verifies the RWDS to RCCWS expansion tank isolation valve is closed. [ITAAC 03.09.10]
05. Verify each RWDS pump can be started and stopped remotely.	Align the RWDS to allow for pump operation. 1) Start and stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops.
06. Verify a local grab sample can be obtained from an RWDS grab sample device indicated on the RWDS piping and instrumentation diagram.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is successfully obtained.

Table 14.2-20: Test # 20 Radioactive Waste Drain System (Continued)

07. Verify each RWDS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each RWDS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
20.02.XX System Level Tests **20.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify RWDS pumps start and stop automatically and transfer liquid waste to its design location in the LRWS.	Align each RWDS sump or tank to allow water in a selected sump or tank to be pumped to its design location in the LRWS (as indicated by the RWDS piping and instrumentation diagrams). 1) Fill the selected sump or tank until a HI water level is obtained to start the first (primary) pump. 2) Continue filling the sump or tank until a HI-HI level starts the second (alternate) pump. 3) Stop filling the sump or tank and allow the primary and alternate pumps to stop on LO level. 4) Change pump controls to make Pump #2 the primary pump and Pump #1 the alternate pump. Refill the sump or tank until the primary pump starts on HI level. 5) Continue filling the sump or tank until a HI-HI level starts the alternate pump.	MCR displays and local, visual observation verifies the following: 1) The first pump starts on HI level and transfers water to its design location in the LRWS. 2) The second (alternate) pump starts on HI-HI level. 3) Both primary and alternate pumps stop on LO level. 4) The primary pump starts on HI level. 5) The alternate pump starts on HI-HI level.
20.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify each RWDS equipment drain sump alarms on a fill rate that exceeds the PLDS leakage rate setpoint.	1) Fill the selected sump at a rate that exceeds the PLDS leakage rate setpoint.	1) PCS data indicate the sump fill rate alarmed at the PLDS leakage rate setpoint.

Table 14.2-21: Test # 21 Balance-of-Plant Drain System

Preoperational test is required to be performed to support sequence of construction turnover of the BPDS.		
The BPDS is described in Section 9.3.3 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The BPDS supports the condensate polisher demineralizers, the cooling tower chemical addition system, and the DWS reverse osmosis units by providing a means to collect and transfer chemical wastes to either the LRWS or to the UWS.	nonsafety-related	21.02.01 21.02.07
2. The BPDS supports the TGB, the two diesel generators, the auxiliary boiler, the Central Utility Building (CUB), and the diesel driven firewater pump by providing a means to collect, treat, and transfer the waste water to the either the LRWS or to the UWS.	nonsafety-related	21.02.01 21.02.07
3. The BPDS supports the CRB floor drains by providing a means to collect, treat, and transfer the waste water to the UWS.	nonsafety-related	21.02.01 21.02.07
21.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
21.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each BPDS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each BPDS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each BPDS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each BPDS pump can be started and stopped remotely.	Align the BPDS to allow for pump operation. 1) Start and stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
05. Verify each BPDS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each BPDS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.

Table 14.2-21: Test # 21 Balance-of-Plant Drain System (Continued)

21.02.XX System Level Tests **21.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify BPDS automatically controlled pumps in sumps and tanks with a fire water removal pump start and stop automatically and transfer liquid waste to its design location.	Align each BPDS sump or tank to allow water in a selected sump or tank to be pumped to its design location. If the sump fill rate in the following test method is insufficient for automatic start of the alternate pump or fire pump, the primary pump or alternate pump may be temporarily removed from service to allow an increase in the sump level. 1) Verify that Pump #1 is set to the primary pump and Pump #2 is set to alternate. Fill the selected sump or tank until a HI water level is obtained to start the primary pump. 2) Continue filling the sump or tank until a HI-HI level starts the alternate pump. 3) Fill the sump or tank until a HI-HI-HI level starts the fire water removal pump. 4) Stop filling the sump or tank to allow the fire water removal pump to stop on LO level. 5) Continue (or start) sump or tank dewatering to allow the primary and alternate pumps to stop on LO level. 6) Change pump controls to make Pump #2 the primary pump and Pump #1 the alternate pump, and refill the sump or tank until the primary pump starts on HI level. 7) Continue filling the sump or tank until a HI-HI level starts the alternate pump. Note: Pump #1 and Pump #2 are not the actual names of the pumps, these names are used to differentiate between the two pumps.	MCR displays and local, visual observation verifies the following: 1) The primary pump starts on HI level and transfers water to its design location in the LRWS or UWS. 2) The alternate pump starts on HI-HI level. 3) The fire water removal pump starts on HI-HI-HI level. 4) The fire water removal pump stops on LO level. 5) Both primary and alternate pumps stop on LO level. 6) The primary pump starts on HI level. 7) The alternate pump starts on HI-HI level.
21.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the BPDS automatically responds to mitigate a release of radioactivity.	Place a chemical waste water sump pump in operation. 1) Initiate a real or simulated high radiation signal on the 00 CPS regeneration skid waste effluent. Repeat the test for each pump.	1) The chemical waste water sump pump stops. 2) Chemical waste collection sump to BPDS collection tank isolation valve is closed. 3) Chemical waste collection sump to LRWS high-conductivity waste (HCW) tank isolation valve is closed. [ITAAC 03.09.06] (items 1 through 3)

Table 14.2-21: Test # 21 Balance-of-Plant Drain System (Continued)

21.02.03.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the BPDS automatically responds to mitigate a release of radioactivity.	Place a waste water sump pump in operation. 1) Initiate a real or simulated high radiation signal in the BPDS TGB floor drains. Repeat the test for each pump.	1) The waste water sump pump stops. 2) Waste water sump discharge to BPDS collection tank isolation valve is closed. 3) Waste water sump discharge to LRWS HCW tank isolation valve is closed. [ITAAC 03.09.06] (items 1 through 3)
21.02.04.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the BPDS automatically responds to mitigate a release of radioactivity.	Place a waste water sump pump in operation. 1) Initiate a real or simulated high radiation signal in the BPDS auxiliary blowdown cooler condensate. Repeat the test for each pump.	1) The chemical waste water sump pump stops. 2) Chemical waste collection sump to BPDS collection tank isolation valve is closed. 3) Chemical waste collection sump to LRWS HCW tank isolation valve is closed. [ITAAC 03.09.06] (items 1 through 3)
21.02.05.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify BPDS automatically controlled pumps, in sumps and tanks without a fire water removal pump, stop automatically and transfer liquid waste to its design location.	Align each BPDS sump or tank to allow water in a selected sump or tank to be pumped to its design location. 1) Verify that Pump #1 is set to the primary pump and Pump #2 is set to alternate. Fill the selected sump or tank until a HI water level alarm is obtained and start the primary pump. 2) Continue filling the sump or tank until a HI-HI level alarm and start the alternate pump. 3) Stop filling the sump or tank to allow the primary and alternate pumps to stop on LO level. Note: Pump #1 and Pump #2 are not the actual names of the pumps; these names are used to differentiate between the two pumps.	MCR displays and local, visual observation verifies the following: 1) The primary pump transfers water to its design location in the LRWS or UWS. 2) Both primary and alternate pumps stop on LO level.

Table 14.2-22: Test # 22 Fire Protection System

Preoperational test is required to be performed once, and is conducted in accordance with the applicable criteria in codes and standards listed in Table 9.5.1-1.		
The FPS is described in Section 9.5.1 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The FPS supports the following buildings and systems by providing fire prevention, detection, and suppression. • RXB • TGB • RWB • Security Buildings • ANB • Diesel Generator Building • Administration and Training Building • Warehouse Building • Fire Water Building • switchyard • site plant cooling structures • CUB • CRB • high voltage AC electrical distribution system (EHVS) • medium voltage AC electrical distribution system (EMVS) • low voltage AC electrical distribution system (ELVS) • RWBVS • CRVS • RBVS	nonsafety-related	Component-level tests
2. The FPS supports the CRB by providing audible and visual alarms to alert operators in the MCR.	nonsafety-related	Component-level tests
22.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify a pump curve test is completed for the fire protection pumps.		
22.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify position indication for each FPS manual valve with remote position indication.	1) Operate each valve manually.	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each FPS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each FPS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.

Table 14.2-22: Test # 22 Fire Protection System (Continued)

04. Verify each FPS pump can be started and stopped.	Align the FPS to allow for pump operation. 1) Start each pump locally. 2) Stop each pump locally.	1) MCR display and local, visual observation indicate each pump starts. Audible and visible water hammer are not observed when the pump starts. 2) MCR display and local, visual observation indicate each pump stops.
05. Verify automatic operation of FPS pumps.	1) Align the FPS and place the FPS pumps in automatic operation to pressurize the system. 2) Stop the jockey pump and simulate a low FPS header pressure to start the electric fire pump. 3) Stop the electric fire pump and simulate a low FPS header pressure to start the diesel fire pump.	Any MCR display or the local, visual observation indicate the following: 1) The jockey pump maintains the FPS header greater than or equal to 10 psig above the pressure setting for the automatic start of the electric fire pump. 2) The electric fire pump starts. Audible and visible water hammer are not observed when the pump starts. 3) The diesel pump starts. Audible and visible water hammer are not observed when the pump starts.
06. Verify each valve with a tamper switch alarms when partially closed.	1) Partially close each FPS manual valve with a tamper switch to its alarm position (approximately 20 percent of its total travel distance).	1) An alarm is received in the MCR when each valve is partially closed.
07. Verify each smoke and fire detector provides audible and visual alarms and annunciation in the MCR.	Isolate the water supply to each preaction or deluge sprinkler before performing this test to prevent wetting equipment. 1) Simulate a smoke or fire signal to each detector.	1) The MCR receives an alarm and indication from each smoke and fire detector.
08. Verify fire pump flow meets its fire protection volumetric flow rate.	Align the FPS for pump operation through the recirculation line. 1) Start the electric fire pump. 2) Start the diesel fire pump.	1) The electric fire pump meets its design volumetric flow rate. 2) The diesel fire pump meets its design volumetric flow rate. [ITAAC 03.07.02] (items 1 and 2)
09. Verify each suppression system actuation valve opens and alarms in the MCR when signal is received.	1) Isolate fluid source and simulate actuation signal.	1) Valve opens and send alarm to MCR.
10. Verify each suppression system flow switch alarms in the MCR.	1) Isolate fluid source and simulate flow signal.	1) Flow alarm sent to MCR.
11. Verify each FPS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each FPS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
22.02.XX System Level Tests		
None		

Table 14.2-23: Test # 23 Fire Detection System

Preoperational test is required to be performed once, and is conducted in accordance with the applicable criteria in codes and standards listed in Table 9.5.1-1.		
The fire detection system (FDS) is described in Section 9.5.1 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
As described in Test Abstract Table 14.2-22	nonsafety-related	As described in Test Abstract Table 14.2-22
01.00.XX Prerequisites As described in Test Abstract Table 14.2-22		
23.00.XX Component Level Tests		
As described in Test Abstract Table 14.2-22		
23.01.XX System Level Tests		
As described in Test Abstract Table 14.2-22		

Table 14.2-24: Test # 24 Main Steam System

Preoperational test is required to be performed for each NPM.		
The MSS is described in Section 10.3. MSS functions are not verified by this test. The MSS functions verified by other tests are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The MSS supports the TGS by providing steam to the TGS.	nonsafety-related	29.02.02 94.03.01
2. The MSS supports the containment system (CNTS) by providing secondary isolation of the main steam (MS) lines.	nonsafety-related	56.02.04
3. The MSS supports the DHRS by providing a backup means for required boundary conditions for DHRS operation.	nonsafety-related	56.02.01
24.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
24.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each MSS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each MSS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each MSS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify automatic operation of MSS extraction steam to protect the main turbine.	Initiate a simulated signal for the following system conditions. 1) FWH high level 2) Turbine trip	Any remote display or local verification indicates the following: 1) Extraction steam block valve closes. 2) Extraction steam non-return check valve closes.
05. Verify the MSS automatically responds to mitigate a release of radioactivity.	Initiate a real or simulated high radiation signal for each of the following: 1) SG #1 main steam line radiation 2) SG #2 main steam line radiation	1) MCR display verifies the following valves are closed: a. main steam common steam header drain pot control valve b. SG #1 drain pot control valve c. SG #2 drain pot control valve [ITAAC 02.07.04]
06. Verify each MSS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each MSS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
24.02.XX System Level Tests		
None		

Table 14.2-25: Test # 25 Condensate and Feedwater System

Preoperational test is required to be performed for each NPM.		
The FWS is described in Section 10.4.6; Section 9.2.6 (condensate storage tank); Section 10.4.1 (condenser); FWS functions are not verified by FWS tests. FWS functions verified by other tests are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The FWS supports the CPS by providing water for CPS rinse and CPS resin transfer.	nonsafety-related	27.02.01
2. The FWS supports the TGS by cooling superheated steam in the gland steam desuperheater before the steam entering the gland seals.	nonsafety-related	29.02.01 94.03.01
3. The FWS supports the CNTS by supplying FW to the SGs.	nonsafety-related	29.02.01 94.03.01
4. The FWS supports the TGS by cooling superheated turbine bypass steam in the turbine bypass desuperheater before the steam entering the main condenser.	nonsafety-related	29.02.01 97.03.01
5. The FWS supports the CNTS by providing secondary isolation of the FW lines.	nonsafety-related	56.02.04
6. The FWS supports the DHRS by providing secondary isolation of the FW lines, ensuring required boundary conditions for DHRS operation.	nonsafety-related	56.02.04
25.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify a pump curve test is completed for the FWS pumps.		
25.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each FWS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each FWS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each FWS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each FWS condensate pump can be started and stopped remotely.	Align the FWS to allow for pump operation. 1) Start and Stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
05. Verify the pump speed of each FWS variable-speed pump can be manually controlled.	Align the FWS to provide a flow path to operate a selected FWS variable-speed pump. 1) From the MCR, vary FWS pump speed from minimum to maximum for each FWS pump.	1) MCR display indicates the speed of each variable speed pump obtains both minimum and maximum pump speeds. Audible and visible water hammer are not observed when the pump starts.

Table 14.2-25: Test # 25 Condensate and Feedwater System (Continued)

06. Verify condensate pump low flow protection and short cycle automatic operation.	1) Align the FWS for automatic short cycle cleanup. Place a condensate pump in operation. 2) Manually throttle a valve in the pump flow path until the flow rate reaches the pump minimum flow setpoint. 3) Open the throttled valve.	MCR displays and local, visual observation verifies the following: 1) The short cycle flow is automatically maintained by the short cycle cleanup flow control valve. 2) The condensate pump minimum flow valve is open. 3) The condensate pump minimum flow valve is closed.
07. Verify FW pump low flow protection.	1) Align the FWS for automatic long cycle cleanup. Place a condensate pump in operation. 2) Manually throttle a valve in the pump flow path until the flow rate reaches the FW pump minimum flow setpoint. 3) Open the throttled valve.	MCR displays and local, visual observation verifies the following: 1) The long cycle flow is automatically maintained by the long cycle cleanup flow control valve. 2) The FW pump minimum flow valve is open. 3) The FW pump minimum flow valve is closed.
08. Verify a local grab sample can be obtained from an FWS grab sample device.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is successfully obtained.
09. Verify each FWS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each FWS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
25.02.XX System Level Tests		
None		

Table 14.2-26: Test # 26 Feedwater Treatment System

Preoperational test is required to be performed once each for the shared or common components. The module-specific portions of the test must be completed once for each NPM.		
The FWTS is described in Section 10.4.8 and the function verified by this test and power ascension testing is:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The FWTS supports the FWS by controlling and maintaining FW chemistry.	nonsafety-related	Component-level tests 72.03.01
26.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
26.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each FWTS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each FWTS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each FWTS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each FWTS pump can be started and stopped remotely and locally (if designed).	Align the FWTS to allow for pump operation. 1) Start and stop each remotely-controlled pump from the MCR. 2) Start and stop each locally-controlled pump locally.	1) MCR display and local, visual observation indicate each pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
05. Verify the speed of each FWTS variable-speed pump can be manually controlled.	1) Vary the speed of each pump from the MCR and local control panel (if design has local pump control).	1) MCR display indicates pump speed varies from minimum to maximum pump speed.
06. Verify each FWTS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each FWTS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
26.02.XX System Level Tests		
None		

Table 14.2-27: Test # 27 Condensate Polisher Resin Regeneration System

Preoperational test is required to be performed once.		
The CPS is described in Section 10.4.5. The CPS and other system functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The CPS supports the FWS by regenerating the resin that purifies the condensate.	nonsafety-related	27.02.01
2. The FWS supports the CPS by providing water for CPS rinse and CPS resin transfer.	nonsafety-related	27.02.01
3. The ABS supports the CPS by supplying chemical supply piping and connections for neutralization.	nonsafety-related	Component Level Tests
27.00.XX Prerequisites: 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. NOTE: Component Level Tests may be performed as SAT on vendor supplied skids.		
27.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each CPS remotely-operated valve can be operated remotely, if not performed as part of SAT.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each CPS air-operated valve fails to its safe position on loss of air, if not performed as part of SAT.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each CPS air-operated valve fails to its safe position on loss of electrical power to its solenoid, if not performed as part of SAT.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each CPS pump can be started and stopped remotely and locally (if designed), if not performed as part of SAT.	Align the CPS to allow for pump operation. 1) Start and stop each remotely-controlled pump from the MCR. 2) Start and stop each locally-controlled pump locally.	1) MCR display and local, visual observation indicate each pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
05. Verify the speed of each CPS variable-speed pump can be manually controlled, if not performed as part of SAT.	1) Vary the speed of each pump from the MCR and local control panel (if design has local pump control).	1) MCR display indicates pump speed varies from minimum to maximum pump speed.
06. Verify a local grab sample can be obtained from a CPS grab sample device, if not performed as part of SAT.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is successfully obtained.
07. Verify each CPS instrument is available on an MCS or PCS display, if not performed as part of SAT. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each CPS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.

Table 14.2-27: Test # 27 Condensate Polisher Resin Regeneration System (Continued)

27.02.XX System Level Test 27.02.01.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the CPS automatically completes resin regeneration.	Align the FWS to support CPS resin regeneration. Align the ABS to support CPS resin regeneration. 1) Automatically transfer the test resin bed from a condensate polisher to the CPS regeneration skid. 2) Initiate an automatic regeneration of the resin. 3) Automatically transfer the test resin bed from the CPS regeneration skid to a condensate polisher.	1) The resin transferred to the regeneration skid. 2) The CPS regeneration cycle completed successfully. 3) The resin transferred to a condensate polisher. 4) ABS steam maintains hot water heater outlet temperature at design setpoint during resin regeneration.

Table 14.2-28: Test # 28 Feedwater Heater Vents and Drains System

Preoperational test is required to be performed for each NPM.		
The feedwater heater vents and drains system (HVDS) is described in Section 10.4.6. and the functions verified by this test and power ascension testing are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The HVDS supports the FWS by venting the FWHs.	nonsafety-related	Component level tests
2. The HVDS supports the FWS by controlling level in the shell side FWHs.	nonsafety-related	Component level tests 94.03.01
28.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
28.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each HVDS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each HVDS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each HVDS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify automatic operation of HVDS valves to protect the turbine on turbine trip.	1) Initiate a simulated turbine trip.	Any remote display or local verification indicates the following: 1) Low, intermediate, and high pressure FWH extraction steam supply valves are closed. 2) Low, intermediate, and high pressure FWH air assisted check valves are closed. 3) Low, intermediate, and high pressure FWHs extraction steam dump valves are open.
05. Verify automatic operation of HVDS valves to protect the turbine on high FWH level.	Initiate a simulated signal for the following system conditions. 1) Low pressure FWH high level. 2) Intermediate pressure FWH high level. 3) High pressure FWH high level.	Any remote display or local verification indicates the following: 1) Low pressure FWH extraction steam supply valve and low pressure FWH extraction steam dump valve are open. 2) Intermediate pressure FWH extraction steam supply valve and intermediate pressure FWH extraction steam dump valve are open. 3) High pressure FWH extraction steam supply valve and high pressure FWH extraction steam dump valve are open.

Table 14.2-28: Test # 28 Feedwater Heater Vents and Drains System (Continued)

06. Verify each HVDS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each HVDS system transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
28.02.XX System Level Tests		
None		

Table 14.2-29: Test # 29 Turbine Generator System

Preoperational test is required to be performed for each NPM.		
The TGS is described in Sections 10.2, 10.4.3, and 10.4.4. The TGS and other functions verified by this test and power ascension testing are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The TGS supports the MSS by providing steam bypass from the MSS to the main condenser.	nonsafety-related	29.02.01 97.03.01
2. The module heatup system (MHS) supports the CVCS by adding heat to primary coolant.	nonsafety-related	29.02.01
3. The CVCS supports the RCS by heating primary coolant.	nonsafety-related	29.02.01
4. The FWS supports the CNTS by supplying FW to the SGs.	nonsafety-related	29.02.01 93.03.01
5. The FWS supports the TGS by cooling superheated turbine bypass steam in the turbine bypass desuperheater before the steam entering the main condenser.	nonsafety-related	29.02.01 97.03.01
6. The FWS supports the TGS by cooling superheated steam in the gland steam desuperheater before the steam entering the gland seals.	nonsafety-related	29.02.01 94.03.01
7. The CVCS supports the ECCS valves by providing water to reset the ECCS valves.	nonsafety-related	29.02.01
8. The MSS supports the TGS by providing steam to the TGS.	nonsafety-related	29.02.01 94.03.01
29.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. The following prerequisites are only required for the System Level Tests: 02. Verify Test 07.02.01 is completed to verify the CARS can maintain main condenser vacuum pressure (reference test Table 14.2-7). 03. The SG FW flush is complete. 04. The CARS is automatically maintaining main condenser vacuum. 05. Initial RCS temperature must be approximately 200°F to allow for hot functional testing to obtain data at an RCS temperature of 200°F and above. 06. The NPM and supporting systems are aligned to increase RCS temperature and pressure.		
29.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each TGS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each TGS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each TGS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.

Table 14.2-29: Test # 29 Turbine Generator System (Continued)

04. Verify each TGS lube oil pump can be started and stopped remotely.	Align the TGS to allow for main lube oil, auxiliary lube oil, and emergency pump operation. 1) Start and stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
05. Verify the TGS exhaust hood is protected against high temperature.	1) Initiate a simulated high exhaust hood temperature.	1) Any remote display or the local, visual observation indicates the exhaust hood spray valve is open.
06. Verify TGS lubricating oil flow capability by automatic start of the auxiliary lube oil pump.	Align the TGS to allow for main lube oil and auxiliary lube oil pump operation. Place the TGS main oil pump in normal service. Place the auxiliary oil pump in standby. 1) Simulate a TGS auxiliary oil pump start.	1) MCR display and local, visual observation indicate the auxiliary oil pump starts. Audible and visible water hammer are not observed when the pump starts.
07. Verify TGS lubricating oil flow capability by automatic start of the emergency direct current (DC) lube oil pump.	Align the TGS to allow for auxiliary lube oil pump and emergency lube oil pump operation. Place the turbine generator auxiliary oil pump in normal service. 1) Simulate a turbine generator emergency oil pump start or simulate a loss of AC power.	1) MCR displays and local, visual observation indicate the TGS emergency oil pump starts. Audible and visible water hammer are not observed when the pump starts.
08. Verify the turbine stop valve and turbine control valves close on turbine overspeed.	1) a. Simulate an overspeed trip signal from the turbine overspeed emergency trip system. b. Record the stroke times of the turbine stop valve and the turbine control valves. 2) a. Simulate an overspeed trip signal from the governor overspeed detection circuit. b. Record the stroke times of the turbine stop valve and the turbine control valves.	1) a. The turbine stop valve and turbine control valves close. b. Each turbine stop valve and turbine control valve close stroke time is within design limits. 2) a. The turbine stop valve and turbine control valves close. b. Each turbine stop valve and turbine control valve close stroke time is within design limits.
09. Verify a local grab sample can be obtained from the gland seal exhauster discharge grab sample device.	1) Place the system in service to allow flow through the grab sample device.	1) A local grab sample is obtained.
10. Verify the turbine can be manually tripped.	1) Manually trip the turbine from an operator workstation in the MCR.	1) The turbine stop valve and turbine control valves close.
11. Verify each TGS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each TGS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.

Table 14.2-29: Test # 29 Turbine Generator System (Continued)

29.02.XX System Level Tests 29.02.01.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the CVCS is capable of supplying water at sufficient pressure to close the ECCS valves. 2. Verify the MHS is capable of heating the RCS to a temperature sufficient to obtain criticality. 3. Verify the MHS is capable of heating the RCS to establish natural circulation flow sufficient to obtain criticality. 4. Verify the TGS automatically controls turbine bypass flow to the main condenser. 5. Verify the FWS automatically controls flow to the SGs to maintain SG inventory. 6. Verify the FWS automatically cools the TGS bypass steam in the MS desuperheater. 7. Verify a local grab sample can be obtained from an MHS grab sample device. 8. Verify the FWS automatically cools the TGS gland steam in the gland steam desuperheater. 9. Verify CCT level is automatically controlled while receiving bypass steam. 10. Verify no dynamic effects caused by changes in fluid flow.	1) Close the ECCS valves. 2) Align the plant to cool the RCS via the TGS bypass system. 3) Warm MS lines. 4) Place the TGS steam bypass valve in automatic control. 5) Place the FW regulating valve in SG inventory control. 6) Place the MHS and the CVCS in automatic control to heat the RCS. 7) Align the FWS to cool the gland seal steam desuperheater.	1) CVCS pressure is sufficient as indicated by closure of the ECCS valves. 2) a. CVCS supply remains in a sub-cooled state while heating the RCS using the MHS as verified by CVCS temperature and pressure. b. RCS temperature is sufficient to obtain criticality. 3) RCS natural circulation flow is sufficient to obtain criticality. 4) The TGS bypass flow maintains steam pressure at setpoint. 5) The FW flow to the SG is maintained at setpoint. 6) The cooled TGS bypass temperature is maintained at setpoint. 7) A local grab sample is successfully obtained at RCS normal operating pressure and maximum temperature achievable. 8) The cooled gland seal steam temperature is maintained at setpoint. 9) CCT level is maintained at setpoint while receiving bypass steam. 10) Water hammer indications: a. Audible indications of water hammer are not observed. b. No damage to pipe supports or restraints. c. No damage to equipment. d. No equipment leakage
29.02.02. This test may be performed after the completion of Test 29.02.01 when the RCS is at normal operating pressure and the RCS has achieved the maximum temperature achievable by warming the RCS using MHS heating.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the maximum main turbine speed that can be obtained using the MHS to heat the RCS.	Place the main turbine in service as follows: 1) Ensure the RCS is at normal operating pressure and at maximum temperature achievable by warming the RCS using MHS heating. 2) Place turbine on turning gear with seal steam in service. 3) Warm up turbine to required temperature. 4) Increase main turbine speed.	1) The maximum main turbine speed is obtained.

Table 14.2-30: Test # 30 Liquid Radioactive Waste System

Preoperational test is required to be performed once.		
The LRWS is described in Section 11.2 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The LRWS supports the solid radioactive waste system (SRWS) by receiving and processing liquid radioactive waste from the SRWS dewatering skid.	nonsafety-related	30.02.02 Component-level test 30.01.11 32.02.07
2. The LRWS supports the PCWS by receiving contaminated pool water to aid in the removal of titrated water or boron. Treated liquid radioactive waste has the option to return to the pool as makeup.	nonsafety-related	30.02.02 Component-level tests
3. The LRWS supports the CVCS by receiving and processing primary coolant from CVCS letdown.	nonsafety-related	30.02.02 33.02.01
4. The LRWS supports the RWDS by receiving and processing the effluent from the RWB radioactive waste drain sumps.	nonsafety-related	30.02.02 20.02.01
5. The LRWS supports the RWDS by receiving and processing the effluent from the RXB radioactive waste drain sumps.	nonsafety-related	30.02.02 20.02.01
6. LRWS supports the CVCS by receiving and processing the noncondensable gases and vapor from the PZR.	nonsafety-related	30.02.01
7. LRWS supports the PCWS by processing any fluid collected in the drain sump of the secondary containment tank.	nonsafety-related	30.02.02 Component-level tests
8. The NDS supports the LRWS by providing nitrogen for purging of the LRWS.	nonsafety-related	30.02.01 Table 14.2-12 component-level tests

Table 14.2-30: Test # 30 Liquid Radioactive Waste System (Continued)

30.00.XX Prerequisites

01. Required ANSI/ANS-55.6 construction testing is completed.
02. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.

30.01.XX Component Level Tests

Test Objective	Test Method	Acceptance Criteria
01. Verify each LRWS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control)	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each LRWS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each LRWS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each LRWS pump can be started and stopped remotely.	Align the LRWS to allow for pump operation. 1) Start and stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
05. Verify the speed of each LRWS variable-speed pump can be manually controlled.	Align the LRWS to provide a flow path to operate a selected pump. 1) Vary the LRWS pump speed from minimum to maximum from the MCR.	1) MCR display indicates the speed of each obtains both minimum and maximum pump speeds.
06. Verify LRWS isolation on discharge to the utility water discharge basin high radiation, low dilution flow and underground pipe break.	Initiate the following a real or simulated signals: 1) LRWS discharge to the utility water discharge basin high radiation signal. 2) LRWS discharge to the utility water discharge basin low dilution flow signal. 3) LRWS discharge to the utility water discharge basin low guard pipe pressure signal.	MCR display and local, visual observation indicate the following: 1) The LRWS discharge to the utility water discharge basin isolation valves close. [ITAAC 03.09.07] 2) The LRWS discharge to the utility water discharge basin isolation valves close. 3) The LRWS discharge to the utility water discharge basin isolation valves close.
07. Verify the LWRS automatically responds to mitigate a release of radioactivity.	1) Initiate a simulated high area radiation signal for the GRWS charcoal bed cubicle.	1) MCR display verifies the LRWS to GRWS discharge isolation valve is closed. [ITAAC 03.09.07]
08. Verify tank valves operate to ensure uninterrupted waste receiving.	Simulate an inservice tank high level signal for each of the following tanks: 1) Low-conductivity waste (LCW) collection tank A and B. 2) HCW collection tank A and B. 3) LCW sample tank A and B HCW sample tank A and B.	1) MCR display and local, visual observation indicate the inservice tank fill valve is closed and the standby tank fill valve is open.
09. Verify degasifier valves operate to ensure uninterrupted waste receiving.	1) Initiate a simulated high degasifier level signal. 2) Initiate a simulated high degasifier pressure signal.	1) MCR display and local, visual observation indicate the inservice degasifier fill valve is closed and the standby degasifier fill valve is open.

Table 14.2-30: Test # 30 Liquid Radioactive Waste System (Continued)

10. Verify LRWS pumps automatically operate to prevent tank overflow.	Align the LRWS to allow each of the following LRWS transfer pumps to automatically transfer effluent to one of its design locations. • Degasifier transfer pump A and B. • LCW collection tank transfer pump A and B. • HCW collection tank transfer pump A and B. • LCW sample tank transfer pump A and B • HCW sample tank transfer pump A and B. • Detergent waste collection tank transfer pump. • Demineralized water break tank transfer pump. 1) Simulate a HI-HI level signal in each of the above tanks. 2) Simulate a low level signal in each of the above tanks.	MCR displays and local, visual observation indicate the following: 1) The transfer pump starts and transfers effluent to its design location. 2) The transfer pump stops.
11. Verify a local grab sample can be obtained from a LRWS grab sample device indicated on the LRWS piping and instrumentation diagram.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is successfully obtained.
12. Verify SRWS dewatering skid effluent can be transferred to LRWS HCW collection tanks.	Align SRWS dewatering skid discharge to one of the LRWS HCW collection tanks. Fill the SRWS dewatering skid HIC to above the low level pump stop setpoint. 1) Start the SRWS dewatering skid diaphragm pump.	1) SRWS dewatering skid effluent is transferred to the LRWS high-conductivity waste collection tank. 2) The SRWS dewatering skid diaphragm pump is stopped.
13. Verify each LRWS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each LRWS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
30.02.XX System Level Tests **30.02.01.** **This test is performed after the completion of Test 29.02.01 when the RCS is at normal operating pressure and the RCS has achieved the maximum temperature achievable by warming the RCS using MHS heating.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify LRWS can process a gaseous waste stream.	1) Align LRWS to receive PZR gaseous waste from the PZR during hot functional testing. 2) Process the PZR gaseous waste through the LRWS degasifier. 3) Purge the degasifier with nitrogen following operation.	1) The LRWS degasifier removes condensable gases and vents waste to the RBVS or GRWS. 2) The LRWS degasifier liquid transfer pumps transfer the liquid condensate waste to the low conductivity waste collection tanks. 3) LRWS degasifier is purged with nitrogen.

Table 14.2-30: Test # 30 Liquid Radioactive Waste System (Continued)

30.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify LRWS can process a liquid waste stream.	Align LRWS to receive liquid waste from a liquid waste stream. 1) Process the liquid waste stream through the LCW waste process. 2) Process the liquid waste stream through the HCW process.	1) The waste treatment streams are successfully processed through the following processes: • filtration • tubular filtration skid • LCW processing skid • HCW processing skid • drum dryer skid • demineralization • transfer to LCW or HCW sample tanks • transfer from LCW or HCW sample tanks to the utility water system discharge basin.

Table 14.2-31: Test # 31 Gaseous Radioactive Waste System

Preoperational test is required to be performed once.		
The GRWS is described in Section 11.3 and the functions verified by this test or another preoperational test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The GRWS supports the LRWS by receiving and collecting potentially radioactive and hydrogen-bearing waste gases that require processing before release to the environment.	nonsafety-related	31.02.01
2. The GRWS supports the CES by receiving and collecting potentially radioactive and hydrogen-bearing waste gases that require processing before release to the environment.	nonsafety-related	31.02.01 36.02.02
3. The NDS supports the GRWS by providing nitrogen for purging of the GRWS.	nonsafety-related	31.02.01 Table 14.2-12 component-level tests
31.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
31.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each GRWS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each GRWS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each GRWS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify GRWS valves automatically operate to maintain vessel volume.	1) Initiate a real or simulated high GRWS moisture separator level. 2) Initiate a real or simulated low GRWS moisture separator level.	MCR display and local, visual observation indicate the following: 1) The moisture separator drain valve is open. 2) The moisture separator drain valve is closed.
05. Verify GRWS inlet isolation valves automatically close and nitrogen purge valve opens on high inlet stream oxygen concentration.	1) Simulate a GRWS inlet stream oxygen concentration high signal.	MCR display and local, visual observation indicate the following: 1) The inlet stream isolation valves are closed. 2) The nitrogen purge valve is open.
06. Verify GRWS isolates upon loss of RWBVS exhaust flow.	1) Simulate a loss of RWBVS exhaust flow.	1) MCR display and local, visual observation indicate the GRWS isolation valves are closed.

Table 14.2-31: Test # 31 Gaseous Radioactive Waste System (Continued)

07. Verify radiation isolation of GRWS charcoal decay beds upon detection of decay bed discharge flow high radiation level.	1) Initiate a real or simulated GRWS train A decay bed discharge flow high radiation signal. 2) Initiate a real or simulated GRWS train B decay bed discharge flow high radiation signal.	MCR display and local, visual observation indicate the following: 1) The following GRWS valves are closed: a. GRWS charcoal decay bed skid A outlet isolation valve b. GRWS charcoal decay bed skid A inlet isolation valve c. GRWS to Radioactive Waste Building HVAC system (RWBVS) exhaust upstream isolation valve d. GRWS to RWBVS exhaust downstream isolation valve 2) The following GRWS valves are closed: a. GRWS charcoal decay bed skid B outlet isolation valve b. GRWS charcoal decay bed skid B inlet isolation valve c. GRWS to Radioactive Waste Building HVAC system (RWBVS) exhaust upstream isolation valve d. GRWS to RWBVS exhaust downstream isolation valve [ITAAC 03.09.04] (items 1 and 2)
08. Verify radiation isolation of GRWS discharge to the RBVS exhaust upon detection of a high radiation level.	1) Initiate a real or simulated GRWS discharge to the RBVS exhaust high radiation signal.	1) MCR display and local, visual observation indicate the GRWS discharge to the RBVS exhaust isolation valves are closed. [ITAAC 03.09.04]
09. Verify a local grab sample can be obtained from a GRWS grab sample device indicated on the GRWS piping and instrumentation diagram.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is successfully obtained.
10. Verify each GRWS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each GRWS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
31.02.XX System Level Test **31.02.01.Test**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify GRWS can process a gaseous waste stream and nitrogen stream.	1) Align GRWS to receive gaseous waste from a gaseous waste stream. Process the gaseous waste stream through the gaseous waste process. 2) Align GRWS charcoal drying heater to receive nitrogen from NDS. Process nitrogen through the charcoal drying process.	1) The gaseous waste stream is successfully processed through the following processes: • gas cooler • moisture separator • charcoal guard bed • charcoal decay beds • RWB exhaust 2) Nitrogen is successfully processed through the charcoal drying heater.

Table 14.2-32: Test # 32 Solid Radioactive Waste System

Preoperational test is required to be performed once.		
The SRWS is described in Section 11.4 and the functions verified by this test or another preoperational test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The SRWS supports the LRWS by receiving spent resin and carbon bed from LRWS processing skids.	nonsafety-related	32.02.01 32.02.04 32.02.06
2. The SRWS supports the CVCS by receiving spent resin from CVCS ion exchange vessels.	nonsafety-related	32.02.02 32.02.05
3. The SRWS supports the PCWS by receiving spent resin and sludge from PCWS ion exchange vessels.	nonsafety-related	32.02.03 32.02.05
4. The SRWS supports the CRVS by receiving exhausted HEPA filters to be compacted and shipped off site.	nonsafety-related	32.02.08
5. The SRWS supports the RWBVS by receiving exhausted HEPA filters to be compacted and shipped off site.	nonsafety-related	32.02.08
6. The SRWS supports the RBVS by receiving exhausted HEPA filters and charcoal bed from RBVS and CRVS, to be compacted and shipped off site.	nonsafety-related	32.02.08
7. The SRWS supports the GRWS by receiving contaminated or exhausted charcoal beds, packaging the waste in approved containers and shipping it to a licensed facility.	nonsafety-related	32.02.08
8. The LRWS supports the SRWS by receiving and processing liquid radioactive waste from the SRWS dewatering skid.	nonsafety-related	32.02.07 30.02.02

Table 14.2-32: Test # 32 Solid Radioactive Waste System (Continued)

32.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
32.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each SRWS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each SRWS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each SRWS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each SRWS pump can be started and stopped remotely.	Align the SRWS to allow for pump operation. 1) Start and stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
05. Verify the speed of each SRWS variable-speed pump can be manually controlled.	Align the SRWS to provide a flow path to operate a selected pump. 1) Vary the SRWS pump speed from minimum to maximum from the MCR.	1) MCR display indicates the speed of each obtains both minimum and maximum pump speeds.
06. Verify a local grab sample can be obtained from an SRWS grab sample device indicated on the SRWS piping and instrumentation diagram.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is successfully obtained.
07. Verify each SRWS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each SRWS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
32.02.XX System Level Tests **32.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify spent resin from the LRWS demineralizers can be transferred to the SRWS phase separator tanks.	Align the LRWS and SRWSs to transfer LRWS demineralizer resin to an SRWS phase separator tank. 1) Start a phase separator transfer pump.	1) The waste management control room (WMCR) displays and local, visual observation verifies LRWS demineralizer resins transferred to an SRWS phase separator tank.
32.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify spent resin from the CVCS ion exchangers can be transferred to the SRWS spent resin storage tanks.	Align the CVCS and SRWSs to transfer CVCS ion exchanger resin to an SRWS spent resin storage tank. 1) Start an SRWS spent resin storage tank transfer pump.	1) WMCR displays and local, visual observation verifies CVCS ion exchanger resin transferred to an SRWS spent resin storage tank.

Table 14.2-32: Test # 32 Solid Radioactive Waste System (Continued)

32.02.03.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify spent resin from the PCWS demineralizers can be transferred to the SRWS spent resin storage tanks.	Align the PCWS and SRWSs to transfer PCWS demineralizer resin to an SRWS spent resin storage tank. 1) Start an SRWS spent resin storage tank transfer pump.	1) WMCR displays and local, visual observation verifies PCWS demineralizer resins transferred to an SRWS spent resin storage tank.
32.02.04.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify spent resin from the SRWS phase separator tanks can be transferred to a dewatering station high integrity container (HIC).	Align an SRWS phase separator tank and the SRWS dewatering station to transfer spent resin to the dewatering station HIC using the SAS. 1) Open SAS isolation valve to the SRWS phase separator tank.	1) WMCR displays and local, visual observation verifies phase separator tank resins are transferred to a dewatering station HIC.
32.02.05.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify spent resin from the SRWS spent resin storage tanks can be transferred to a dewatering station HIC.	Align an SRWS spent resin storage tank and the SRWS dewatering station to transfer spent resin to the dewatering station HIC using SAS air. 1) Open SAS isolation valve to the spent resin storage tank.	1) WMCR displays and local, visual observation verifies spent resin storage tank resins are transferred to a dewatering station HIC.
32.02.06.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify granulated activated charcoal (GAC) from the LRWS granulated activated charcoal filter can be transferred to a dewatering station HIC.	1) Align a LRWS and SRWS to GAC to the dewatering station HIC using the clean in place system.	1) WMCR displays and local, visual observation verifies spent resin storage tank resins are transferred to a dewatering station HIC.
32.02.07.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the dewatering skid pump removes standing water in the HIC with spent resin in the dewatering station HIC.	1) Align the dewatering skid pump to an LRWS high conductivity waste tank and start the dewatering skid pump.	1) Free-standing water in the HIC has been removed.
32.02.08.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the SRWS waste compactor compacts solid radioactive waste.	1) Place solid radioactive waste in compactor and start compactor.	1) The waste has been compacted.

Table 14.2-33: Test # 33 Chemical and Volume Control System

Preoperational test is required to be performed for each NPM.		
The CVCS is described in Section 9.3.4 and the functions verified by this test, other preoperational tests, and power ascension testing are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The CVCS supports the RCS by providing primary coolant makeup.	nonsafety-related	33.02.01 94.03.01
2. The CVCS supports the RCS by providing primary coolant letdown.	nonsafety-related	33.02.01 94.03.01
3. The CVCS supports the RCS by providing PZR spray flow for RCS pressure control.	nonsafety-related	33.02.02 94.03.01
4. The CVCS supports the RCS by changing the boron concentration of the primary coolant.	nonsafety-related	33.02.03
5. The BAS supports the CVCS by providing uniformly mixed borated water on demand.	nonsafety-related	33.02.03
6. The LRWS supports the CVCS by receiving and processing primary coolant from CVCS letdown.	nonsafety-related	33.02.01 30.02.02
The CVCS functions verified by other tests are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
7. The CVCS supports the ECCS valves by providing water to reset the ECCS valves.	nonsafety-related	29.02.01
8. The CVCS supports the RCS by heating primary coolant.	nonsafety-related	29.02.01
9. The CVCS supports the RCS by isolating dilution sources.	safety-related	56.02.04
10. The CVCS supports the RCS by providing primary coolant makeup in beyond design-basis events.	nonsafety-related	56.02.08
33.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify a pump curve test is completed and approved for the CVCS pumps. 03. Component Level Tests 33.01.04, 33.01.05 and 33.01.06 must be performed under preoperational test conditions that approximate design-basis temperature, differential pressure, and flow conditions to the extent practicable, consistent with preoperational test limitations.		
33.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each CVCS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each CVCS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each CVCS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.

Table 14.2-33: Test # 33 Chemical and Volume Control System (Continued)

04. Verify each CVCS American Society of Mechanical Engineers (ASME) Code Class 3 air-operated valve changes position under preoperational temperature, differential pressure, and flow conditions.	1) Operate each valve from the MCR.	1) MCR display verifies the valve opens and closes under preoperational temperature, differential pressure, and flow conditions. [ITAAC 02.02.01]
05. Verify each CVCS ASME Code Class 3 air-operated valve fails to its safe position on loss of air under preoperational temperature, differential pressure, and flow conditions.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position under preoperational temperature, differential pressure, and flow conditions. [ITAAC 02.02.02]
06. Verify each CVCS ASME Code Class 3 air-operated valve fails to its safe position on loss of electrical power to its solenoid under preoperational temperature, differential pressure, and flow conditions.	Place each valve in its non-safe position. 1) Isolate electrical power to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position under preoperational temperature, differential pressure, and flow conditions. [ITAAC 02.02.02]
07. Verify each CVCS pump can be started and stopped remotely.	Align the CVCS to allow for pump operation. 1) Start and stop each CVCS pump from the MCR.	1) MCR display and local, visual observation indicate the pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
08. Verify the speed of each CVCS variable-speed pump can be manually controlled.	Align the CVCS to provide a flow path to operate a selected pump. 1) Vary the CVCS pump speed from minimum to maximum from the MCR.	1) MCR display indicates the speed of each obtains both minimum and maximum pump speeds.
09. Verify each CVCS operating makeup pump automatically stops to protect the pump and the standby pump starts.	Align the CVCS to allow for pump operation. Place a makeup pump in service. 1) Initiate a simulated makeup pump trip.	1) MCR display and local, visual observation indicate the operating pump stops and the standby pump starts. Audible and visible water hammer are not observed when the pump starts.
10. Verify each CVCS recirculation pump automatically stops to protect the pump and the standby pump starts.	Align the CVCS to allow for pump operation. Place a recirculation pump in service. 1) Initiate a simulated recirculation pump trip.	1) MCR display and local, visual observation indicate the operating pump stops and the standby pump starts.
11. Verify CVCS letdown flow isolates on high flow to protect plant equipment.	1) Initiate a simulated CVCS high letdown flow signal.	1) MCR display and local, visual observation indicate the LRWS letdown flow control valve and LRWS letdown isolation valves (3) are closed.

Table 14.2-33: Test # 33 Chemical and Volume Control System (Continued)

12. Verify ion exchanger isolation on non-regenerative heat exchanger high outlet temperature to protect plant equipment.	1) Initiate a simulated high non-regenerative heat exchanger outlet temperature signal.	1) MCR display and local, visual observation indicate the following: a. CVCS purification bypass diverting valve is in the bypass position. b. Mixed bed ion exchanger A inlet isolation valves (2) are closed. c. Auxiliary ion exchanger inlet isolation valve is closed. d. Cation exchanger inlet isolation valve is closed.
13. Verify the CVCS automatically responds to mitigate a release of radioactivity.	1) Initiate a real or simulated high radiation signal for the RCS discharge flow to the regenerative heat exchanger.	MCR display verifies the following: 1) CVCS RCS discharge to process sampling isolation valve closed. [ITAAC 02.07.02]
14. Verify each CVCS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each CVCS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
33.02.XX System Level Tests **33.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify proper operation of the automatic PZR level control.	This test is performed in conjunction with Turbine Generator System Test 29.02.01, which heats the RCS from ambient conditions to no less than 345°F but as high as reasonably achievable. 1) Place PZR level control in automatic operation during RCS heatup to demonstrate automatic letdown. Use the MCS data historian to review PZR level at maximum-obtained RCS temperature. 2) To raise PZR level, use MCS automation and operator permission to increase to a target PZR level. Note: PZR letdown level control is automatic; however, PZR makeup level control is automatic with consent of operator.	1) MCS data indicate that automatic PZR letdown maintained PZR level at setpoint as described in Section 9.3.4. 2) MCS data indicate that the PZR level control results in CVCS makeup to the RCS to increase PZR level to the target setpoint as described in Section 9.3.4.

Table 14.2-33: Test # 33 Chemical and Volume Control System (Continued)

33.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify proper operation of the automatic PZR pressure control. 2. Verify no dynamic effects caused by changes in fluid flow.	This test is performed in conjunction with Turbine Generator System Test 29.02.01, which heats the RCS from ambient conditions to no less than 345°F but as high as reasonably achievable. 1) Place PZR pressure control in automatic and raise pressure setpoint to the normal operating band. 2) Raise PZR pressure to the PZR spray valve open setpoint. Use the MCS data historian to review PZR pressure at maximum-obtained RCS temperature.	1) MCS data indicate automatic PZR heater operation raised PZR pressure to the setpoint as described in Section 9.3.4. 2) MCS data indicate automatic PZR spray valve operation lowered PZR pressure to the spray valve closure setpoint as described in Section 9.3.4. 3) Water hammer indications: a. Audible indications of water hammer are not observed. b. No damage to pipe supports or restraints. c. No damage to equipment. d. No equipment leakage
33.02.03.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify proper operation of CVCS automatic dilution and boration control.	This test is performed in conjunction with Turbine Generator System Test 29.02.01, which heats the RCS from ambient conditions to no less than 345°F but as high as reasonably achievable. Ensure that RCS low flow rate alarm is clear to ensure adequate mixing for dilution and boration. 1) Place the BAS storage tank on recirculation and sample boron concentration. 2) Use the MCS automation and operator permission to decrease to a target RCS boron concentration. 3) Use the MCS and operator. Permission to increase to a target RCS boron concentration.	1) BAS storage tank sample boron concentration is within specifications (as described in Section 9.3.4). 2) MCS data indicate that the dilution of the RCS results in a decreased boron concentration within acceptable limits of the target concentration as described in Section 9.3.4. 3) MCS data indicate that the boration of the RCS results in a increased boron concentration within acceptable limits of the target concentration as described in Section 9.3.4.

Table 14.2-34: Test # 34 Boron Addition System

Preoperational test is required to be performed for each NPM.		
The BAS is described in Section 9.3.4. The BAS function verified by this test is:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The BAS supports the PCWS by providing borated water to the RXB pools.	nonsafety-related	34.02.01
The BAS function verified by other test is:		
System Function	**System Function Categorization**	**Function Verified by Test #**
2. The BAS supports the CVCS by providing uniformly mixed borated water on demand.	nonsafety-related	33.02.03
34.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify a pump curve test is completed and approved for the BAS pumps.		
34.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each BAS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each BAS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each BAS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify the BAS transfer pump can be started and stopped remotely.	Align the BAS to allow for pump operation. 1) Start and stop the transfer pump from the MCR.	1) MCR display and local, visual observation indicate the pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
05. Verify the BAS supply pump can be started and stopped remotely.	Align the BAS to allow for pump operation. 1) Start and stop the supply pump from the MCR.	1) MCR display and local, visual observation indicate the pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
06. Verify the speed of the BAS variable-speed pumps can be manually controlled.	Align the BAS to provide a flow path to operate a selected pump. 1) Vary the BAS pump speed from minimum to maximum from the MCR.	1) MCR display indicates the speed of each pump obtains both minimum and maximum pump speeds. Audible and visible water hammer are not observed when the pump starts.
07. Verify a local grab sample can be obtained from a BAS grab sample device.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is successfully obtained.

Table 14.2-34: Test # 34 Boron Addition System (Continued)

08. Verify each BAS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each BAS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
34.02.XX System Level Test		
34.02.01.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the BAS automatically adds a specified quantity of borated water from the BAS batch tank to the RXB pools.	1) Verify the BAS batch tank contains a sufficient volume of water to conduct this test. 2) Align the BAS and the PCWS to supply water from the BAS to the PCWS pump suction. 3) Enter a BAS batch tank target level to terminate batch operation to the spent fuel pool.	MCR displays and local, visual observation verifies the following: 1) The BAS to PCWS valve initially opens to supply water from the BAS to the PCWS. 2) The BAS to PCWS valve automatically closes when the BAS batch tank obtains the target level.

Table 14.2-35: Test # 35 Module Heatup System

Preoperational test is required to be performed for each NPM.		
The MHS is described in Section 9.3.4. MHS functions are not verified by MHS tests. MHS functions verified by other tests are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The MHS supports the CVCS by adding heat to primary coolant.	nonsafety-related	29.02.01
35.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
35.01.XX Component Level Tests		
01. Verify a local grab sample can be obtained from an MHS grab sample device.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is obtained.
02. Verify each MHS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each MHS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
35.02.XX System Level Tests		
None		

Table 14.2-36: Test # 36 Containment Evacuation System

Preoperational test is required to be performed for each NPM.		
The CES is described in Sections 9.3.6 and 5.2.5 and the functions verified by this test or another preoperational test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The CES supports the CNTS by removing water vapor from the containment vessel (CNV).	nonsafety-related	36.02.01 36.02.02 36.02.03
2. The CES supports the CNTS by condensing water vapor removed from the CNV in the CES condenser.	nonsafety-related	36.02.01 36.02.02 36.02.03
3. The CES supports the CNTS by removing non-condensable gases from the CNV.	nonsafety-related	36.02.01 36.02.02
4. The CES supports the RCS by providing RCS leak detection monitoring capability.	nonsafety-related	36.02.03
5. The GRWS supports the CES by receiving and collecting potentially radioactive and hydrogen-bearing waste gases that require processing before release to the environment.	nonsafety-related	36.02.02 31.02.01
36.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
36.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each CES remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each CES air-operated valve fails to its safe position on loss of air.	Place each CES valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each CES air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each CES valve in its non-safe position. 1) Isolate electrical power to each CES air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each CES pump can be started and stopped remotely.	1) Start and stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops.
05. Verify the speed of each CES variable-speed pump can be manually controlled.	1) Vary the speed of each pump from the MCR and local control panel (if design has local pump control).	1) MCR display indicates pump speed varies from minimum to maximum pump speed.
06. Verify each CES pump automatically stops to protect plant equipment.	Place a pump in operation. 1) Initiate a real or simulated signal for each pump trip condition.	1) MCR displays and local, visual observation verifies the pump stops.
07. Verify each CES pump suction and discharge valve automatically closes to protect the CES equipment.	Open the pump suction and discharge valves. 1) Initiate a real or simulated signal for each valve close conditions.	1) Each pump suction and discharge valve closes on each real or simulated valve close condition.

Table 14.2-36: Test # 36 Containment Evacuation System (Continued)

08. Verify a local grab sample can be obtained from a CES grab sample device indicated on the CES piping and instrumentation diagram.	1) Place the system in service to allow flow through the grab sampling device.	1) A local grab sample is successfully obtained.
09. Verify each CES instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each CES transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
36.02.XX System Level Tests **36.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the automatic operation of the CES to establish and maintain design vacuum for the CNV.	1) After the CFDS completes draindown of the CNV and the NPM is in hot functional testing, place the CES in automatic operation.	1) The automated control establishes and maintains vacuum in the CNV within design limit per Section 6.2.2.
36.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify radiation isolation and flow diversion on high radiation level in the CES.	The NPM is in hot functional testing with the RCS at normal operating pressure. The CES is operating in automatic control with a CNV steady-state vacuum pressure indicating the noncondensable gases have been removed from the CNV. 1) Initiate a real or simulated high radiation signal for the CES vacuum pump discharge. 2) Initiate a simulated high area radiation signal for the GRWS charcoal bed cubicle to the individual valve being tested.	1) a. The CES effluent flow path to the RBVS is isolated and diverted to GRWS. b. The CES effluent to process sample panel isolation valve is closed. c. The CES purge air solenoid valves to the vacuum pumps are closed. [ITAAC 02.07.01] (Items 1a through 1c) d. The automated control maintains vacuum in the CNV. 2) The CES to GRWS vapor condenser isolation valve is closed. [ITAAC 02.07.01]

Table 14.2-36: Test # 36 Containment Evacuation System (Continued)

36.02.03.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the CES level instrumentation supports RCS leakage detection. 2. Verify the CES pressure instrumentation supports RCS leakage detection.	1) The NPM is in hot functional testing with the RCS at normal operating pressure and the maximum operating temperature achievable by heating the RCS with the MHS. 2) The CES is operating in automatic control with a CNV steady-state vacuum pressure indicating the noncondensable gasses have been removed from the CNV. 3) Record the MCS baseline leakage rate into the CNV. 4) Isolate the CFDS to CNTS spool piece to allow test equipment to be connected to the spool piece. 5) Inject water at a flow rate less than or equal to one gpm. This test may be done in conjunction with Test 36.02.02.	1) The CES detects a level increase in the CES sample tank, which correlates to a detection of an unidentified RCS leakage rate of one gpm within one hour, by providing an alarm signal to the MCR within one hour of the start of water injection into the CNV indicating the baseline leakage rate has been exceeded. [ITAAC 02.03.01] 2) The CES detects a pressure increase in the inlet pressure instrumentation that correlates to a detection of an unidentified RCS leakage rate of one gpm within one hour, by providing an alarm signal to the MCR within one hour of the start of water injection into the CNV indicating the baseline leakage rate has been exceeded. [ITAAC 02.03.02]

Table 14.2-37: Test # 37 Containment Flooding and Drain

Preoperational test component level testing is required to be performed once. System level testing is required to be performed as indicated for each system level test.		
The CFDS is described in Section 9.3.7 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The CFDS supports the CNTS by flooding the CNV in preparation for refueling operations.	nonsafety-related	37.02.02
2. The CFDS supports the CNTS by draining the CNV in preparation for startup operations.	nonsafety-related	37.02.01
The CFDS function verified by another test is:		
3. The CFDS supports the RCS by providing borated coolant inventory for the removal of core heat during a beyond-design-basis accident.	nonsafety-related	56.02.08
37.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
37.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each CFDS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each CFDS air-operated valve fails to its safe position on loss of air.	Place each CFDS valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
03. Verify each CFDS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each CFDS valve in its non-safe position. 1) Isolate electrical power to each CFDS air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each CFDS pump can be started and stopped remotely.	1) Start and stop each pump from the MCR.	1) MCR display and local, visual observation indicate each pump starts and stops. Audible and visible water hammer are not observed when the pump starts.
05. Verify each CFDS pump automatically stops to protect plant equipment.	Place a pump in operation. 1) Initiate a real or simulated signal for each pump trip condition.	1) MCR displays and local, visual observation verifies the pump stops.
06. Verify each CFDS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each CFDS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.

Table 14.2-37: Test # 37 Containment Flooding and Drain (Continued)

37.02.XX System Level Tests 37.02.01.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the CFDS can automatically drain the CNTS.	1) Drain the CNTS using CFDS automatic operation and designed manual operation.	1) The CNTS is drained using CFDS automatic controls. (This test is required to be performed for each NPM.)
37.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the CFDS can automatically flood the CNTS.	1) Flood the CNTS using CFDS automatic operation and designed manual operation.	1) The CNTS is flooded using CFDS automatic controls. (This test is required to be performed for each NPM.)
37.02.03.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the CFDS automatically responds to mitigate a release of radioactivity.	1) While the CFDS is draining the CNTS, initiate a real or simulated high radiation signal on the gaseous effluent of the CFDS containment drain separator tank.	1) The CFDS containment drain separator gaseous discharge to RBVS isolation valve is closed. [ITAAC 03.09.05]

Table 14.2-38: Test # 38 Containment System

Preoperational test is required to be performed for each NPM.		
The CNTS is described in Section 6.2 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The CNTS supports the RXB by providing a barrier to contain mass, energy, and fission product release from a degradation of the reactor coolant pressure boundary.	safety-related	38.02.01 38.02.02
2. The CNTS supports the ECCS operations by providing a sealed containment.	safety-related	38.02.01
3. The ECCS supports CNTS by providing a portion of the containment boundary for maintaining containment integrity.	safety-related	38.02.01
The CNTS functions verified by other tests are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
4. The CNTS supports the DHRS by closing CIVs for the MSS and FWS when actuated by the MPS for DHRS operation.	safety-related	56.02.04
5. The CNTS supports the RCS by closing the CIVs for PZR spray, RCS injection, RCS discharge, and reactor pressure vessel (RPV) high point degasification when actuated by the MPS for RCS isolation.	safety-related	56.02.04
6. The CNTS supports the RXB by providing a barrier to contain mass, energy, and fission product release by closure of the CIVs upon a containment isolation signal.	safety-related	56.02.04
7. The CNTS supports the Reactor Building crane (RBC) by providing lifting attachment points that the RBC can connect to so that the module can be lifted.	nonsafety-related, risk-significant	45.02.01 45.02.02
8. The CNTS supports the MPS by providing PAM nonsafety-related information signals.	nonsafety-related	59.02.02

Table 14.2-38: Test # 38 Containment System (Continued)

38.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
38.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each hydraulic skid supplies sufficient pressure for valve operation.	1) Verify each hydraulic skid supplies sufficient pressure for valve operation.	1) Pump maintains required system pressure.
02. Verify each CNTS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each CNTS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
38.02.XX System Level Tests **38.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the leak tightness of the CNTS.	1) Perform 10 CFR Part 50, Appendix J local leak rate tests (Type B and Type C tests) of the CNTS in accordance with the guidance provided in ANSI/ANS 56.8, RG 1.163, and NEI 94-01.	1) Local leak rate tests are completed on containment penetrations listed in Table 6.2-4 that require Appendix J, Type B or C testing. [ITAAC 02.01.07]
38.02.02. **Test 38.02.02 is performed at hot functional conditions.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the CNTS safety-related check valves change position under design temperature, differential pressure, and flow.	1) The check valves are tested in accordance with the requirements of ASME OM code, ISTC-5220, check valves.	1) Each CNTS safety-related check valve strokes fully open and closed under forward and reverse flow conditions, respectively. [ITAAC 02.01.21]

Table 14.2-39: Test # 39 Reactor Coolant System

Preoperational test is required to be performed for each NPM.		
The RCS is described in Section 5.4 and the RCS functions verified by other tests are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The RCS supports the MPS by providing instrument information signals for MPS actuation.	safety-related, risk-significant	56.02.01
2. The RCS supports the MPS by providing instrument information signals for low temperature overpressure protection (LTOP) actuation.	safety-related	56.02.01
3. The RCS supports the MPS by providing PAM instrument information signals.	nonsafety-related	59.02.02
39.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
39.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each RCS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each RCS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
39.02.XX System Level Tests		
None		

Table 14.2-40: Test # 40 Emergency Core Cooling System

Preoperational test is required to be performed for each NPM. System Level Test 40.02.01 is only required to be performed once for the first NPM tested. This test supports FOAK testing as described in Section 14.2.3.3.		
The ECCS is described in Section 6.3, and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The ECCS supports the RCS by opening the ECCS reactor vent valves (RVVs) and reactor recirculation valves (RRVs) when their respective trip valve is actuated by the MPS.	safety-related	40.02.01 56.02.02
2. The ECCS supports the RCS by providing recirculated coolant from the containment to the RPV for the removal of core heat.	safety-related	40.02.01 56.02.02
The ECCS functions verified by other tests are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
3. The ECCS supports the RCS by providing LTOP for maintaining the reactor coolant pressure boundary.	safety-related	56.02.02
4. The ECCS supports the CNTS by providing a portion of the containment boundary for maintaining containment integrity.	safety-related	38.02.01
5. The ECCS supports MPS by providing PAM instrument information signals.	nonsafety related	59.02.01
40.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
40.01.XX Component Level Tests		
None		

Table 14.2-40: Test # 40 Emergency Core Cooling System (Continued)

40.02.XX System Level Test **40.02.01.** **Test 40.02.01 is performed at hot functional testing to allow ECCS actuation at elevated RCS pressure and temperature conditions, starting just above the inadvertent actuation block (IAB).**		
The RCS is heated to the highest temperature achievable by MHS heating. These hot functional testing conditions provide the highest temperature conditions that can be achieved before fuel load. The RCS level is within the expected range of module operation, near the low end of the normal operating range for hot zero power (HZP) conditions. This test can be performed concurrently with Test 56.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify ECCS RRC valves open below high RCS pressure IAB setpoint. 2. Verify the RPV liquid level remains above the top of the core during and following ECCS actuation. 3. Verify the heat removal capacity of the ECCS, operating with the CNV, is consistent with the design basis.	1) Ensure RCS pressure is as close to, but above, the IAB RCS pressure threshold as practicable. 2) Ensure RCS temperature is at the maximum temperature achievable by heating the RCS using MHS heating. 3) Ensure RCS level is as low in the normal operating band as is practically achievable for the established plant conditions. 4) Manually initiate ECCS from the MCR. 5) Allow RPV riser level and CNV level to become relatively stable.	1) ECCS RRVs open below IAB setpoint. 2) RPV riser level remains above the top of the core. 3) CNV pressure remains within upper and lower bounds calculated using safety analysis methods, while accounting for test initial conditions and instrumentation uncertainty. [ITAAC 02.01.14] [ITAAC 02.01.19]

Table 14.2-41: Test # 41 Decay Heat Removal System

Preoperational test is required to be performed for each NPM. System Test 41.02.01 is required to be performed once for the first NPM tested. This test supports FOAK testing described in Section 14.2.3.3.		
The DHRS is described in Section 5.4.3. FOAK 41.02.01 is described in Section 5.4.3. DHRS functions are not verified by DHRS tests. DHRS functions verified by other tests are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The DHRS supports the RCS by opening the DHRS actuation valves for DHRS operation.	safety-related	56.02.04 98.03.01
2. The DHRS supports the MPS by providing MPS actuation instrument information signals.	safety-related	56.02.01
3. The DHRS supports the MPS by providing PAM instrument information signals.	nonsafety-related	59.02.02
4. The UHS supports the DHRS by accepting the heat from the DHRS heat exchanger.	safety-related	98.03.01
41.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
41.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each DHRS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each DHRS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
41.02.XX System Level Test **41.02.01.** **RCS is at normal operating pressure and the RCS has achieved the maximum temperature achievable by warming the RCS using MHS heating.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify DHRS removes heat from the RCS.	1) Verify RCS is at normal operating pressure and the RCS has achieved the maximum temperature achievable by warming the RCS using MHS heating. 2) Open DHRS actuation valves and close containment isolation valves by initiating a containment isolation via MPS. 3) Allow the RCS to cool down less than 345 degrees. 4) Compare RCS cooldown rate to test analysis conducted using the code of record as described in Section 5.4.3.	1) DHRS cooldown of RCS meets design-basis requirements.

Table 14.2-42: Test # 42 In-Core Instrumentation System

Preoperational test is required to be performed for each NPM.		
The in-core instrumentation system (ICIS) is described in Section 7.0.4 and the function verified by this test and power ascension testing is:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The ICIS supports the MPS by providing reactor core system (RXCS) temperature information.	nonsafety-related	42.02.01 87.03.01
The ICIS functions verified by another test is:		
System Function	**System Function Categorization**	**Function Verified by Test #**
2. The ICIS supports the MPS by providing PAM instrument information signals.	nonsafety-related	59.02.02
42.00.XX Prerequisites 01. The ICIS instrument strings are inserted into the core. 02. Verify an instrument calibration is performed on all ICIS thermocouples by cross-calibrating the thermocouple to the RCS narrow range resistance temperature detectors (RTDs) before RCS heatup.		
42.01.XX Component Level Tests		
None		
42.02.XX System Level Test **42.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify proper temperature indication is obtained from the ICIS thermocouples.	1) Heat the RCS from ambient conditions to the maximum RCS temperature that can be obtained by the MHS. 2) Use the MCS data historian to cross-check the ICIS thermocouples to each other and the RCS narrow-range and wide range RTDs.	1) MCS data indicate that the ICIS thermocouples respond properly.

Table 14.2-43: Test # 43 Module Assembly Equipment

Preoperational test is required to be performed once.		
The module assembly equipment (MAE) consists of module import trolley, the upender, and the inspection rack.		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. MAE supports the NPM actively by providing material handling to allow its transport in the horizontal orientation to travel from outside the RXB to its interior and to rotate it to operational orientation.	nonsafety-related	component-level tests
43.00.XX Prerequisites 01.An MAE factory acceptance test (FAT) is successfully completed and approved, if required.		
43.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify the operation of MAE controls that limit motion and speed. (This test may be performed as part of SAT.)	1) Actuate or simulate actuation of the interlocks.	1) The MAE equipment controls limit motion and speed per design.
43.02.XX System-Level Tests		
None		

Table 14.2-44: Test # 44 Fuel Handling Equipment

Preoperational test is required to be performed once.		
The fuel handling equipment (FHE) system is described in Section 9.1.4 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The FHE system supports new fuel by providing ability to visually inspect fuel.	nonsafety-related	44.02.01 44.02.02
2. The FHE system supports the RXCS by moving fuel within the core.	nonsafety-related	44.02.03 44.02.04
3. The FHE system supports the spent fuel storage system by moving fuel into the spent fuel storage system.	nonsafety-related	44.02.04
44.00.XX Prerequisites 01.An FHE system FAT is successfully completed and approved. 02. A rated-load test is successfully completed and approved on the FHE system on the following equipment in accordance with ASME NOG-1 paragraph 7423. a. Fuel handling machine (FHM) main hoist b. FHM auxiliary hoists 03. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
44.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify the operation of FHE controls that limit motion and speed.	1) Actuate or simulate actuation of the interlocks.	1) The FHE equipment controls limit motion and speed per design.
02. Verify each FHE instrument is available on an MCS or PCS display if the FHE instrument is designed to be displayed on an MCR workstation. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each FHE system transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
44.02.XX System Level Tests **44.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the proper operation of the new fuel jib crane.	1) Transfer a dummy fuel assembly from its receipt shipping container to the new fuel inspection stand and from the new fuel inspection stand to the new fuel elevator.	1) A dummy fuel assembly is successfully transferred to the new fuel inspection stand. 2) A dummy fuel assembly is successfully transferred to the new fuel elevator.
44.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the proper operation of the new fuel elevator.	1) Lower a dummy fuel assembly in the new fuel elevator.	1) A dummy fuel assembly is successfully lowered to the position where it can be retrieved by the FHM mast.

Table 14.2-44: Test # 44 Fuel Handling Equipment (Continued)

44.02.03.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the proper operation of the FHM.	1) Transfer the dummy fuel assembly from the new fuel elevator to the FHM mast. 2) Transfer the dummy fuel assembly from the new fuel elevator location to a designated RXCS location. 3) Seat the dummy fuel assembly.	1) The dummy fuel assembly is successfully transferred to the FHM mast. 2) The dummy fuel assembly is successfully transferred to its designated core location and partially inserted. 3) The dummy fuel assembly is fully seated.
44.02.04.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the proper operation of the FHM.	1) Withdraw the dummy fuel assembly to a position where the FHM can automatically transfer the assembly. 2) Transfer the dummy fuel assembly from the RXCS to a designated spent fuel storage location. (Manual operation of the fuel assembly is required for final fuel insertion.) 3) Seat the dummy fuel assembly.	1) The dummy fuel assembly is successfully transferred to its designated storage location and partially inserted. 2) The dummy fuel assembly is fully seated.
44.02.05.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the FHM maintains at least 10 feet of water above the top of the fuel assembly when lifted to its maximum height with the pool level at the lower limit of the normal operating low water level.	1) Perform a test of the FHM mast mechanical stop limit switch.	1) The FHM maintains at least 10 feet of water above the top of the fuel assembly when lifted to its maximum height with the pool level at the lower limit of the normal operating low water level. [ITAAC 03.04.05]
44.02.06.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. The new fuel jib crane hook movement is limited to prevent carrying a fuel assembly over the fuel storage racks in the spent fuel pool.	1) Using the new fuel jib crane hook attempt to transfer a dummy fuel assembly or new fuel assembly over the fuel storage racks in the spent fuel pool.	1) The new fuel jib crane interlocks prevent the crane from carrying a fuel assembly over the spent fuel racks. [ITAAC 03.04.06]

Table 14.2-45: Test # 45 Reactor Building Cranes

Preoperational test is required to be performed once unless otherwise noted in the test.		
The RBC system is described in Section 9.1.5 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The RBC supports the NPM by providing structural support and mobility while moving from refueling, inspection and operating bay.	nonsafety-related, risk-significant	45.02.01 45.02.02
2. The MAE bolting supports the CNTS by providing material handling to allow for disassembly and reassembly of the CNV lower flange.	nonsafety-related	45.02.02
3. The MAE bolting supports the RPV actively by providing material handling to allow for disassembly and reassembly of the RPV lower flange.	nonsafety-related	45.02.02
4. The CNTS supports the RBC by providing lifting attachment points that the RBC can connect to so that the module can be lifted.	nonsafety-related, risk-significant	45.02.01 45.02.02
45.00.XX Prerequisites 01.An RBC site acceptance test is completed and approved. 02. A rated-load test is completed and approved on the RBC on the NPM top support structure in accordance with ASME NOG-1 paragraph 7423. a. RBC main hoist b. RBC auxiliary hoists c. RBC wet hoist 03. A rated-load test is completed and approved on the NPM top support structure in accordance with ANSI N14.6. 04. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
45.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify RBC controls that limit RBC motion and speed.	1) Actuate or simulate actuation of the RBC interlocks.	1) Local visual observation indicates that the interlocks limit RBC motion and speed.
02. Verify RBC remains in current position on loss of control or power or seismic event.	Initiate the following real or simulated signals: 1) Loss of control. 2) Loss of power. 3) Seismic switch actuation.	1) Local visual observation indicates that the bridge, trolley, main hoist, wet hoist, auxiliary hoist trolley and auxiliary hoist brakes are set.
03. Verify each RBC instrument is available on an MCS or PCS display if the RBC instrument is designed to be displayed on an MCR workstation. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each RBC system transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.

Table 14.2-45: Test # 45 Reactor Building Cranes (Continued)

45.02.XX System Level Tests	45.02.01.	
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify RBC load path and removal of an NPM from a reactor bay. 2. Verify RBC load path and installation of an NPM in a reactor bay.	Place the lower block assembly on the RBC. Lift an NPM and move the RBC with the attached NPM to its design home location. 1) Use the RBC semi-automatic programmed controls to install the NPM in the lead NPM bay location and return the RBC to the design home location. 2) Use the RBC semi-automatic programmed controls to retrieve the NPM from the lead NPM bay location and return the RBC with attached module to the design home location. Repeat this sequence for each NPM installation.	1) The bridge and trolley speeds do not exceed maximum design speeds. 2) The bridge and trolley does not move at the same time. 3) The bridge and trolley maximum allowable speed is toggled from full-speed to microspeed when the RBC hook gets within the design distance of a predefined reference location. 4) The main hoist only moves within the predefined elevation zones. 5) The NPM is positioned at the design rotation at predefined reference locations. 6) The NPM is fully seated in the reactor bay receiver. (Acceptance Criteria (1) through (4) only need to be satisfied for the first performance of the test. Acceptance Criteria (5) and (6) need to be satisfied for each NPM.

Table 14.2-45: Test # 45 Reactor Building Cranes (Continued)

45.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. a. Verify the NPM can be disassembled using the CNV support stand and the RPV support stand and associated tooling. b. Verify the RBC semi-automatic controls can be used to transport the NPM through the disassembly process. 2. a. Verify the NPM can be assembled using the CNV support stand and the RPV support stand and associated tooling. b. Verify the RBC semi-automatic controls can be used to transport the NPM through the assembly process.	The RBC is at the design home location with an NPM attached to the lower block assembly. 1) Use the RBC semi-automatic programmed controls to move the NPM from the design home location to the CNV support stand and seat the NPM lower CNV in the CNV support stand. De-tension and remove the lower CNV closure bolts. Use the RBC semi-automatic programmed controls to move the NPM from the CNV support stand to the RPV support stand and seat the NPM in the RPV support stand. De-tension and remove the lower RPV closure bolts. Use the RBC semi-automatic programmed controls to move the upper NPM from the RPV support stand to the module inspection rack and seat the upper NPM on the module inspection rack support lug receiving pockets. Use the RBC semi-automatic programmed controls to disengage the lower block assembly from the upper NPM and move the RBC and lower block assembly from the module inspection rack to the design home location.	1) a. The NPM is disassembled using the CNV support stand and the RPV support stand and associated tooling. b. The RBC semi-automatic controls are used to transport the NPM through the disassembly process. 2) a. The NPM is assembled using the CNV support stand and the RPV support stand and associated tooling. b. The RBC semi-automatic controls are used to transport the NPM through the assembly process.

Table 14.2-45: Test # 45 Reactor Building Cranes (Continued)

	2) Use the RBC semi-automatic programmed controls to move the NPM and lower block assembly from the design home location to the module inspection rack and attach the upper NPM to the lower block assembly. Use the RBC semi-automatic programmed controls to move the upper NPM from the module inspection rack to the RPV support stand and seat the upper NPM on the lower RPV and RPV support stand. Install and tension the lower RPV closure bolts. Use the RBC semi-automatic programmed controls to move the upper NPM from the RPV support stand to the CNV support stand and seat the upper NPM on the lower CNV and CNV support stand. Install and tension the lower CNV closure bolts. Use the RBC semi-automatic programmed controls move the RBC and NPM from the CNV support stand to the design home location.	

Table 14.2-46: Test # 46 Process Sampling System

Preoperational test is required to be performed for each NPM.		
The PSS is described in Section 9.3.2 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The PSS supports the RCS during normal operations by providing sampling and analysis of reactor coolant discharge (letdown) liquid.	nonsafety-related	46.02.01
2. The PSS supports the CVCS by providing sampling of reactor coolant at process points in the CVCS.	nonsafety-related	46.02.01
3. The PSS supports the CNTS during normal operations by providing sampling of containment gas and analysis of hydrogen and oxygen concentration in containment.	nonsafety-related	46.02.02
4. The PSS supports the FWS by providing sampling and analysis of condensate and FW.	nonsafety-related	46.02.03
5. The PSS supports the MSS by providing sampling and analysis of MS.	nonsafety-related	46.02.03
6. PSS supports the CNTS during accident condition by providing containment atmosphere monitoring and analysis of hydrogen and oxygen concentration to respond to emergencies.	nonsafety-related	46.02.02
46.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
46.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each PSS remotely-operated valve can be operated remotely.	1) Operate each valve from the MCR and local control panel (if design has local valve control).	1) MCR display and local, visual observation indicate each valve fully opens and fully closes.
02. Verify each PSS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. 1) Isolate and vent air to the valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.

Table 14.2-46: Test # 46 Process Sampling System (Continued)

03. Verify each PSS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. 1) Isolate electrical power to each air-operated valve.	1) MCR display and local, visual observation indicate each valve fails to its safe position.
04. Verify each PSS return pump to CVCS can be started and stopped locally.	Align the PSS and CVCS to allow for return pump operation. 1) Start and stop each return pump locally.	1) Local display and local, visual observation indicate each return pump starts and stops. Audible and visible water hammer are not observed when each return pump starts.
05. Verify each PSS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each PSS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
46.02.XX System Level Tests **46.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify sampling capability of the primary sampling points.	1) The NPM is in hot functional testing with the RCS at normal operating pressure and the maximum operating temperature achievable by heating the RCS with the MHS. The RCS supply and discharge flow is in service. Align the CVCS and PSS to provide continuous sampling flow to the PSS analysis panel. 2) The RCS discharge line is in service. Align the RCS and PSS to provide sampling flow to the primary sampling ion chromatography units. 3) Open the PSS grab sample panel manual valve to obtain an RCS injection flow pressurized grab sample. 4) Open the PSS grab sample panel manual valve to obtain an RCS discharge flow pressurized grab sample. 5) Open the PSS grab sample panel manual valve to obtain a CVCS demineralizer discharge flow pressurized grab sample.	1) The PSS analysis panel instruments provide indication of the water analysis. 2) The primary sampling ion chromatography unit monitors for the programmed ion. 3) An RCS injection flow grab sample is successfully obtained. 4) An RCS discharge flow grab sample is successfully obtained. 5) A CVCS demineralizer discharge flow grab sample is successfully obtained.

Table 14.2-46: Test # 46 Process Sampling System (Continued)

46.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify sampling capability of the containment sampling points.	The NPM is in hot functional testing with the RCS at normal operating pressure and the maximum operating temperature achievable by heating the RCS with the MHS. The CES is in service. 1) Align the CES and PSS to provide continuous sampling flow to the PSS containment gas sample panel.	1) The PSS containment gas sample panel instruments provide indication of the gas analysis.
46.02.03.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify sampling capability of the secondary sampling points.	1) The NPM is in hot functional testing with the RCS at normal operating pressure and the maximum operating temperature achievable by heating the RCS with the MHS. The FWS and MSS are in service. Align the FWS, MSS, and PSS to provide continuous sampling flow to the PSS secondary sampling system FW and MS sample panel. 2) Open the manual FW and MS ion chromatography analysis panel valve to obtain a FW to SG sample. 3) Open the manual FW and MS ion chromatography analysis panel valve to obtain an SG #1 steam sample. 4) Open the manual FW and MS ion chromatography analysis panel valve to obtain an SG #2 steam sample. 5) Open the manual FW and MS ion chromatography analysis panel valve to obtain a condensate pump discharge sample.	1) The PSS secondary sampling system FW and MS sample panel instruments provide indication of the water and steam analysis. 2) The FW and MS ion chromatography analysis panel monitors the programmed ion. 3) The FW and MS ion chromatography analysis panel monitors the programmed ion. 4) The FW and MS ion chromatography analysis panel monitors the programmed ion. 5) The FW and MS ion chromatography analysis panel monitors the programmed ion.

Table 14.2-47: Test # 47 High Voltage AC Electrical Distribution System

Preoperational test is required to be performed once.		
The EHVS is described in Section 8.3.1, and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The EHVS supports the EMVS by providing electrical power.	nonsafety-related	Component level tests
2. The EHVS supports the TGS by providing electrical protection and control.	nonsafety-related	Component level tests
3. The EHVS supports the offsite transmission system by providing electrical power during normal operation and configuration management of utility.	nonsafety-related	Component level tests
47.00.XX Prerequisites 01. Verify an instrument calibration is performed on all EHVS instruments that provide information signals to the PCS for the bus and main power transformer under test. 02. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 03. Verify all protective devices associated with the EHVS bus and main power transformer under test are tested before that bus is energized, and approved test records indicate each protective device is calibrated within its required test interval.		
47.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each EHVS breaker can be operated locally.	1) Operate each breaker from the local control panel while the breaker is in the test position.	1) MCR display and local, visual observation indicate each breaker opens and closes.
02. Verify each EHVS breaker can be operated remotely.	1) Operate each breaker from the MCR while the breaker is in the test position.	1) MCR display and local, visual observation indicate each breaker opens and closes.
03. Verify each EHVS breaker trips on its fault conditions.	1) Simulate each fault condition for a breaker when the breaker is in the test position.	1) MCR display and local, visual observation indicate each breaker opens on each fault condition.
04. Verify each EHVS bus can be powered by offsite power via its main power transformer. (Test not required if an offsite power system is not provided.)	1) Energize each EHVS bus from its main power transformer.	1) Bus voltage is within design limits.
05. Verify each EHVS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each EHVS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or recorded by the applicable control system historian.
47.02.XX System Level Tests		
None		

Table 14.2-48: Test # 48 Medium Voltage AC Electrical Distribution System

Preoperational test is required to be performed once. The testing of each EMVS bus that provides power to 00 loads (common system loads) is performed with the EMVS loads of the first NPM in power operation.		
The EMVS is described in Section 8.3.1 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The EMVS supports the low voltage AC electrical distribution system by providing electrical power.	nonsafety-related	component-level tests
2. The EMVS supports the CHWS by providing electrical power to loads.	nonsafety-related	component-level tests
3. The EMVS supports the SCWS by providing electrical power to loads.	nonsafety-related	component-level tests
48.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify all protective devices associated with the EMVS bus and modular unit auxiliary transformer under test are tested before that bus is energized. Approved test records indicate each protective device is calibrated within its required test interval.		
48.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each EMVS breaker can be operated locally.	1) Operate each breaker from the local control panel while the breaker is in the test position.	1) MCR display and local, visual observation indicate each breaker opens and closes.
02. Verify each EMVS breaker can be operated remotely.	1) Operate each breaker from the MCR while the breaker is in the test position.	1) MCR display and local, visual observation indicate each breaker opens and closes.
03. Verify each EMVS breaker trips on its fault conditions.	1) Simulate each fault condition for a breaker when the breaker is in the test position.	1) MCR display and local, visual observation indicate each breaker opens on each fault condition.
04. a. Verify each EMVS bus can be powered via its modular unit auxiliary transformer. b. Verify each EMVS bus can be powered via an adjacent bus. (Test not required if an offsite power system is not provided.)	1) a. Energize each EMVS bus from its modular unit auxiliary transformer. b. Energize each EMVS bus from an adjacent EMVS bus.	1) Bus voltage is within design limits.
05. Verify each EMVS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each EMVS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or recorded by the applicable control system historian.
06. Verify the automatic transfer of each EMVS bus to each adjacent EMVS bus.	1) Simulate all conditions that require an automatic bus transfer to an adjacent bus. Repeat for each adjacent EMVS bus. This test may be performed with the EMVS bus energized or deenergized.	1) MCR display and local, visual observation indicate the required tie breaker from the adjacent bus closes.
48.02.XX System Level Tests		
None		

Table 14.2-49: Test # 49 Low Voltage AC Electrical Distribution System

Preoperational test is required to be performed in support of the testing of each NPM. The testing of each ELVS bus that provides power to common system loads is performed with the first NPM tested.		
The ELVS is described in Section 8.3.1, and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The ELVS provides AC power to system loads via ELVS buses.	nonsafety-related	component-level tests
49.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify all protective devices associated with the ELVS bus and station service transformer under test are tested before that bus is energized.		
49.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each ELVS breaker can be operated locally.	1) Operate each breaker from the local control panel while the breaker is in the test position.	1) MCR display and local, visual observation indicate each breaker opens and closes.
02. Verify each ELVS breaker can be operated remotely.	1) Operate each breaker from the MCR while the breaker is in the test position.	1) MCR display and local, visual observation indicate each breaker opens and closes.
03. Verify each ELVS breaker trips on its fault conditions.	1) Simulate each fault condition for a breaker when the breaker is in the test position.	1) MCR display and local, visual observation indicate each breaker opens on each fault condition.
04. Verify each ELVS bus can be powered by offsite power via its station service transformer. (Test not required if an offsite power system is not provided.)	1) Energize each ELVS bus from its station service transformer.	1) Bus voltage is within design limits.
05. Verify automatic bus transfer of each ELVS bus.	Perform the following test for each of the ELVS buses. 1) Open the ELVS supply breaker to a given ELVS bus.	1) The associated ELVS bus tie breaker closes.
06. Verify each ELVS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each ELVS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or recorded by the applicable control system historian.
49.02.XX System Level Tests		
None		

Table 14.2-50: Test # 50 Augmented DC Power System

Component level tests are required to be performed for each NPM, and once for the augmented DC power system (EDAS) common channels. **System Level Test 50.02.01 and Test 50.02.02 are required to be performed once. System Level Test 50.02.01 and Test 50.02.02 may be performed concurrently.** **System Level Test 50.02.03 is required to be performed once for each NPM.**		
The EDAS is described in Sections 8.1.2, 8.1.3 and 8.3.2, and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The EDAS supports the following systems by providing DC electrical power. • MPS • NMS • RMS • plant lighting system (PLS) • PPS • SDIS	nonsafety-related	All functions are verified by component-level tests. System level tests provide additional verification as follows: 50.02.01 50.02.02 50.02.03
EDAS system functions verified by other tests are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
2. EDAS supports the MPS by providing EDAS module-specific operating parameter information signals.	nonsafety-related	59.01.07
3. EDAS supports the PPS by providing EDAS common operating parameter information signals.	nonsafety-related	59.01.03
50.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify a valve-regulated lead-acid battery acceptance tests is performed on all EDAS batteries to confirm battery capacity in accordance with Institue of Electrical and Electronics Engineers Standard 1188 Sections 6 and 7. 03. Verify battery charger performance testing is completed by the manufacturer or a site acceptance test is completed in accordance with manufacturer instructions.		
50.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each EDAS bus can be powered by its associated battery.	1) Configure the EDAS battery and battery charger(s) associated with an EDAS bus such that the battery is the only source of power to the bus. Repeat the test for the remaining EDAS channels.	1) EDAS bus voltage is within design limits.
02. Verify each EDAS bus can be powered by its associated battery charger(s). (Test may be performed as part of SAT.)	1) Configure the EDAS battery and battery charger(s) associated with an EDAS bus such that a battery charger is the only source of power to the bus. 2) Repeat the test if the bus has a standby battery charger. Repeat the test for the remaining EDAS channels.	1) EDAS bus voltage is within design limits.

Table 14.2-50: Test # 50 Augmented DC Power System (Continued)

03. Verify each EDAS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each EDAS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or recorded by the applicable control system historian.
50.02.XX System Level Tests		
50.02.01.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the EDAS common buses provide independent power to the MCR emergency lighting. (RG 1.41 Independence Test)	1) With both EDAS common buses energized and providing power to MCR emergency lighting, de-energize the EDAS Division I common bus. 2) With both EDAS common buses energized and providing power to MCR emergency lighting, de-energize the EDAS Division II common bus.	1) The MCR lighting designed to be powered by the EDAS Division I common bus is de-energized, and the MCR emergency lighting designed to be powered by the EDAS Division II common bus is energized. 2) The MCR emergency lighting designed to be powered by the EDAS Division II common bus is de-energized, and the MCR emergency lighting designed to be powered by the EDAS Division I common bus is energized.
50.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the EDAS common buses provide independent power to all SDIS MCR displays. (RG 1.41 Independence Test)	1) With EDAS Division I and Division II common buses energized verify power is available in the MCR for all SDIS displays. 2) De-energize the EDAS Division I common bus. 3) Re-energize the EDAS Division I common bus and de-energize the EDAS Division II common bus.	1) Power is available in the MCR for SDIS displays. 2) a. Power is not available in the MCR for SDIS Division I displays. b. Power is available in the MCR for SDIS Division II displays. 3) a. Power is not available in the MCR for SDIS Division II displays. b. Power is available in the MCR for SDIS Division I displays.

Table 14.2-50: Test # 50 Augmented DC Power System (Continued)

50.02.03.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify EDAS module-specific channels provide independent and redundant power to the ECCS trip valve solenoids and PAM Type B and C variables. (RG 1.41 Independence Test)	1) With all EDAS module-specific channels de-energized for the NPM under test, energize EDAS module-specific channel A. 2) With all EDAS module-specific channels de-energized for the NPM under test, energize EDAS module-specific channel C. 3) With all EDAS module-specific channels de-energized for the NPM under test, energize EDAS module-specific channel B. 4) With all EDAS module-specific channels de-energized for the NPM under test, energize EDAS Module -specific channel D.	1) Power is available to the Division I ECCS trip valve solenoids. 2) a. Power is available to the Division I ECCS trip valve solenoids. b. All PAM Type B and C variables shown on Figure 7.1-2 are displayed on an SDIS display for the NPM under test. 3) a. Power is available to the Division II ECCS trip valve solenoids. b. All PAM Type B and C variables shown on Figure 7.1-2 are displayed on an SDIS display for the NPM under test. 4) Power is available to the Division II ECCS trip valve solenoids.

Table 14.2-51: Test # 51 Normal DC Power System

Component-level tests 51.01.01 through 51.01.18 are required to be performed for the first NPM. **Component-level test 51.01.19 is required to be performed once per normal DC power system (EDNS) subsystem.** **Component-level battery, battery charger, and inverter tests may be completed as part of SAT.**		
EDNS is described in Section Section 8.1.3 and Section 8.3.2 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The EDNS supports the following systems by providing DC electrical power. • EHVS • EMVS • ELVS • TGS	nonsafety-related	Functions verified by prerequisite and component level tests.
2. The EDNS supports the following systems by providing AC electrical power. • communication system (COMS) • FDS • FPS • RMS • meteorological and environmental monitoring system • MCS • PCS • plant-wide video monitoring system • RBVS • seismic monitoring system (SMS) • TBVS	nonsafety-related	Functions verified by prerequisite and component-level tests.
51.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify a valve-regulated lead-acid battery acceptance tests is performed on all EDNS batteries to confirm battery capacity in accordance with Institue of Electrical and Electronics Engineers Standard 1188 Sections 6 and 7. 03. Verify battery charger performance testing is completed by the manufacturer or a site acceptance test is completed in accordance with manufacturer instructions. 04. Verify inverter performance testing is completed by the manufacturer or a site acceptance test is completed in accordance with manufacturer instructions.		
51.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each EDNS RXB subsystem DC bus can be powered by its associated battery.	1) Configure the battery and battery charger associated with one of the EDNS RXB subsystems such that the battery is the only source of power to its associated DC bus. Repeat the test for the other EDNS RXB subsystem.	1) EDNS DC bus voltage is within design limits.

Table 14.2-51: Test # 51 Normal DC Power System (Continued)

02. Verify each EDNS RXB subsystem DC bus can be powered by its associated battery charger.	1) Configure the battery and battery charger associated with one of the EDNS RXB subsystems such that the battery charger is the only source of power to its associated DC bus. Repeat the test for the other EDNS RXB subsystem.	1) EDNS DC bus voltage is within design limits.
03. Verify each EDNS RXB subsystem AC bus can be powered by its associated inverter.	1) Energize the AC bus of one of the EDNS RXB subsystems from the inverter source of its associated inverter. Repeat the test for the other EDNS RXB subsystem.	1) EDNS AC bus voltage is within design limits.
04. Verify each EDNS RXB subsystem AC bus can be powered by its associated voltage regulating transformer.	1) Energize the AC bus of one of the EDNS RXB subsystems from the voltage regulating transformer source of its associated inverter. Repeat the test for the other EDNS RXB subsystem.	1) EDNS AC bus voltage is within design limits.
05. Verify the EDNS CRB subsystem DC bus can be powered by its associated battery.	1) Configure the battery and battery charger associated with the EDNS CRB subsystem such that the battery is the only source of power to its associated DC bus.	1) EDNS DC bus voltage is within design limits.
06. Verify the EDNS CRB subsystem DC bus can be powered by its associated battery charger.	1) Configure the battery and battery charger associated with the EDNS CRB subsystem such that the battery charger is the only source of power to its associated DC bus.	1) EDNS DC bus voltage is within design limits.
07. Verify each EDNS CRB subsystem AC bus can be powered by its associated inverter.	1) Energize the EDNS CRB subsystem AC bus from the inverter source of its associated inverter.	1) EDNS AC bus voltage is within design limits.
08. Verify each EDNS CRB subsystem AC bus can be powered by its associated voltage regulating transformer.	1) Energize the EDNS CRB subsystem AC bus from the voltage regulating transformer source of its associated inverter.	1) EDNS AC bus voltage is within design limits.
09. Verify the EDNS RWB subsystem DC bus can be powered by its associated battery.	1) Configure the battery and battery charger associated with the EDNS RWB subsystem such that the battery is the only source of power to its associated DC bus.	1) EDNS DC bus voltage is within design limits.
10. Verify the EDNS RWB subsystem DC bus can be powered by its associated battery charger.	1) Configure the battery and battery charger associated with the EDNS RWB subsystem such that the battery charger is the only source of power to its associated DC bus.	1) EDNS DC bus voltage is within design limits.
11. Verify each EDNS RWB subsystem AC bus can be powered by its associated inverter.	1) Energize the EDNS RWB subsystem AC bus from the inverter source of its associated inverter.	1) EDNS AC bus voltage is within design limits.
12. Verify each EDNS RWB subsystem AC bus can be powered by its associated voltage regulating transformer.	1) Energize the EDNS RWB subsystem AC bus from the voltage regulating transformer source of its associated inverter.	1) EDNS AC bus voltage is within design limits.

Table 14.2-51: Test # 51 Normal DC Power System (Continued)

13. Verify each EDNS PDC subsystem DC bus can be powered by its associated battery.	1) Configure the battery and battery charger associated with the EDNS PDC subsystems such that the battery is the only source of power to its associated DC bus. Repeat the test for all buses of EHV PDC, EMV PDC, and ELV PDC.	1) EDNS DC bus voltage is within design limits.
14. Verify each EDNS PDC subsystem DC bus can be powered by its associated battery charger.	1) Configure the battery and battery Charger associated with the EDNS PDC subsystem such that the battery charger is the only source of power to its associated DC bus. 2) Repeat the test for the swing battery charger if the bus has a swing battery charger. Repeat the test for all buses of EHV PDC, EMV PDC, and ELV PDC.	1) EDNS DC bus voltage is within design limits.
15. Verify each EDNS PDC subsystem AC bus can be powered by its associated inverter.	1) Energize the EDNS PDC subsystem AC bus from the inverter source of its associated inverter. Repeat the test for all buses of EHV PDC, EMV PDC, and ELV PDC.	1) EDNS AC bus voltage is within design limits.
16. Verify each EDNS PDC subsystem AC bus can be powered by its associated voltage regulating transformer.	1) Energize the EDNS PDC subsystem AC bus from the voltage regulating transformer source of its associated inverter. Repeat the test for all buses of EHV PDC, EMV PDC, and ELV PDC.	1) EDNS AC bus voltage is within design limits.
17. Verify each EDNS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display)	1) Initiate a single real or simulated instrument signal from each EDNS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or recorded by the applicable control system historian.
51.02.XX System Level Tests		
None		

Table 14.2-52: Test # 52 Backup Power Supply System

Preoperational test is required to be performed once.		
The BPSS is described in Section 8.3.1, and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The BPSS supports EMVS by providing diesel generator backup electrical power.	nonsafety-related	52.02.01
52.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. 02. Verify all protective devices associated with the BPSS diesel generators have been tested before performing this test.		
52.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each BPSS breaker can be operated locally.	1) Operate each breaker from the local control panel while the breaker is in the test position.	1) MCR display and local, visual observation indicate each breaker opens and closes.
02. Verify each BPSS breaker can be operated remotely.	1) Operate each breaker from the MCR while the breaker is in the test position.	1) MCR display and local, visual observation indicate each breaker opens and closes.
03. Verify the BPSS diesel generators can be started and stopped locally and remotely.	Align the BPSS to allow for diesel generator operation. 1) Start and stop the diesel generator from the MCR. 2) Start and stop the diesel generator locally. Repeat the test for the other diesel generator.	1) MCR display and local, visual observation indicate the diesel generator started and stopped. 2) MCR display and local, visual observation indicate the diesel generator started and stopped.
04. Verify the BPSS diesel generator day tank fuel oil transfer pumps automatically maintain day tank levels.	Align a fuel oil transfer pump to provide oil to its associated day tank. 1) Simulate a low level in the day tank. Repeat the test for each day tank fuel oil transfer pump.	1) MCR display and local, visual observation indicate the transfer pump starts and then stops when day tank level reaches the high level setpoint.
05. Verify each BPSS instrument is available on an MCS or PCS display. (Test not required if the instrument calibration verified the MCS or PCS display.)	1) Initiate a single real or simulated instrument signal from each BPSS transmitter.	1) The instrument signal is displayed on an MCS or PCS display, or recorded by the applicable control system historian.
52.02.XX System Level Tests **52.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify BPSS diesel generator automatically starts and achieves rated voltage and frequency.	Align the BPSS to allow for diesel generator operation. 1) Initiate a real or simulated loss of power signal.	1) MCR display and local, visual observation indicate the diesel generator started and achieved rated voltage and frequency.

Table 14.2-53: Test # 53 Plant Lighting System

Preoperational test is required to be performed once.		
The PLS is described in Section 9.5.3 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. PLS supports the CRB by providing normal lighting.	nonsafety-related	53.01.01
2. The PLS supports the CRB by providing emergency lighting in the MCR.	nonsafety-related	53.01.02
3. The PLS supports the RXB by providing normal lighting.	nonsafety-related	53.01.01
4. The PLS supports the RXB by providing emergency lighting for post-fire safe-shutdown activities outside of the MCR and RSS.	nonsafety-related	53.01.03
53.00.XX Prerequisites **N/A** **(Note: Component level test 53.01.03. supports ITAAC and the requirements of NFPA 804.)**		
53.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify the PLS provides normal illumination of the MCR operator workstations, and the MCR safety display information panel.	1) With normal MCR lighting in service, measure the light at each MCR workstation.	1) a. The PLS provides lighting levels for a computer-based control room specified in NUREG-0700, Revision 3.
02. The PLS provides emergency illumination of the MCR operator workstations and the MCR safety display information panel.	1) With MCR emergency illumination in service, measure the light at each MCR workstation and MCR safety display information panel.	1) a. The PLS provides at least 10 foot-candles of illumination at the MCR operator workstations and the MCR safety display information panel. [ITAAC 03.08.02]
03. Verify the eight-hour battery pack emergency lighting fixtures provide illumination for post-fire safe-shutdown activities performed by operators outside the MCR.	1) With no AC power available, measure the light at each eight-hour battery pack emergency lighting fixture target area.	1) The required target areas are illuminated to provide at least one foot-candle illumination in the areas outside the MCR where post-fire safe-shutdown activities are performed. [ITAAC 03.08.01]
53.02.XX System Level Tests		
None		

Table 14.2-54: Test # 54 Module Control System

Preoperational test is required to be performed as indicated by tests for MCS-controlled systems and systems providing data to the MCS.
The MCS is described in Section 7.0.4.
On-site testing of the system is performed by module control system SAT. The MCS is a distributed control system that allows monitoring and control of NPM-specific plant components. The MCS includes all manual controls and visual display units necessary to provide operator interaction with the process control mechanism. The boundary of the MCS is at the terminations on the MCS hardware. The MCS supplies nonsafety inputs to the human-system interfaces for nonsafety displays in the MCR and other locations where MCS human-system interfaces are necessary. There are two boundaries between MCS and MPS, the fiber-optic isolated portion and the hard-wired module boundary. The MCS has a direct, bi-directional interface with the PCS. A complete staging and testing of system hardware and software configurations is conducted. This FAT is conducted in accordance with a written test procedure for testing the software and hardware of the MCS before installation in the plant. Following installation, SAT must be completed in accordance with developed procedures to ensure the MCS is installed and fully functional as designed. To ensure the MCS communicates with module-specific plant components, component-level testing is performed on all systems controlled by MCS to manually operate the associated components from the MCR. These component-level tests are described in the test abstracts of the systems that contain the actuated components. In addition, it is verified that each instrument supplying data to the MCS is component tested in preoperational test abstracts to ensure the signal is available on an MCS or PCS display. These component-level tests are described in the test abstracts of the systems that contain the instrument.
54.00.XX Prerequisites 01. Prerequisites associated with MCS testing are identified in the test abstracts that contain module-specific components that ensure communication with the MCS.
54.01.XX Component Level Tests
None
54.02.XX System Level Tests
None

Table 14.2-55: Test # 55 Plant Control System

Preoperational test is required to be performed as indicated by tests for PCS-controlled systems and systems providing data to the PCS.
The PCS is described in Section 7.0.4.
On-site testing of the system is performed by PCS SAT. The PCS is a distributed control system that allows monitoring and control of virtually all module-specific plant components. The PCS includes all manual controls and video display units (VDUs) necessary to provide operator interaction with the process control mechanism. The boundary of the PCS is at the terminations on the PCS hardware. The PCS supplies nonsafety inputs to the VDUs for nonsafety displays in the MCR, and other locations where PCS video display units are necessary. The boundary between the PPS and PCS is at the output connection of the safety-related optical isolators in the PPS, and on the terminals of the equipment interface module for each input from the PCS to the PPS. The PCS has a direct, bi-directional interface with the MCS. The network interface devices for the PCS domain controller and historian provide the interface between the human machine interface network layer and the control network layer. A complete staging and testing of system hardware and software configurations is conducted. This FAT is conducted in accordance with a written test procedure for testing the software and hardware of the PCS before installation in the plant. Following installation, SAT must be completed in accordance with developed procedures to ensure the PCS is installed and fully functional as designed. To ensure the PCS communicates with module-specific plant components, component-level testing is performed on all systems controlled by PCS to manually operate the associated components from the MCR. These component-level tests are described in the test abstracts of the systems that contain the actuated components. In addition, it is verified that each instrument supplying data to the PCS is component tested in preoperational test abstracts to ensure the signal is available on an MCS or PCS display. These component-level tests are described in the test abstracts of the systems that contain the instrument.
55.00.XX Prerequisites 01. Prerequisites associated with PCS testing are identified in the test abstracts that contain module-specific components that ensure communication with or are controlled by the PCS.
55.01.XX Component Level Tests
None
55.02.XX System Level Tests
None

Table 14.2-56: Test # 56 Module Protection System

Preoperational test is required to be performed for each NPM.		
The MPS is described in Sections 7.0, 7.1, and 7.2 and the functions verified by this test and power ascension testing are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The MPS supports the CNTS by removing electrical power to the trip solenoids of the following CIVs on a CNTS isolation actuation signal: • RCS injection CIVs • RCS discharge CIVs • PZR spray CIVs • RPV high point degasification CIVs • Feedwater isolation valves (FWIVs) • Main steam isolation valves (MSIVs) • Main steam isolation bypass valves (MSIBV) • Containment evacuation system CIVs • Reactor component cooling water system CIVs • CFDS CIVs	safety-related	56.02.04
2. The MPS supports the CNTS by removing electrical power to the trip solenoids of the following valves on a DHRS actuation signal. • MSIVs • MSIBV • FWIVs	safety-related	56.02.04
3. The MPS supports the ECCS by removing electrical power to the trip solenoids of the following valves on an ECCS actuation signal. • RVVs • RRVs	safety-related	56.02.04
4. The MPS supports the CNTS by removing electrical power to the trip solenoids of the following CIVs on a CVCS isolation actuation signal: • RCS injection CIVs • RCS discharge CIVs • PZR spray CIVs • RPV high point degasification CIVs	safety-related	56.02.04
5. The MPS supports the CVCS by removing electrical power to the trip solenoids of the DWS supply isolation valves on a DWS isolation actuation signal.	safety-related	56.02.04

Table 14.2-56: Test # 56 Module Protection System (Continued)

6. The MPS supports the ECCS by removing electrical power to the trip solenoids of the reactor vent valves on an LTOP actuation signal.	safety-related	56.02.04
7. The MPS supports the ELVS by removing electrical power to the PZR heaters on a PZR heater trip actuation signal.	safety-related	56.02.06
8. The MPS supports the ELVS by removing electrical power to the CRDS for a reactor trip.	safety-related	56.02.06
9. The DHRS supports the RCS by opening the DHRS actuation valves on a DHRS actuation signal for DHRS operation.	safety-related	56.02.04
10. The CNTS supports the DHRS by closing CIVs for the MS and FW systems when actuated by the MPS.	safety-related	56.02.04
11. The CNTS supports the RCS by closing the CIVs for PZR spray, RCS injection, RCS letdown, and RPV high point degasification when actuated by the MPS.	safety-related	56.02.04
12. The CNTS supports the RXB by providing a barrier to contain mass, energy, and fission product release by closure of the CIVs upon a containment isolation signal.	safety-related	56.02.04
13. The ECCS supports the RCS by opening the ECCS RVVs and RRVs when their respective trip valve is actuated by the MPS.	safety-related	56.02.02
14. The ECCS supports the RCS by providing recirculated coolant from the containment to the RPV for the removal of core heat.	safety-related	56.02.02
15. The ECCS supports the RCS by providing LTOP for maintaining the reactor coolant pressure boundary.	safety-related	56.02.02
16. The CVCS supports the RCS by isolating dilution sources.	safety-related	56.02.04
17. The FWS supports the CNTS by providing secondary isolation of the FW lines.	nonsafety-related	56.02.04
18. The MSS supports the CNTS by providing secondary isolation of the MS lines.	nonsafety-related	56.02.04
19. The FWS supports the DHRS by providing secondary isolation of the FW lines, ensuring required boundary conditions for DHRS operation.	nonsafety-related	56.02.04

Table 14.2-56: Test # 56 Module Protection System (Continued)

20. The NMS supports the MPS by providing neutron flux data for various reactor trips.	safety-related	56.02.01 86.03.01
21. ECCS supports MPS by providing instrumentation information signals.	nonsafety-related	56.02.01
22. The DHRS supports the MPS by providing MPS actuation instrument information signals.	safety-related	56.02.01
23. The RCS supports the MPS by providing instrument information signals.	nonsafety-related	56.02.01
24. The RCS supports the MPS by providing instrument information signals for LTOP actuation.	safety-related	56.02.01
25. The MPS supports the DHRS by removing electrical power to the trip solenoids of the DHRS actuation valves on a DHRS actuation signal.	safety-related	56.02.04
26. The MPS supports the CNTS by providing power to sensors.	safety-related	56.02.01
27. The MPS supports the DHRS by providing power to sensors.	safety-related	56.02.01
28. The MPS supports the RCS by providing power to sensors.	safety-related	56.02.01
56.00.XX Prerequisite 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
56.01.XX Component Level Tests		
None		
56.02.XX System Level Tests **56.02.01.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify the instrument signals of MPS monitored variables are displayed in the MCR.	Table 7.1-2 lists all of sensors that input to MPS. This test may be performed concurrently with SDIS test 59.02.02 for PAM Type B and Type C testing described in Section 14.2.12 1) Inject a single signal as close as practicable for each sensor listed in Table 7.1-2 and monitor its response on an MCR workstation and the module-specific safety display instrument panel (if designed for safety display instrument display). If the sensor signal is designed to be disconnected when the NPM is moved then it is necessary to test the signal from the sensor to the disconnect and then from the disconnect to the MCR display.	1) Each MPS monitored signal is displayed on an MCR workstation and the module-specific safety display instrument panel (if designed for safety display instrument display).

Table 14.2-56: Test # 56 Module Protection System (Continued)

56.02.02.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify each ECCS reactor vent valve and reactor recirculation valve operates to satisfy its ESF-actuated design stroke time. 2. Verify the MPS can manually actuate ESF equipment from the MCR. 3. Verify deliberate operator action is required to return the ESF actuated equipment to its non-actuated position.	This test verifes the stroke time of each RRV and RVV and verifes ECCS engineered safety feature actuation capability from the MCR by actuating the valves with RCS pressure below the IAB low RCS pressure threshold. 1) Verify all RVVs and RRVs are closed. 2) Initiate a manual ECCS engineered safety feature actuation signal from the MCR. 3) a. Attempt to operate ECCS from the MCR. b. Remove the manual ESF actuation signal and attempt to operate ECCS from the MCR. c. Use the MCR enable nonsafety control switch to allow operation of ECCS from the MCR. Repeat for LTOP engineered safety feature actuation	1) Each ECCS reactor recirculation valve and reactor vent valve travels from fully closed to fully open in less than or equal to the time specified in TS. 2) The MPS actuates the ESF equipment to perform its safety-related function as described in Table 7.1.4. [ITAAC 02.01.14] [ITAAC 02.01.19] [ITAAC 02.05.06] [ITAAC 02.05.07] [ITAAC 02.05.08] 3) a. ECCS cannot be operated from the MCR. b. ECCS cannot be operated from the MCR. c. ECCS can be operated from the MCR. [ITAAC 02.01.14] [ITAAC 02.05.08]
56.02.03. **Test 56.02.03 is performed concurrently with Test 56.02.04, which operates all of the ESF actuation valves during hot functional testing.** **Test 56.02.03. records the stroke times of DHRS actuation valves as they travel to their ESF-actuated position with the RCS pressure at normal operating pressure.**		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify each DHRS actuation valve operates to satisfy its ESF-actuated design stroke time.	1) Time the operation of all DHRS actuation valves as they actuate to their ESF position during the manual ESF actuation testing in Test 56.02.04.	1) Each DHRS actuation valve travels from fully closed to fully open in less than or equal to the time specified in TS.

Table 14.2-56: Test # 56 Module Protection System (Continued)

56.02.04.
Test 56.02.04 is performed at hot functional testing concurrently with Turbine Generator System Test 29.02.01 to allow testing of ESF actuations at normal operating pressure and elevated temperatures. Test 29.02.01 heats the RCS from ambient conditions to the highest temperature achievable by MHS heating. These hot functional testing conditions provide the highest differential pressure and temperature conditions that can be achieved before fuel load.

Test Objective	Test Method	Acceptance Criteria
1. Verify the MPS can manually actuate ESF equipment from the MCR. 2. Verify deliberate operator action is required to return the ESF actuated equipment to its non-actuated position. 3. Verify no dynamic effects caused by changes in fluid flow.	Table 7.1-4 lists all of the ESF functions. The RCS is at normal operating pressure supplying bypass steam to the condenser. 1) Initiate a manual ESF actuation signal from the MCR. 2) a. Attempt to operate the actuated ESF equipment from the MCR. b. Remove the manual ESF actuation signal and attempt to operate the actuated ESF equipment from the MCR. c. Use the MCR enable nonsafety control switch to allow operation of the ESF actuated equipment from the MCR. Repeat as necessary to ensure the following ESF functions are tested: • DHRS • secondary system isolation • CNTS isolation • DWS isolation • CVCS isolation • PZR heater trip	1) The MPS actuates the ESF equipment to perform its safety-related function as described in Table 7.1-4. [ITAAC 02.01.13] [ITAAC 02.01.15] [ITAAC 02.01.18] [ITAAC 02.01.20] [ITAAC 02.05.06] [ITAAC 02.05.07] [ITAAC 02.05.08] 2) a. The actuated equipment cannot be operated from the MCR. b. The actuated equipment cannot be operated from the MCR. c. The ESF equipment can be operated from the MCR. [ITAAC 02.01.13] [ITAAC 02.01.15] [ITAAC 02.05.08] 3) a. Audible indications of water hammer are not observed. b. No damage to pipe supports or restraints. c. No damage to equipment. d. No equipment leakage.

56.02.05.
Test 56.02.05 is performed concurrently with Test 56.02.04, which operates all of the ESF actuation valves during hot functional testing.
Test 56.02.05 records the stroke times of CIVs as they travel to their ESF-actuated position with the RCS pressure at normal operating pressure.

Test Objective	Test Method	Acceptance Criteria
1. Verify the CIVs operate to satisfy their ESF-actuated design stroke time.	Table 6.2-4 contains the design closure time for containment isolation valves. 1) Time the operation of all CIVs as they actuate to their ESF position during the manual ESF actuation testing in 56.02.04.	1) Each CIV travels from fully open to fully closed in less than or equal to the time listed in Table 6.2-4 after receipt of a containment isolation signal. [ITAAC 02.01.08]

Table 14.2-56: Test # 56 Module Protection System (Continued)

56.02.06. **This test verifes the time response of MPS reactor trip and ESF actuation signals. The reactor trip test verifies response time through reactor trip breaker actuation. The ESF response time is tested through the de-energization of the associated solenoid valve or the opening of the PZR heater supply breaker.**		
Test Objective	**Test Method**	**Acceptance Criteria**
Verify the MPS response times from sensor output through: 1. Reactor trip breaker actuation for the reactor trip function. 2. De-energization of the associated solenoid valve for ESF-actuated valves. 3. Opening of the PZR heater supply breaker for the PZR heater trip.	Section 7.1.4 contains a description of design-basis event actuation delays assumed in the plant safety analysis and listed in Table 7.1-6. The actuation delays do not include ESF actuated component delays for actuated valves. 1) Perform a time response test for the actuation signals listed in Table 7.1-6.	1) The MPS reactor trip functions listed in Table 7.1-3 and ESF functions listed in Table 7.1-4 have response times that are less than or equal to the design-basis safety analysis response time assumptions in Table 7.1-6. [ITAAC 02.05.09]
56.02.07.		
Test Objective	**Test Method**	**Acceptance Criteria**
1. Verify MCR alarms when automatic operating bypasses are established. 2. Verify MCR alarms when manual operating bypasses are established. 3. Verify MPS maintenance bypasses are indicated in the MCR.	The purpose of this test is to verify MCR alarms, not to verify the logic of the operating bypasses. Any signal that establishes the bypass can be used. Table 7.1-5 contains a list of operating bypasses. 1) For automatically established operating bypasses perform the following: a. Simulate the logic required to establish the operating bypass. b. Remove the logic. c. Repeat for each automatically established operating bypass. 2) For manually established operating bypasses perform the following: a. Simulate the logic required to allow the operating bypass to be established. b. Manually establish the operating bypass. c. Repeat the logic. d. Repeat for each manually established operating bypass. 3) a. Place a safety function module (SFM) in maintenance bypass by using the out of service and trip/bypass switches associated with the SFM. b. Repeat tests for all SFMs.	1) Each automatic operating bypass is alarmed in the MCR. [ITAAC 02.05.10] 2) Each manual operating bypass is alarmed in the MCR. [ITAAC 02.05.10] 3) The inoperable status of the SFM is provided in the MCR. [ITAAC 02.05.11]

Table 14.2-57: Test # 57 Plant Protection System

Preoperational test is required to be performed once.		
The PPS is described in Section 7.0.4. The PPS functions are not verified by PPS tests. PPS functions verified by other tests are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The PPS supports the CRVS by providing actuation and control signals to the CRE isolation dampers.	nonsafety-related	15.02.01
2. The PPS supports the CRHS by providing actuation and control signals.	nonsafety-related	15.02.01
3. The PPS supports the CRVS by providing actuation and control signals to the outside air isolation dampers.	nonsafety-related	16.02.03
57.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and calibration due dates, for instruments required to perform this test.		
57.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each variable monitored by PPS is available on an MCS or PCS display.	1) Initiate a single real or simulated instrument signal from each transmitter monitored by PPS.	1) Each PPS variable is displayed on an MCS or PCS display, or is recorded by the applicable control system historian.
57.02.XX System Level Tests		
None		

Table 14.2-58: Test # 58 Neutron Monitoring System

Preoperational test is required to be performed for each NPM.		
The neutron monitoring system (NMS) is described in Section 7.0.4. NMS functions are not verified by NMS tests. NMS functions verified by other tests are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The NMS supports the MPS by providing neutron flux data for various reactor trips.	safety-related	56.02.01 86.03.01
2. The NMS supports the MPS by providing information signals for PAM.	nonsafety-related	59.02.02
3. The NMS supports the MPS by providing information signals for PAM during containment vessel flooded conditions.	nonsafety-related	59.02.02
58.00.XX Prerequisites 01. Prerequisites associated with NMS testing are identified in the referenced test abstract cited under the "Function Verified by Test #" heading.		
58.01.XX Component Level Tests		
None		
58.02.XX System Level Tests		
None		

Table 14.2-59: Test # 59 Safety Display and Indication System

Component-level testing for the module-specific SDIS is required to be performed for each NPM. Component-level testing for the common SDIS is required to be performed once. Test 59.02.01 System-level testing for the module-specific SDIS is required to be performed for each NPM to verify proper trending of RCS pressure and temperature. Test 59.02.02 System-level testing for the module-specific SDIS is required to be performed for each NPM to verify PAM variables are displayed and alarms retrieved.		
SDIS is described in Section 7.0.4 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The SDIS actively supports the CRB by providing the MCR accident monitoring plant conditions.	nonsafety-related	Module-specific SDIS component-level tests Common SDIS component-level tests 59.02.01 59.02.02
2. The SDIS actively supports the PCS by providing plant status and indication data to the plant data historian.	nonsafety-related	Module-specific SDIS component-level tests Common SDIS component-level tests 59.02.01 59.02.02
3. The ICIS supports the MPS by providing RXCS temperature information.	nonsafety-related	59.02.02
4. The ECCS supports MPS by providing PAM instrument information signals.	nonsafety-related	59.02.02
5. The RCS supports the MPS by providing PAM instrument information signals.	nonsafety-related	59.02.02
6. The CNTS supports the MPS by providing PAM information signals.	nonsafety-related	59.02.02
7. The RMS supports the RXB by monitoring radiation levels in the building in proximity of the bioshield.	nonsafety-related	59.02.02
8. The NMS supports the MPS by providing information signals for PAM.	nonsafety-related	59.02.02
9. The NMS supports the MPS by providing information signals for PAM during containment vessel flooded conditions.	nonsafety-related	59.02.02
10. The decay heat removal system supports the MPS by providing PAM instrument information signals.	nonsafety-related	59.02.02
11. The EDAS supports the PPS by providing common EDAS operating parameter information signals.	nonsafety-related	59.01.03
12. The EDAS supports the MPS by providing module-specific EDAS operating parameter information signals.	nonsafety-related	59.01.07

Table 14.2-59: Test # 59 Safety Display and Indication System (Continued)

59.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test. Note: Testing of PAM Type B and Type C displays and alarms is performed in 59.02.01. Note: Testing of NPM level, pressure, and temperature and flow instruments is performed in 59.02.02.		
59.01.XX **Component Level Tests: Common SDIS Test**		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify the proper valve position indication for each valve that provides input to the PPS.	1) Open and close each valve monitored by PPS.	1) The valve opens and closes as indicated by a common SDIS display and an MCR workstation display.
02. Verify radiation monitor indication is obtained in the MCR for each radiation monitor that provides input to the PPS.	1) Provide a simulated signal for each radiation monitor monitored by PPS.	1) The radiation signal is displayed by a common SDIS display and an MCR workstation.
03. Verify EDAS and ELVS voltage indication is obtained in the MCR for voltmeters that provide input to the PPS.	1) Provide a simulated signal for each EDAS and ELVS voltmeter monitored by PPS.	1) The voltage signal is displayed by a common SDIS display and an MCR workstation.
04. Verify instrument indication is obtained in the MCR for instruments that provide input to the PPS.	1) Provide a simulated signal for each instrument monitored by PPS.	1) The instrument signal is displayed by a common SDIS display and an MCR workstation.
Component Level Tests: Module Specific SDI Test		
Test Objective	**Test Method**	**Acceptance Criteria**
05. Verify the proper valve position indication for each ESF valves that provide input to MPS.	1) With the NPM assembled, open and close the valves listed in Table 7.1-2. 2) Provide a real or simulated signal for each reactor safety valve position (Table 7.1-2).	1) The valves open and close as indicated by a module-specific SDIS display and an MCR workstation display. 2) The valve opens and closes as indicated by a module-specific SDIS display and an MCR workstation display.
06. Verify radiation monitor indication is obtained in the MCR for each radiation monitor that provides input to the MPS.	1) Provide a simulated signal for each radiation monitor monitored by MPS listed in Table 7.1-2.	1) The radiation monitor signal is displayed by a module-specific SDIS display and an MCR workstation.
07. Verify EDAS and ELVS voltage indication is obtained in the MCR for each voltmeter that provide input to the MPS.	1) Provide a simulated signal for each EDAS and ELVS voltmeter monitored by MPS (Table 7.1-2).	1) The voltage signal is displayed by a module-specific SDIS display and an MCR workstation.
08. Verify neutron flux indication is obtained in the MCR for each radiation monitor that provides input to the MPS.	1) Provide a simulated signal for each neutron flux instrument monitored by MPS (Table 7.1-2).	1) The neutron flux signal is displayed by a module-specific SDIS display and an MCR workstation display.
09. Verify a neutron flux instrument fault indication is obtained in the MCR for each signal that provides input to the MPS.	1) Provide a simulated signal for each neutron flux instrument fault monitored by MPS (Table 7.1-2).	1) The neutron flux instrument fault is displayed by a module-specific SDIS display and an MCR workstation display.

Table 14.2-59: Test # 59 Safety Display and Indication System (Continued)

59.02.XX System Level Test

59.02.01.

Test 59.02.01 is conducted concurrently with Turbine Generator System Test 29.02.01, which warms the RCS from ambient conditions to the highest temperature achievable by MHS heating.

Test Objective	Test Method	Acceptance Criteria
1. Verify that the output signals from the NPM level, pressure, temperature, and flow instruments listed in Table 7.1-2 properly trend while increasing RCS temperature and pressure. Note: This is not a verification of instrument calibrations.	1) Increase RCS temperature from ambient to the highest temperature achievable by MHS heating. 2) Using the MCS, historian records the engineering values for the output of the instruments described in the test objective. Record data at approximately 50°F intervals from ambient temperature to the maximum RCS temperature. Note: Instrument signals are provided to the module-specific SDIS display and the MCR workstations.	1) All instruments track within acceptable design limits. (Use TS channel check limits, when applicable).

59.02.02.

Test Objective	Test Method	Acceptance Criteria
1. Verify PAM Type B and C variables are displayed on the module-specific SDIS displays in the MCR. 2. Verify alarms associated with PAM Type B and C variables are retrieved in the MCR. 3. Verify module-specific PAM Type D variables are displayed on the module-specific SDIS displays in the MCR.	1) Simulate an injection signal for the PAM Type B and C variables listed in Table 7.1-7. 2) Increase or decrease a simulated injection signal for the PAM Type B and C variables listed in Table 7.1-7 to obtain its associated alarm. 3) Simulate an injection signal for the PAM Type D variables listed in Table 7.1-7.	1) The PAM Type B and C variables listed in Table 7.1-7 are retrieved and displayed on the SDIS displays in the MCR. [ITAAC 02.05.13] 2) The alarms associated with the PAM Type B and C variables listed in Table 7.1-7 are retrieved and displayed on the SDIS displays in the MCR. 3) The PAM Type D variables listed in Table 7.1-7 are retrieved and displayed on the SDIS displays in the MCR.

Table 14.2-60: Test # 60 Fixed-Area Radiation Monitoring System

Preoperational test is required to be performed once.		
The fixed-area radiation monitoring system (RMS) is described in Section 12.3.4 and the function verified by this test is:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The RMS supports the following buildings by monitoring radiation levels: • ANB • CRB • RWB • TGB • RXB	nonsafety-related	Component-level test
RMS function verified by another test is:		
System Function	**System Function Categorization**	**Function Verified by Test #**
2. The RMS supports the RXB by monitoring radiation levels in the building in proximity of the bioshield.	nonsafety-related	59.02.02
60.00.XX Prerequisites 01. Verify an instrument calibration is completed, with approved records and within calibration due dates, for instruments required to perform this test.		
60.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify each fixed airborne radiation monitor's response to an alarm condition.	1) Actuate the check source on a fixed airborne radiation monitor listed in Table 12.3-9. Repeat test for the remainder of fixed airborne radiation monitors.	MCR display and local, visual observation indicate the following: 1) The MCR audible and visual alarms are received. 2) The local readout, audible alarm, and visual alarm are received.
02. Verify each fixed area radiation monitor's response to an alarm condition.	1) Actuate the check source on a fixed area radiation monitor listed in Table 12.3-10. Repeat test for the remainder of fixed area radiation monitors.	MCR display and local, visual observation indicate the following: 1) The MCR audible and visual alarms are received. 2) The local readout, audible alarm, and visual alarm are received.
60.02.XX System Level Tests		
None		

Table 14.2-61: Test # 61 Communication System

Preoperational test is required to be performed after construction turnover of the COMS.		
The COMS is described in Section 9.5.2 and the function verified by this test is:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The COMS supports the following locations by providing voice and data communications within the building and surrounding areas. • RXB • TGB • RWB • CRB • Security Buildings • ANB • Diesel Generator Building • Administrative and Training Building • CUB • Warehouse Building • Fire Water Building • Switchyard • Site plant cooling structures • Site water intake/discharge structure • Site utility rack structure	nonsafety-related	61.01.01 61.01.02 61.01.03 61.01.04
61.00.XX Prerequisites 01. Required communication system SAT have been completed and approved.		
61.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify the wide area mass notification system can be heard throughout the plant site.	Station test personnel in each required test area of the plant to monitor the wide area mass notification system. 1) Use the public address to provide a test announcement. 2) Use the general alarm system to provide a test alarm.	1) The test announcement is heard at each test site. 2) The test emergency alarm is heard at each test site.
02. Verify plant radio communications can be heard throughout the plant site.	1) Station test personnel in each required test area of the plant to communicate using plant radios.	1) The plant radio communication is obtained at each test site.
03. Verify wireless communication throughout the plant site.	1) Station test personnel in each required test area of the plant to communicate using voice and data communication.	1) The voice and data communication is obtained at each test site.
04. Verify the central alarm station is equipped with a conventional (landline) telephone service that can be used to communicate with the MCR and local law enforcement authorities.	1) Test the conventional (landline) service from the central alarm station to the MCR and local law enforcement authorities.	1) The conventional service connects with the MCR and the local law enforcement authorities. [ITAAC 03.16.11]

Table 14.2-61: Test # 61 Communication System (Continued)

05. Verify that plant radio communications maintains continuous communications among the central alarm station and on-duty watchmen, armed security officers, armed responders, or other security personnel who have responsibilities within the physical protection program and during contingency response events.	1) Test communications with the plant radio system in areas described in the physical protection program boundaries and areas described in the contingency response event areas.	1) The radios must provide continuous communications in all test areas. [ITAAC 03.16.12]
06. Verify all nonportable communication devices (including conventional telephone systems) in the central alarm station remain operable during the loss of normal power.	1) Remove normal power from the central alarm station nonportable communication devices.	1) The nonportable communication devices establish connections with the normal power removed. [ITAAC 03.16.13]
61.02.XX System Level Tests		
None		

Table 14.2-62: Test # 62 Seismic Monitoring System

The SMS is described in Section 3.7.4. COL Item 14.2-6: An applicant that references the NuScale Power Plant US460 standard design will provide a test abstract for the seismic monitoring system preoperational testing.		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. As described in Section 3.7.4.	nonsafety-related	Provided by applicant.
62.00.XX Prerequisites Provided by applicant.		
62.01.XX Component Level Tests		
Provided by applicant.		
62.02.XX System Level Tests		
Provided by applicant.		

Table 14.2-63: Test # 63 Hot Functional Testing

Preoperational testing is required to be performed once for each NPM.			
The following identifies the tests employed in support of the performance of hot functional testing.			
Hot Functional Testing Tests	**Test Objective**	**Verified by Test #**	**Tested Function Categorization**
1. CES	1) Verifies the automatic operation of the CES to establish and maintain design vacuum for the containment vessel. 2) Verify radiation isolation and flow diversion on high radiation level in the CES. 3) Verifies the CES supports RCS leakage detection.	1) 36.02.01 2) 36.02.02 3) 36.02.03	nonsafety-related
2. CNTS	1) Verifies each CNTS safety-related check valves open and close under preoperational conditions.	1) 38.02.02	safety-related
3. CVCS	1) Verifies CVCS automatic operation to maintain PZR level. 2) Verifies automatic PZR pressure control. 3) Verifies CVCS automatic boration and dilution of the RCS.	1) 33.02.01 2) 33.02.02 3) 33.02.03	nonsafety-related
4. ECCS	1) Each ECCS valve opens after receipt of an ESF signal and after RCS pressure is decreased to the threshold pressure for operation of the IAB	1) 40.02.01	safety-related
5. FW system	1) Verifies the FWS automatically controls flow to the SGs to maintain SG inventory. 2) Verifies the FWS automatically cools the turbine generator bypass steam flow in the MS desuperheater.	1) 29.02.01 2) 29.02.01	nonsafety-related
6. ICIS	1) Verifies proper temperature indication is obtained from the ICIS thermocouples.	1) 42.02.01	nonsafety-related
7. LRWS	1) Verifies the LRWS receives and processes a gaseous stream from the PZR.	1) 30.02.01	nonsafety-related

Table 14.2-63: Test # 63 Hot Functional Testing (Continued)

8. MHS	1) Verifies the MHS is capable of heating the RCS to a temperature sufficient to obtain criticality. 2) Verifies the MHS is capable of heating the RCS to establish natural circulation flow sufficient to obtain criticality. 3) Verifies a local grab sample can be obtained from an MHS grab sample device indicated on the MHS piping and instrumentation diagram.	1) 29.02.01 2) 29.02.01 3) 29.02.01	nonsafety-related
9. MPS	1) Verifies design responses to manual ESF signals. 2) Verifies containment isolation valves closure times.	1) 56.02.04 2) 56.02.05	safety-related
10. PPS	1) Verifies sampling capability of the primary sampling points. 2) Verifies sampling capability of the containment sampling points. 3) Verifies sampling capability of the secondary sampling points.	1) 46.02.01 2) 46.02.02 3) 46.02.03	nonsafety-related
11. SDIS	1) Verify that the output signals from the NPM level, pressure, temperature, and flow instruments listed in Table 7.1-2 properly trend while increasing RCS temperature and pressure.	1) 59.02.01	nonsafety-related
12. TGS	1) Verifies the TGS automatically controls turbine bypass flow to the main condenser. 2) Verify the maximum main turbine speed that can be obtained using the MHS to heat the RCS. 3) Verifies the ECCS valves close when the CVCS provides water to reset the ECCS valves.	1) 29.02.01 2) 29.02.01 3) 29.02.01	nonsafety-related

Table 14.2-63: Test # 63 Hot Functional Testing (Continued)

63.00.XX Prerequisites
Prerequisites associated with performing hot functional testing are identified in the referenced test abstract cited under the “Verified by Test #” heading.

Table 14.2-64: Test # 64 Module Assembly Equipment Bolting

Preoperational test is required to be performed once.		
The MAE is described in Section 9.1.5. MAE bolting functions are not verified by MAE bolting tests. MAE bolting functions verified by other tests are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The MAE bolting supports the CNTS actively by providing material handling to allow for disassembly and reassembly of the containment vessel lower flange.	nonsafety-related	45.02.01
2. The MAE bolting supports the RPV actively by providing material handling to allow for disassembly and reassembly of the RPV lower flange.	nonsafety-related	45.02.01
64.00.XX Prerequisites 01. Prerequisites associated with MAE bolting testing are identified in the referenced test abstract cited under the "Function Verified by Test #" heading.		
64.01.XX Component Level Tests		
None		
64.02.XX System-Level Tests		
None		

Table 14.2-65: Test # 65 Steam Generator Flow-Induced Vibration

This is a one-time test to be performed before loading fuel in the first ever NPM. There are no preoperational tests for the SG system.		
Validation testing is performed at test facilities as separate effects tests on prototypic SG tubes and functionally equivalent SG tube supports per Section 5.1 of TR-121354-P.		
The SG flow-induced vibration testing is performed consistent with the requirements of the NuScale CVAP as described in the "NuScale Comprehensive Vibration Assessment Program Analysis Technical Report," TR-121353-P, and the "NuScale Comprehensive Vibration Assessment Program Measurement and Inspection Plan Technical Report," TR-121354-P. The SG tube testing consists of in-air and in-water modal testing and primary side flow testing. The CVAP is addressed in Section 3.9.2. The SGs are discussed in Section 5.4.1.		
System Function	**System Function Categorization**	**Function Verified by Test #**
None	N/A	N/A
65.00.XX Prerequisites: N/A		
65.01.XX Component Level Tests		
None		
Acceptance Criteria: 1) The SG tube testing shows that fluid elastic instability and vortex shedding do not occur under primary side flow rates consistent with any operating condition, considering all applicable uncertainties and biases of this separate effects test. 2) The SG tube testing shows that for primary side flow rates consistent with 100 percent power operation, the SG tube vibration responses are less than those predicted with the turbulent buffeting analysis methodology.		

Table 14.2-66: Test # 66 Security Access Control

Preoperational test is required to be performed once.		
Security access control is described in "NuScale Design of Physical Security Systems," TR-118318.		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The security access controls support the security plan described in TR-118318.	security-related	Component level test 66.01.01
66.00.XX Prerequisites 01. Security access control boundary for the protected and vital areas, described in the security technical report, are established.		
66.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Verify an access control system with a numbered photo identification badge system that controls access to vital areas within the RXB and CRB to authorized personnel.	1) Use authorized and unauthorized identification badges in all vital area access points in the RXB and CRB identified in "NuScale Design of Physical Security Systems," TR-118318.	1) The access points do not allow access to unauthorized badges. 2) The access points allow authorized personnel. [ITAAC 03.16.04]
66.02.XX System Level Tests		
None		

Table 14.2-67: Test # 67 Security Detection and Alarm

Preoperational test is required to be performed once.		
Security detection and alarm is described in "NuScale Design of Physical Security Systems," TR-118318.		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The security detection and alarm system acts to satisfy the functional requirements described in TR-118318.	security-related	Component level tests 67.01.01 - 67.01.05
67.00.XX Prerequisites 01. Required security system SAT is completed and approved.		
67.01.XX Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
01. Unoccupied vital areas must be designed with locking devices and intrusion detection devices that annunciate in the central alarm station.	1) Access to all unoccupied vital areas that are identified in the TR-118318.	1) Verify the access door is locked. Upon entry into the room verify an intrusion alarm is received in the central alarm station. [ITAAC 03.16.05]
02. Security alarm devices including transmission lines to annunciators are tamper-indicating and self-checking.	1) Insert a signal real or simulated tamper signal. 2) Insert a signal real or simulated of a component failure for all alarm devices and transmission lines in the RXB and CRB. 3) Place all security alarm devices in the RXB and CRB on standby power.	1) Verify alarm annunciation is received in the central alarm station for each test method. The alarm must indicate the type and location of the alarm. [ITAAC 03.16.07]
03. Intrusion detection and assessment systems provides visual and audible alarm annunciation in the central alarm station.	1) Put all intrusion detection equipment described in TR-118318 into an alarm state.	1) Verify an audible and visual alarm is received in the central alarm station. [ITAAC 03.16.08]
04. Intrusion detection system recording equipment records onsite security alarm annunciation including false alarm, alarm check, and tamper indication and the type of alarm, location, alarm circuit, date, and time.	1) Place all intrusion detection equipment in the RXB and CRB in the following alarm conditions (as applicable to the equipment): a. False alarm b. Alarm check c. Tamper indication	1) Verify the intrusion detection system recording system records each alarm to include: a. Location of the alarm b. Type of alarm c. Alarm circuit d. Date e. Time (this test can be done in conjunction with audible and visual alarm testing) [ITAAC 03.16.09]
05. Emergency exits in the RXB and CRB must be alarmed with intrusion detection devices and secured by locking devices that allow prompt egress during an emergency.	1) Attempt to enter each the RXB and CRB exits. 2) Exit each of the RXB and CRB exits.	1) Verify the locking device prevents entry. 2) Verify the exit allows for prompt exit of the building and alarms in the central alarm station when opened. [ITAAC 03.16.10]
67.02.XX System Level Tests		
None		

Table 14.2-68: Test # 68 Initial Fuel Loading and Precritical

The Initial Fuel Loading Precritical Test is required to be performed for each NPM.
This test is performed after initial fuel loading but before initial criticality.
Test Objectives
1. Identify the sequence for precritical testing (after fuel load and before criticality). 2. The precritical tests are: a. RCS Flow Measurement 70.03.01 b. NPM Temperatures 71.03.01 c. Primary and Secondary System Chemistry 72.03.01 d. CRDS - Manual Operation, Rod Speed, and Rod Position Indication 73.03.01 e. Control Rod Assembly Full-Height Drop Time 74.03.01 f. Control Rod Assembly Ambient Temperature Full-Height Drop Time 75.03.01 g. Pressurizer Spray Bypass Flow 76.03.01
68.00.XX Prerequisites
None
68.03.01 Test Method
1. Identify the specific plant conditions required for each precritical test procedure to maintain TS operability. 2. Identify the prerequisites required for each precritical test procedure. 3. Determine the test sequence for precritical testing based on TS requirements and test prerequisites.
Acceptance Criterion
1. The sequence for precritical testing is determined.

Table 14.2-69: Test # 69 Initial Fuel Load

The Initial Fuel Load Test is required to be performed for each NPM.
This test is performed before initial fuel load.
Test Objectives
1. Conduct initial fuel load with no inadvertent criticality. 2. Install fuel assemblies and control components at the locations specified by the design of the initial RXCS.
69.00.XX Prerequisites
01. Plant systems required for initial fuel loading have completed preoperational testing. 02. Plant systems required for initial fuel loading have been aligned per operations procedures. 03. The design of the initial RXCS that specifies the final core configuration of fuel assemblies and control components is completed. 04. A core load sequence is approved. 05. Neutron monitoring data from a previous NPM initial fuel loading or calculations showing the predicted response of monitoring channels are available for evaluating monitoring data. 06. The lower RPV is installed in the RPV support stand. 07. RXB radiation monitors are functional. 08. Boron concentration in the pool is within TS limits. 09. The nuclear instrumentation system is calibrated and operable.
69.03.01 Test Method
1. Install fuel and control components per approved procedures. 2. Monitor boron concentration inside the RPV periodically during fuel load to ensure it satisfies TS. 3. Monitor neutron counts during the load of each fuel assembly and plot an independent inverse count rate ratio for each source range detector after each fuel load assembly is loaded. 4. Verify neutron count data are consistent with calculations showing the predicted response. For fuel loading of the second NPM and all subsequent NPMs use data obtained from previous fuel loadings. 5. Demonstrate the inverse count rate ratio does not show significant approach to criticality. 6. Maintain the status of the core loading.
Acceptance Criteria
1. Each fuel assembly and control component is installed in the location specified by the design of the initial reactor core. 2. There is no indication of inadvertent criticality.

Table 14.2-70: Test # 70 Reactor Coolant System Flow Measurement

The RCS Flow Measurement Test is required to be performed for each NPM.
This test is performed after initial fuel loading but before initial criticality.
Test Objective
1. Verify that the RCS flow is sufficient to ensure adequate boron mixing in the RCS coolant.
70.00.XX Prerequisites
01. The core is installed. 02. The NPM is fully assembled. 03. The RCS is at HZP (RCS at normal operating pressure with RCS temperature at the maximum temperature obtainable when heated only by the MHS). 04. The RCS flow meters have been calibrated.
70.03.01 Test Method
1. Record RCS flow using MCR indication.
Acceptance Criterion
1. The RCS flow at HZP satisfies the minimum RCS flow assumed in the safety analysis.

Table 14.2-71: Test # 71 NuScale Power Module Temperatures

Startup test is required to be performed for each NPM.
This test is performed after initial fuel loading but before initial criticality.
Test Objectives
1. Perform a cross calibration of the RTDs monitored by the MPS listed in Table 7.1-2. 2. Verify incore thermocouple resistance leakage satisfies manufacturer's criteria.
71.00.XX Prerequisites
01. The core is installed. 02. The NPM is fully assembled. 03. The calibration of reactor coolant system RTDs is completed.
71.03.01 Test Method
1. With the RCS at ambient temperature and isothermal conditions record the following data: • MCR indication of RTD temperatures monitored by MPS • MCR indication of incore thermocouples temperatures • Leakage resistance of the incore thermocouples 2. Increase RCS temperature by approximately 50°F. 3. Record RTD and incore thermocouple data at isothermal conditions. 4. Repeat data collection until RCS temperature is at the highest temperature obtainable using only the module heatup system. 5. Cross-calibrate RTD temperatures monitored by MPS that monitor the same variable.
Acceptance Criteria
1. The cross calibration of the reactor coolant system RTDs is completed. 2. The leakage resistance of the fixed incore detectors satisfies manufacturer's recommendations.

Table 14.2-72: Test # 72 Primary and Secondary System Chemistry

Startup test is required to be performed for each NPM.
This test is performed before criticality and at approximately 25, 50, 75, and 100 percent reactor thermal power.
Test Objective
1. Verify water quality in the primary system and secondary system using the PSS.
72.00.XX Prerequisites
01. The PSS instruments have been calibrated. 02. The NPM is fully assembled. 03. The RCS is at HZP (RCS at normal operating pressure and RCS temperature at the maximum temperature obtainable when heated only by the MHS).
72.03.01 Test Method
1. Use the PSS to sample the normal primary system sample points listed in Table 9.3.2-1. 2. Use the PSS to sample the normal secondary system sample points listed in Table 9.3.2-3. 3. To the extent practicable, responses of PSS radiation monitors are verified by laboratory analyses of grab samples taken at the same process location. 4. Conduct the test before criticality and at steady-state condition at approximately 25, 50, 75, and 100 percent reactor thermal power.
Acceptance Criterion
1. The sample analyses satisfy the limits specified in plant procedures.

Table 14.2-73: Test # 73 Control Rod Drive System - Manual Operation, Rod Speed, and Rod Position Indication

Startup test is required to be performed for each NPM.
This test is performed after initial fuel loading but before initial criticality.
Test Objectives
1. Verify the ability to manually fully insert and fully withdraw individual CRAs from the MCR. 2. Verify CRA rod position indications provide indication of rod movement. 3. Verify individual CRA position indications are within the required number of steps of their associated group position. 4. Verify the rod insertion and withdrawal speeds are within design limits.
73.00.XX Prerequisites
01. The core is installed. 02. The NPM is fully assembled. 03. The RCS is at HZP (RCS at normal operating pressure and RCS temperature at the maximum temperature obtainable when heated only by the MHS). 04. All RCS temperatures satisfy the minimum TS temperature for criticality. 05. The nuclear instrumentation system is calibrated and operable. 06. The shutdown margin is within the limits specified in the core operating limits report.
73.03.01 Test Method
1. Individually withdraw and insert each shutdown bank and regulating bank from the MCR a sufficient number of steps to verify that the individual CRA positions are within the required number of steps of their group position as required by TS. Only the tested bank is withdrawn. All other banks are fully inserted. Repeat the test until all shutdown banks and regulating banks are tested. 2. With all shutdown and regulating banks fully inserted, fully withdraw and then fully insert one CRA. Repeat these steps until all CRAs are tested.
Acceptance Criteria
1. All CRAs can be individually fully withdrawn and fully inserted from the MCR. 2. Individual CRA position indications are within the number of steps of their associated group position as required by TS. 3. The CRA insertion and withdrawal speeds are within the design limits identified in Section 3.9.4.

Table 14.2-74: Test # 74 Control Rod Assembly Full-Height Drop Time

Startup test is required to be performed for each NPM.
This test is performed after initial fuel loading but before initial criticality.
Test Objective
1. Verify each CRA satisfies the CRA drop time acceptance criteria for RCS flow at 0 percent reactor thermal power.
74.00.XX Prerequisites
01. The core is installed. 02. The NPM is fully assembled. 03. The RCS is at HZP (RCS at normal operating pressure and RCS temperature at the maximum temperature obtainable when heated only by the MHS). 04. All RCS temperatures satisfy the minimum TS temperature for criticality. 05. The nuclear instrumentation system is calibrated and operable. 06. The shutdown margin is within the limits specified in the core operating limits report.
74.03.01 Test Method
1. Fully withdraw each individual CRA. 2. Interrupt the electrical power to the associated CRDM. 3. Measure the CRA drop time.
Acceptance Criteria
1. Each CRA drop time is within TS limits. 2. Each CRA drop time is within two sigma of the drop time data for all control rods, or is verified within TS limits by a minimum of three additional performances of this test.

Table 14.2-75: Test # 75 Control Rod Assembly Ambient Temperature Full-Height Drop Time

Startup test is required to be performed for each NPM.
This test is performed after initial fuel loading but before initial criticality.
Test Objective
1. Verify each CRA satisfies the CRA drop time acceptance criteria for RCS at ambient temperature.
75.00.XX Prerequisites
01. The core is installed. 02. The NPM is fully assembled. 03. The RCS is at cold temperature conditions. 04. The nuclear instrumentation system is calibrated and operable. 05. The shutdown margin is within the limits specified in the core operating limits report.
75.03.01 Test Method
1. Fully withdraw each individual CRA. 2. Interrupt the electrical power to the associated CRDM. 3. Measure the CRA drop time.
Acceptance Criteria
1. Each CRA drop time is within TS limits. 2. Each CRA drop time is within two sigma of the drop time data for all control rods, or is verified within TS limits by a minimum of three additional performances of this test.

Table 14.2-76: Test # 76 Pressurizer Spray Bypass Flow

Startup test is required to be performed for each NPM.
This test is performed after initial fuel loading but before initial criticality.
Test Objective
1. Verify the PZR spray bypass flow rate is adequate to prevent thermal fatigue of the spray line components and provide sufficient mixing in the PZR to maintain PZR water chemistry similar to the rest of the RCS while avoiding unnecessary energization of the PZR heaters.
76.00.XX Prerequisites
01. The core is installed. 02. The NPM is fully assembled. 03. The RCS is at HZP (RCS at normal operating pressure and RCS temperature at the maximum temperature obtainable when heated only by the MHS).
76.03.01 Test Method
1. With the automatic PZR spray valve closed, adjust the manual spray bypass valve to maintain a continuous spray bypass flow of approximately one gpm. 2. If the continuous bypass spray flow requires the operation of the PZR backup heaters to maintain the PZR pressure setpoint, throttle close the bypass valve until PZR pressure is maintained by the proportional heaters.
Acceptance Criterion
1. The spray bypass valve flow satisfies design requirements.

Table 14.2-77: Test # 77 Initial Criticality

Startup test is required to be performed for each NPM.
This test is performed after initial fuel loading.
Test Objective
1. Achieve initial criticality in a controlled manner.
77.00.XX Prerequisites
01. The RCS is at HZP (RCS at normal operating pressure and RCS temperature at the maximum temperature obtainable when heated only by the MHS). 02. All RCS temperatures satisfy the minimum TS temperature for criticality. 03. The nuclear instrumentation system is calibrated and operable. 04. The shutdown margin is within the limits specified in the core operating limits report. 05. An estimated critical position (calculation) is performed. 06. RCS measured boron is at or near the desired estimated critical position value. 07. The shutdown banks and the regulating banks are fully inserted. 08. A neutron count rate of at least 1/2 counts per second registers on the startup channels, and the signal to noise ratio is greater than 2.
77.03.01 Test Method
1. Shutdown banks are withdrawn in sequence using the sequence of a normal plant startup. Gather data to plot the inverse. 2. Count rate ratio. The inverse count rate ratio is used to monitor reactivity. 3. Once all shutdown banks are fully withdrawn, then the regulating bank is withdrawn using the sequence of a normal plant startup. The inverse count rate ratio is plotted to monitoring reactivity for the approach to criticality. 4. After criticality is obtained, the regulating bank is confirmed to be above the TS regulating group insertion limit. Should criticality be reached with the regulating bank below the insertion limit specified by the core operating limits requirement, the limiting condition of operation test exception is invoked. The RCS boron are increased until the regulating bank is withdrawn sufficiently to meet the insertion limit.
Acceptance Criterion
1. The reactor is critical with the regulating banks above their TS insertion limit.

Table 14.2-78: Test # 78 Post-Critical Reactivity Computer Checkout

Startup test is required to be performed for each NPM.
This test is performed after initial criticality.
Test Objective
1. Verify proper operation of the reactivity computer to measure reactivity changes in the core during low-power testing.
78.00.XX Prerequisites
01. The reactor is critical with the neutron flux level within the range for low-power physics testing. 02. The RCS temperature and pressure are stable at the normal no-load values. 03. The neutron flux level and RCS boron concentration are stable. 04. The reactivity computer is installed and internal reactivity computer checks have been completed.
78.03.01 Test Method
1. Withdraw the regulating bank to achieve a positive startup rate below TS limits. 2. Measure the reactor period or doubling time. 3. Reinsert the regulating bank to re-establish the initial steady-state neutron flux. 4. Measure the negative reactor period or halving time. 5. Validate the core response against the reactivity computer input delayed neutron fractions and prompt neutron lifetime using pre-determined test criteria. 6. Adjust and recalibrate reactivity computer until acceptance criteria are met.
Acceptance Criterion
1. The reactivity computer is calibrated.

Table 14.2-79: Test # 79 Low-Power Test Sequence

Startup test is required to be performed for each NPM.
This test is performed before initial criticality.
Test Objectives
1. Identify the sequence for low-power testing. 2. The low-power tests are: a. Determination of Zero-Power Physics Testing Range 80.03.01 b. All Rods Out Boron Endpoint Determination 81.03.01 c. Isothermal Temperature Coefficient Measurement 82.03.01 d. Bank Worth Measurement 83.03.01
79.00.XX Prerequisites
None
79.03.01 Test Method
For each of the tests identified in the test objectives above: 1. Identify the specific plant conditions required for each low-power test procedure to maintain TS operability. 2. Identify the prerequisites required for each low-power test procedure. 3. Determine the test sequence for low-power testing based on TS requirements and test prerequisites.
Acceptance Criterion
1. The sequence for low-power testing is determined.

Table 14.2-80: Test # 80 Determination of Zero-Power Physics Testing Range

Startup test is required to be performed for each NPM.
This test is performed after initial criticality.
Test Objectives
1. Determine the reactor flux level at which the point of nuclear heating is detectable. 2. Establish the range of neutron flux in which HZP reactivity measurements are to be performed.
80.00.XX Prerequisites
01. The reactor is critical with the neutron flux level at steady-state below the expected level of nuclear heating. 02. The RCS temperature and pressure is steady-state at the normal HZP conditions. 03. The RCS boron concentration is steady-state. 04. The reactivity computer is operational and recording the core average neutron flux level. 05. The regulating bank is positioned to allow reactivity changes by rod motion alone.
80.03.01 Test Method
1. Withdraw the regulating bank to establish a slow startup rate allowing neutron flux level to increase until nuclear heating is observed. 2. Record the reactivity computer neutron flux level and the corresponding MCR flux indication at which nuclear heating occurs. 3. Insert the regulating bank to establish a reactivity computer flux level about one-third of the value at which nuclear heating is observed. This flux level becomes the maximum value for the zero-power testing range.
Acceptance Criterion
1. The zero-power testing range flux level is determined.

Table 14.2-81: Test # 81 All Rods Out Boron Endpoint Determination

Startup test is required to be performed for each NPM.
This test is performed after initial criticality.
Test Objective
1. Determine the critical RCS boron concentration for all rods out (ARO) (fully withdrawn shutdown banks and regulating banks) at HZP.
81.00.XX Prerequisites
01. The reactor is critical with the neutron flux level at steady-state below the expected level of nuclear heating. 02. The RCS temperature and pressure is steady-state at the normal HZP conditions. 03. The RCS boron concentration is steady-state. 04. The reactivity computer is operational and recording the core average neutron flux level.
81.03.01 Test Method
1. Add a pre-determined volume of borated water to the RCS and withdraw the regulating bank to maintain critical conditions. The final regulating bank position is near fully withdrawn and limits the usable positive reactivity remaining in the rods with the reactor critical. 2. Measure the just-critical boron concentration by chemical analysis. 3. Fully withdraw the regulating bank without adjusting the boron concentration. Measure and calculate the change in reactivity for ARO and the RCS temperature difference from program T_{AVG}, due to an equivalent change in boron concentration. Add the equivalent boron change to the just-critical boron concentration to yield the endpoint for ARO.
Acceptance Criterion
1. The measured value for the ARO boron endpoint satisfies the design value contained within the test acceptance criteria.

Table 14.2-82: Test # 82 Isothermal Temperature Coefficient Measurement

Startup test is required to be performed for each NPM.
This test is performed after initial criticality.
Test Objectives
1. Determine the isothermal temperature coefficient. 2. Calculate the moderator temperature coefficient.
82.00.XX Prerequisites
01. The reactor is critical with the neutron flux level at steady-state below the expected level of nuclear heating. 02. The RCS temperature and pressure is steady-state at the normal HZP conditions. 03. The RCS boron concentration is steady-state. 04. The reactivity computer is operational and recording the core average neutron flux level. 05. The regulating rod bank is positioned near fully withdrawn (near their ARO position).
82.03.01 Test Method
1. Vary RCS temperature (heatup/cooldown) while maintaining rods and boron concentration constant. 2. Monitor reactivity results and determine the isothermal temperature coefficient. 3. Calculate the moderator temperature coefficient using the isothermal temperature coefficient and design values.
Acceptance Criterion
1. The moderator temperature coefficient is within the limits specified in the core operating limits report.

Table 14.2-83: Test # 83 Bank Worth Measurement

Startup test is required to be performed for each NPM.
This test is performed after initial criticality.
Test Objectives
1. Measure the integral and differential worth of the reference bank (the test bank with the highest predicted worth). 2. Measure the worth of the remaining shutdown and regulating banks by control rod exchange (rod swap).
83.00.XX Prerequisites
01. The reactor is critical with the neutron flux level at steady-state within the range for HZP physics testing. 02. The RCS temperature and pressure is steady-state at the normal HZP conditions. 03. The RCS boron concentration is steady-state. 04. The reactivity computer is operational and recording the core average neutron flux level. 05. The regulating rod banks are positioned near fully withdrawn (near their ARO position).
83.03.01 Test Method
1. The referenced bank rod worth measurement is made by performing a slow controlled boron dilution while the reference bank is inserted to maintain criticality. The rod worth is measured using the reactivity computer. During boron dilution the reference bank step insertions maintain neutron flux within the zero-power physics test range until the referenced bank is fully inserted. 2. A test bank rod worth measurement is made by inserting the test bank while the reference bank is withdrawn. The test bank worth is determined by the final position of the referenced bank.
Acceptance Criterion
1. The measured worth for each individual bank, and sum of bank worths, is consistent with the predicted value within the test acceptance criteria.

Table 14.2-84: Test # 84 Power-Ascension

Startup test is required to be performed for each NPM.
This test is performed before power-ascension testing.
Test Objective
Identify the sequence for the following power-ascension tests. a. Core Power Distribution Map 85.03.01 b. Neutron Monitoring System Power Range Flux Calibration 86.03.01 c. RCS Temperature Instrument Calibration 87.03.01 d. RCS Flow Calibration 88.03.01 e. Radiation Shield Survey 89.03.01 f. RBVS Capability 90.03.01 g. Thermal Expansion 91.03.01 h. Control Rod Assembly Misalignment 92.03.01 i. SG Level Control System 93.03.01 j. Ramp Change in Load Demand 94.03.01 k. Step Change in Load Demand 95.03.01 l. Loss of FWH 96.03.01 m. 100 Percent Load Rejection 97.03.01 n. Reactor Trip from 100 Percent Power 98.03.01 o. Island Mode Test for the First NPM 99.03.01 p. Island Mode Test for Multiple NPMs 100.03.01 q. NPM Vibration 102.03.01
84.00.XX Prerequisites
None
84.03.01 Test Method
1. Identify the specific plant conditions required for each power-ascension test procedure to maintain TS operability. 2. Identify the prerequisites required for each power-ascension test procedure. 3. Determine the test sequence for power-ascension testing based on TS requirements and test prerequisites.
Acceptance Criterion
1. The sequence for power-ascension testing is determined.

Table 14.2-85: Test # 85 Core Power Distribution Map

Startup test is required to be performed for each NPM.
This test is performed at approximately 25, 50, 75, and 100 percent reactor thermal power
Test Objectives
1. Obtain a core power distribution map during power ascension. 2. Using the data from the core power distribution map verify core power distribution is consistent with design predictions and associated TS limits.
85.00.XX Prerequisites
01. The ICIS is operational. 02. The NPM is operating in a steady-state condition at the specified power level. 03. Maintain reactor power, T_{AVG}, and PZR level constant during data collection.
85.03.01 Test Method
1. With the plant at power levels of approximately 25, 50, 75, and 100 percent of reactor thermal power, obtain a core power distribution map during power ascension using the MCS and instrument input from the in-core self-powered neutron detectors. 2. Use data from the in-core maps to verify that core power distribution is consistent with design predictions and TS limits.
Acceptance Criterion
1. Core power distribution is consistent with design predictions and TS limits.

Table 14.2-86: Test # 86 Neutron Monitoring System Power Range Flux Calibration

Startup test is required to be performed for each NPM.
This test is performed at approximately 25, 50, 75 and 100 percent reactor thermal power.
Test Objective
1. Calibrate the NMS power range neutron flux signals during power ascension.
86.00.XX Prerequisites
01. The ICIS is operational. 02. The NPM is operating in a steady-state condition at the specified power level.
86.03.01 Test Method
1. With the plant at power levels of approximately 25, 50, 75 and 100 percent of reactor thermal power, record the following data: • power range neutron flux from the ICIS self-powered neutron detectors • NMS power range (linear power) signal • heat balance data 2. Maintain reactor power, T_{AVG}, and PZR level constant during data collection. 3. Calibrate the NMS neutron flux power range (linear power) signal using the recorded data.
Acceptance Criterion
1. The NMS neutron flux power range (linear power) signal is calibrated.

Table 14.2-87: Test # 87 Reactor Coolant System Temperature Instrument Calibration

Startup test is required to be performed for each NPM.
This test is performed at approximately 25, 50, 75, and 100 percent reactor thermal power.
Test Objective
1. Calibrate narrow range RCS hot leg temperature instruments, wide range RCS hot leg temperature instruments, and narrow range RCS cold leg temperature instruments.
87.00.XX Prerequisites
01. The ICIS is operational. 02. The NPM is operating in a steady-state condition at the specified power level.
87.03.01 Test Method
1. With the plant at power levels of approximately 25, 50, 75, and 100 percent of reactor thermal power, record the following data: • NMS flux power range (linear power) signal • RCS narrow range hot leg temperature • RCS wide range hot leg temperature • RCS narrow range cold leg temperature • ICIS core inlet and outlet temperature 2. Maintain reactor power, T_{AVG}, and PZR level at steady-state during data collection. 3. Calibrate the RCS narrow range and wide range hot leg temperature instruments and the RCS narrow range cold leg temperature using the recorded data.
Acceptance Criterion
1. The RCS hot and cold let temperature instruments have been calibrated.

Table 14.2-88: Test # 88 Reactor Coolant System Flow Calibration

Startup test is required to be performed for each NPM.
This test is performed at approximately 25, 50, 75, and 100 percent reactor thermal power.
Test Objective
1. Calibrate the RCS flow instruments during power ascension.
88.00.XX Prerequisites
01. The ICIS is operational. 02. The NPM is operating in a steady-state condition at the specified power level. 03. The nuclear instrumentation system is calibrated and operable.
88.03.01 Test Method
1. With the plant at power levels of approximately 25, 50, 75, and 100 percent of reactor thermal power, record the following data: • NMS flux power range (linear power) signal • RCS narrow range hot leg temperature • RCS narrow range cold leg temperature • ICIS core inlet and outlet temperature 2. Maintain reactor power, T_{AVG}, and PZR level at steady state during data collection. 3. Calibrate the RCS flow instruments using the recorded data.
Acceptance Criterion
1. The RCS flow instruments have been calibrated.

Table 14.2-89: Test # 89 Radiation Shield Survey

Startup test is required to be performed for each NPM.
This test is performed at approximately 25, 50, and 100 percent reactor thermal power.
Test Objective
1. Verify the adequacy of radiation shields in the RXB designed to protect personnel from radiation originating from sources within the reactor vessel.
89.00.XX Prerequisites
01. Radiation survey instruments are calibrated. 02. The NPM is operating in a steady-state condition at the specified power level.
89.03.01 Test Method
1. Measure gamma and neutron radiation dose rates at designated locations at approximately 25, 50, and 100 percent reactor thermal power in accordance with RG 1.69 and ANSI/ANS-6.3.1 (1987, R2007). 2. The designated locations are the accessible areas outside permanent radiation shields in the RXB.
Acceptance Criterion
1. Radiation dose rates are consistent with design expectations.

Table 14.2-90: Test # 90 Reactor Building Ventilation System Capability

Startup test is required to be performed for each NPM.
This test is performed at approximately 50 and 100 percent reactor thermal power.
Test Objective
1. Verify that the RBVS maintains the design environment in areas containing equipment that is environmentally qualified for a harsh or mild environment.
90.00.XX Prerequisite
01. The NPM is operating in a steady-state condition at the specified power level.
90.03.01 Test Method
1. With the plant at power levels of approximately 50 and 100 percent of reactor thermal power and RBVS in normal lineup, record temperature and humidity for the environmental qualification zones listed in Table 3C-1 that are not under the bioshield. 2. With the plant at power levels of approximately 50 and 100 percent of reactor thermal power and RBVS in normal lineup, record the temperature and humidity in the rooms containing electrical equipment qualified for a mild environment.
Acceptance Criteria
1. Room temperature and humidity in environmental qualification zones listed in Table 3C-1 that are not under the bioshield satisfy the indoor design conditions for the RBVS contained in Table 9.4.2-1. 2. Room temperature and humidity in rooms containing electrical equipment qualified for a mild environment satisfy the indoor design conditions for the RBVS contained in Table 9.4.2-1.

Table 14.2-91: Test # 91 Thermal Expansion

Startup test is required to be performed for each NPM.
This test is performed during plant heatup and cooldown.
Test Objectives
1. Verify that ASME Code Class 1, 2, and 3 system piping can expand without obstruction and that expansion is within design limits. All ASME Code Class 1, 2, and 3 system piping is within the RXB. 2. Verify that high-energy piping inside the RXB can expand without obstruction and that expansion is within design limits.
91.00.XX Prerequisite
01. Temporary instrumentation is installed on piping as required to monitor the deflections for the piping under test.
91.03.01 Test Method
1. Thermal expansion testing is performed in accordance with ASME OM Code, Division 3, Part 7 as discussed in Section 3.9.2.1. 2. Record deflection data during plant heatup and cooldown. 3. Identify support movements by recording hot and cold positions of the supports.
Acceptance Criteria
In accordance with ASME OM Code, Division 3, Part 7, for the piping systems tested: 1. There is no evidence of constrained thermal expansion of piping or components, other than by installed supports and restraints that are designed to prevent thermal movement. 2. Pipe support movements must be within manufacturer specifications. 3. Piping and components return to their approximate baseline cold position.

Table 14.2-92: Test # 92 Control Rod Assembly Misalignment

Startup test is required to be performed for each NPM.
This test is performed at approximately 50 and 100 percent reactor thermal power.
Test Objectives
1. Verify that core thermal and nuclear parameters at 50 and 100 percent reactor thermal power are in accordance with predictions with a single high-worth rod fully inserted, during rod movement, and following return of the rod to its bank position. 2. Verify the capability of the in-core neutron flux instrumentation to detect a control rod misalignment equal to or less than the TS limits at 50 and 100 percent reactor thermal power. 3. Monitor the power distribution following the recovery of a misaligned CRA.
92.00.XX Prerequisites
01. The reactor is operating at steady-state conditions and is at that condition for a sufficient time to reach xenon equilibrium. 02. The reactor power level, RCS boron concentration, and temperature are stable. 03. The regulating and shutdown banks are positioned as required for the specific measurement, near fully withdrawn for CRA insertion, and at their respective insertion limits for CRA withdrawal.
92.03.01 Test Method
1. For the CRA insertion, insert a group of selected CRAs, one at a time, first to the limit of misalignment specified in TS, then fully inserted, and finally restored to the bank position. Compensate for reactivity changes by dilution and boration as required. 2. For the CRA withdrawal, withdraw one or more selected CRAs, one at a time, to the fully withdrawn position. Compensate for reactivity changes by boration and dilution as required. 3. Record incore and excore instrumentation signals to determine their response and to determine the power distribution and power peaking factors before CRA misalignment, at partial misalignment, at full misalignment, and periodically after restoration to normal.
Acceptance Criteria
1. Measured power distributions and power peaking factors are within TS limits and are consistent with the predictions.

Table 14.2-93: Test # 93 Steam Generator Level Control

Startup test is required to be performed for each NPM.
This test is performed at approximately 25, 50, 75, and 100 percent reactor thermal power.
Test Objective
1. Verify the ability of SG inventory control systems to sustain a ramp increase in load demand. 2. Assess the dynamic response of SG inventory for ramp increase in load demand.
93.00.XX Prerequisite
01. The FWS is operating in SG inventory pressure control (FW regulating valves in automatic control).
93.03.01 Test Method
1. Raise reactor thermal power to approximately 25 percent. 2. Use the MCR turbine controls to provide a 5 percent of full power per minute load increase in demand at approximately 25, 50, and 75 percent reactor thermal power. 3. Use the MCR turbine controls to provide a 5 percent of full power per minute load decrease in demand at approximately 25, 50, and 75, and 100 percent reactor thermal power.
Acceptance Criteria
1. The SG inventory control systems, with no manual intervention, maintain the following parameters within design limits during and following the transient: a. SG superheat b. SG pressure c. SG inventory d. Feed pump speed 2. The SG inventory control systems response is reviewed and compared to expected performance. Necessary adjustments to the control systems have been made before proceeding to the next power plateau.

Table 14.2-94: Test # 94 Ramp Change in Load Demand

Startup test is required to be performed for each NPM.
This test is performed at approximately 25, 50, 75, and 100 percent reactor thermal power.
Test Objectives
1. Verify the ability of the plant automatic control systems to sustain a ramp increase in load demand. a. Assess the dynamic response of the plant for ramp increase in load demand.
94.00.XX Prerequisites
01. The NPM is operating in a steady-state condition at the designated power level. 02. The plant's electrical distribution system is aligned for normal operation. 03. The following control systems are in automatic control: a. Reactivity control b. RCS temperature control c. PZR pressure control d. PZR level control e. Turbine control f. FW level control g. SCWS basin level control h. FWH level control i. CCT level control 04. If required, verify instrumentation is installed for piping vibration testing.
94.03.01 Test Method
1. Use the MCR turbine controls to provide a 5 percent of full power per minute load increase in demand at approximately 25, 50, and 75 percent reactor thermal power. 2. Use the MCR turbine controls to provide a 5 percent of full power per minute load decrease in demand at approximately 25, 50, and 75, and 100 percent reactor thermal power. 3. Conduct piping vibration testing, as required, during power changes.

Table 14.2-94: Test # 94 Ramp Change in Load Demand (Continued)

Acceptance Criteria
1. The turbine does not trip. 2. The reactor does not trip. 3. The MS safety valves do not open. 4. The turbine does not overspeed. 5. The plant automatic control systems, with no manual intervention, maintain the following parameters within design limits during and following the transient: a. Reactor power b. RCS temperature c. PZR pressure d. PZR level e. SG superheat f. SG pressure g. SG inventory h. Gland seal temperature i. SCWS basin level j. FWH level k. CCT level l. Main condenser vacuum m. Outlet temperature of turbine bypass desuperheater 6. Control system response is reviewed and compared to expected performance. Necessary adjustments to the control systems have been made before proceeding to the next power plateau. 7. Water hammer indications a. Audible indications of water hammer are not observed. b. No damage to pipe supports or restraints. c. No damage to equipment. d. No equipment leakage as a result of the ramp change. 8. Piping vibration - System specific steady state vibration testing criteria are established by the piping designer. Actual acceptance criteria depends on the selected test method, but may include: a. Limits for stresses calculated based on the observed/measured vibration response of the system. b. No permanent deformation or damage is observed in the piping system or supports. c. Vibration displacements are not excessive, may not potentially cause the piping to come in contact with surrounding SSC, and are such that the movement of supports and flexible joints is within their allowable limits.

Table 14.2-95: Test # 95 Step Change in Load Demand

Startup test is required to be performed for each NPM.
This test is performed at approximately 25, 50, 75, and 100 percent reactor thermal power.
Test Objectives
1. Verify the ability of the plant automatic control systems to sustain step load increases and step load decreases in demand. 2. Assess the dynamic response of the plant for a load step demand.
95.00.XX Prerequisites
01. The NPM is operating in a steady-state condition at the specified power level. 02. The plant's electrical distribution system is aligned for normal operation. 03. The following control systems are in automatic control: a. Reactivity control b. RCS temperature control c. PZR pressure control d. PZR level control e. Turbine control f. FW level control g. SCWS basin level control h. FWH level control i. CCT level control
95.03.01 Test Method
1. Use the MCR turbine controls to provide a 10 percent step load increase in demand at approximately 25, 50, and 75 percent reactor thermal power. 2. Use the MCR turbine controls to provide a 10 percent step load decrease in demand at approximately 25, 50, 75, and 100 percent reactor thermal power.
Acceptance Criteria
1. The turbine does not trip. 2. The reactor does not trip. 3. The MS safety valves do not open. 4. The turbine does not overspeed. 5. The plant automatic control systems, with no manual intervention, maintain the following parameters within design limits during and following the transient: a. Reactor power b. RCS temperature c. PZR pressure d. PZR level e. SG superheat f. SG pressure g. SG inventory h. Gland seal temperature i. SCWS basin level j. FWH level k. CCT level l. Main condenser vacuum m. Outlet temperature of turbine bypass desuperheater 6. Control system response is reviewed and compared to expected performance. Necessary adjustments to the control systems have been made before proceeding to the next power plateau. 7. Water hammer indications a. Audible indications of water hammer are not observed. b. No damage to pipe supports or restraints. c. No damage to equipment. d. No equipment leakage as a result of the step load change.

Table 14.2-96: Test # 96 Loss of Feedwater Heater

Startup test is required to be performed for each NPM.
This test is performed at approximately 50 and 90 percent reactor thermal power.
Test Objectives
1. Verify the ability of the plant automatic control systems to sustain a loss of the high pressure FWH during power operation. 2. Assess the dynamic response of the plant for the loss of the high pressure FWH.
96.00.XX Prerequisites
01. The NPM is operating in a steady-state condition at the specified power level. 02. The plant's electrical distribution system is aligned for normal operation. 03. The following control systems are in automatic control: a. Reactivity control b. RCS temperature control c. PZR pressure control d. PZR level control e. Turbine control f. FW level control g. SCWS basin level control h. FWH level control i. CCT level control
96.03.01 Test Method
1. Close the turbine generator extraction steam supply isolation valve to the high pressure FWH from the MCR at approximately 50 and 90 percent reactor thermal power.
Acceptance Criteria
1. The reactor does not trip. 2. The turbine does not trip. 3. The MS safety valves do not open. 4. The plant automatic control systems, with no manual intervention, maintain the following parameters within design limits during and following the transient: a. Reactor power b. RCS temperature c. PZR pressure d. PZR level e. SG superheat f. SG pressure g. SG inventory h. Gland seal temperature i. SCWS basin level j. FWH level k. CCT level l. Main condenser vacuum m. Outlet temperature of turbine bypass desuperheater

Table 14.2-97: Test # 97 100 Percent Load Rejection

Startup test is required to be performed for each NPM.
This test is performed at approximately 100 percent reactor thermal power.
Test Objectives
1. Verify the ability of the plant automatic control systems to sustain a 100 percent load rejection from full power. 2. Assess the dynamic response of the plant for a 100 percent power load rejection.
97.00.XX Prerequisites
01. The NPM is operating in a steady-state condition at full reactor thermal power. 02. The plant's electrical distribution system is aligned for normal operation. 03. The following control systems are in automatic control: a. Reactivity control b. RCS temperature control c. PZR pressure control d. PZR level control e. Turbine control f. FW level control g. SCWS basin level control h. FWH level control i. CCT level control
97.03.01 Test Method
1. Manually trip the generator output breaker to provide a 100 percent load rejection.
Acceptance Criteria
1. The turbine trips. 2. The reactor does not trip. 3. The MS safety valves do not open. 4. The turbine does not overspeed beyond design limits. 5. The turbine generator bypass valve opens and modulates steam flow to the condenser to maintain steam generator pressure. 6. The plant automatic control systems, with no manual intervention, maintain the following parameters within design limits during and following the transient: a. Reactor power b. RCS temperature c. PZR pressure d. PZR level e. SG superheat f. SG inventory g. Gland seal temperature h. SCWS basin level i. FWH level j. CCT hotwell level k. Main condenser vacuum l. Outlet temperature of turbine bypass desuperheater 7. Water hammer indications a. Audible indications of water hammer are not observed. b. No damage to pipe supports or restraints. c. No damage to equipment. d. No equipment leakage as a result of the load rejection.

Table 14.2-98: Test # 98 Reactor Trip from 100 Percent Power

Startup test is required to be performed for each NPM.
This test is performed at 100 percent reactor thermal power.
Test Objectives
1. Assess the dynamic response of the plant to a reactor trip. 2. Verify each fully withdrawn CRA satisfies the CRA drop time acceptance criteria at full flow conditions. 3. Verify the ability of the DHRS to cool the RCS to Mode 3 (all RCS temperatures < 345 °F).
98.00.XX Prerequisites
01. The NPM is operating in a steady-state condition at full reactor thermal power. 02. The plant's electrical distribution system is aligned for normal operation.
98.03.01 Test Method
1. Manually trip the reactor from the MCR. 2. Measure the drop time for each fully withdrawn CRA. 3. Allow the RCS temperature trends to stabilize. 4. Manually initiate DHRS. 5. Allow the RCS to cool to mode 3 after DHRS actuation.
Acceptance Criteria
Acceptance criteria to be verified after manual reactor trip: 1. The reactor trips. 2. The turbine generator bypass valve operates to prevent opening of the MS safety valve. 3. The turbine trips. 4. Water hammer indications a. Audible indications of water hammer are not observed. b. No damage to pipe supports or restraints. c. No damage to equipment. d. No equipment leakage as a result of the reactor trip. Acceptance criteria to be verified after DHRS actuation: 5. a. DHRS actuation valves open. b. MSIVs close. c. FWIVs close. d. FW regulating valves close e. Secondary MSIVs close f. Secondary MSIBVs close g. PZR heater breakers trip 6. The RCS cools to a stable condition in mode 3 (all RCS temperatures < 345 °F) without operator intervention. 7. The RCS cooldown rate is within TS limits. 8. Each fully withdrawn CRA drop time is within TS limits.

Table 14.2-99: Test # 99 Island Mode Test for the First NuScale Power Module

This startup test is required to be performed for the first NPM in power operation. No other NPMs are in power operation. This test is performed once per facility. Startup Test 100.03.01 tests island mode for multiple NPMs.
This test is performed at 100 percent reactor thermal power. Island mode operation is described in Section 8.3.1.
Test Objective for the first NPM in power operation
1. Verify the first NPM in power operation can operate independently from an offsite transmission grid after transition from the transmission grid to island mode. 2. Verify plant electrical loads may be transitioned from island mode to an offsite transmission grid without interruption to the operation of the first NPM in power operation.
99.00.XX Prerequisites
01. The first NPM in power operation is in normal operation at 100 percent reactor thermal power.
99.03.01 Test Method
1. Simulate a loss of the transmission grid by opening the switchyard supply breakers.
Acceptance Criteria
1. a. The service unit generator does not trip and changes from droop mode control to isochronous mode to control the loads on site. b. The first NPM in power operation remains at approximately 100 percent reactor thermal power using turbine generator bypass operation. c. Electrical power to plant loads is uninterrupted without loss of voltage or automatic bus transfers. 2. The plant electrical loads are transitioned back to the external offsite grid connection when it becomes available.

Table 14.2-100: Test # 100 Island Mode Test for Multiple NuScale Power Modules

This startup test is required to be performed once with multiple (at least two) NPMs in operation. This test is performed once per facility. Startup Test 99.03.01 tests island mode for a single NPM.
Island mode operation is described in Section 8.3.1.
Test Objective for multiple NPMs in operation:
1. Verify all NPMs under test can operate independently from an offsite transmission grid after transition from the transmission grid to island mode. 2. Verify plant electrical loads may be transitioned from island mode to an offsite transmission grid without interruption to the operation of the service unit NPM.
100.00.XX Prerequisites
01. The NPMs selected for test are in normal operation at 100 percent reactor thermal power.
100.03.01 Test Method
1. Simulate a loss of the transmission grid by opening the switchyard supply breakers.
Acceptance Criteria
1. a. The service unit turbine generator transitions to island mode by changing from droop mode control to isochronous mode control to control the load on the 13.8kV bus it is supplying. b. The service unit NPM remains at approximately 100 percent reactor thermal power using turbine generator bypass operation. c. The non-service unit turbine generators trip. d. The non-service unit NPMs power reduces to approximately 95 percent reactor thermal power using turbine generator bypass operation. e. Electrical power to plant loads is uninterrupted without loss of voltage or automatic bus transfers. 2. The plant electrical loads are successfully transitioned back to an external offsite grid connection when it becomes available.

Table 14.2-101: Test # 101 Remote Shutdown Controls and Monitoring

Remote shutdown controls and monitoring is described in Section 7.1.1. Testing associated with remote shutdown controls and monitoring occurs during the performance of FAT and SAT as described below.
Remote shutdown controls and monitoring provides additional, identical, sets of MCS and PCS operator workstations at alternate locations to monitor the NPM status and operate the MCS and PCS during an MCR evacuation. The ability to activate the nonsafety MCS and PCS displays and controls at these alternate locations are verified during SAT. The ability to isolate the safety-related MCR module protection system manual switches using the MCR isolation switches located outside the control room as described in Section 7.2.12 are verified during module protection system FAT and SAT. **Table 14.2-54: Module Control System Test # 54 and Table 14.2-55: Plant Control System Test # 55 contain details regarding MCS and plant control system FAT and SAT.**

Table 14.2-102: Test # 102 NuScale Power Module Vibration

This startup test is required to be performed once for the first NPM to be tested. This test supports FOAK testing described in Section 14.2.3.3.
This test is performed during the load ramp from zero to 100 percent power and at 100 percent reactor thermal power. The NPM vibration testing is described in Section 3.9.2; and "NuScale Comprehensive Vibration Assessment Program Measurement and Inspection Plan Technical Report," TR-121354-P. This test is coordinated with Test 94.03.01 and Test 98.03.01.
Test Objective for the first NPM to be tested
1. Perform vibration testing of CNTS main steam line branch connections, including DHRS steam piping, and MS drain valve branches during the load ramp up to and at 100 percent reactor thermal power to verify vibration amplitudes in the piping regions confirm there is no acoustic resonance (AR) response. 2. Perform vibration monitoring of the NPM using the signals from dynamic pressure sensors. More details regarding the instrumentation locations and vibration mechanisms being monitored are provided in Section 6.0 of TR-121354-P. Vibration monitoring must be performed during the load ramp up to and at 100 percent reactor thermal power and during a test of DHRS actuation, which are coordinated with Test 98.03.01.
102.00.XX Prerequisites
01. The DHRS steam piping and MS drain valve branches are instrumented to obtain AR data. 02. The NPM is instrumented in accordance with Section 6.0 of TR-121354-P to provide vibration monitoring.
102.03.01 Test Method
1. Perform load ramp up to 100 percent power, then operate the NPM for a sufficient duration at 100 percent power to ensure one million vibration cycles for the component with the lowest structural natural frequency. 2. Monitor the vibration of the CNTS steam piping branches, including the DHRS steam lines and MS drain valve branches. Also monitor the signals of the dynamic pressure sensors. If an unacceptable vibration response develops at any time during initial startup testing, the test conditions must be adjusted to stop the vibration and the reason for the vibration anomaly are investigated before continuing with the testing.
Acceptance Criteria
1. Measured vibration amplitudes in the CNTS steam piping branches confirm there is no acoustic resonance concern. 2. Measured vibration responses in the NPM confirm there are no resonant peaks that could indicate a strongly-coupled flow induced vibration mechanism.

Table 14.2-103: List of Test Abstracts

Test Number	System Abbreviation	Test Abstract
01	PCWS	Pool Cooling and Cleanup System
02	UHS	Ultimate Heat Sink
03	PLDS	Pool Leakage Detection System
04	RCCWS	Reactor Component Cooling Water System
05	CHWS	Chilled Water System
06	ABS	Auxiliary Boiler System
07	ACC	Air Cooled Condenser
08	SCWS	Site Cooling Water System
09	PWS	Potable Water System
10	UWS	Utility Water System
11	DWS	Demineralized Water System
12	NDS	Nitrogen Distribution System
13	SAS	Service Air System
14	IAS	Instrument and Control Air System
15	CRHS	Control Room Habitability System
16	CRVS	Normal Control Room HVAC System
17	RBVS	Reactor Building HVAC System
18	RWBVS	Radioactive Waste Building HVAC System
19	TBVS	Turbine Building HVAC System
20	RWDS	Radioactive Waste Drain System
21	BPDS	Balance-of-Plant Drain System
22	FPS	Fire Protection System
23	FDS	Fire Detection System
24	MSS	Main Steam System
25	FWS	Condensate and Feedwater System
26	FWTS	Feedwater Treatment System
27	CPS	Condensate Polishing System
28	HVDS	Feedwater Heater Vents and Drains System
29	TGS	Turbine Generator System
30	LRWS	Liquid Radioactive Waste System
31	GRWS	Gaseous Radioactive Waste System
32	SRWS	Solid Radioactive Waste System
33	CVCS	Chemical and Volume Control System
34	BAS	Boron Addition System
35	MHS	Module Heatup System
36	CES	Containment Evacuation System
37	CFDS	Containment Flooding and Drain System
38	CNTS	Containment System
39	RCS	Reactor Coolant System
40	ECCS	Emergency Core Cooling System
41	DHRS	Decay Heat Removal System
42	ICIS	In-core Instrumentation System
43	MAE	Module Assembly Equipment
44	FHE	Fuel Handling Equipment
45	RBC	Reactor Building Crane
46	PSS	Process Sampling System
47	EHVS	High Voltage AC Electrical Distribution System
48	EMVS	Medium Voltage AC Electrical Distribution System
49	ELVS	Low Voltage AC Electrical Distribution System
50	EDAS	Augmented DC Power System

Table 14.2-103: List of Test Abstracts (Continued)

Test Number	System Abbreviation	Test Abstract
51	EDNS	Normal DC Power System
52	BPSS	Backup Power Supply System
53	PLS	Plant Lighting System
54	MCS	Module Control System
55	PCS	Plant Control System
56	MPS	Module Protection System
57	PPS	Plant Protection System
58	NMS	Neutron Monitoring System
59	SDIS	Safety Display and Indication System
60	RMS	Fixed-Area Radiation Monitoring System
61	COMS	Communication System
62	SMS	Seismic Monitoring System
63	HFT	Hot Functional Testing
64	MAEB	Module Assembly Equipment Bolting
65	SG	Steam Generator Flow-Induced Vibration
66	N/A	Security Access Control
67	N/A	Security Detection and Alarm
68	N/A	Initial Fuel Loading and Precritical
69	N/A	Initial Fuel Load
70	N/A	Reactor Coolant System Flow Measurement
71	N/A	NuScale Power Module Temperatures
72	N/A	Primary and Secondary System Chemistry
73	N/A	Control Rod Drive System-Manual Operation, Rod Speed, and Rod Position Indication
74	N/A	Control Rod Assembly Full-Height Drop Time
75	N/A	Control Rod Assembly Ambient Temperature Full-Height Drop Time Test
76	N/A	Pressurizer Spray Bypass Flow
77	N/A	Initial Criticality
78	N/A	Post-Critical Reactivity Computer Checkout
79	N/A	Low-Power Test Sequence
80	N/A	Determination of Zero-Power Physics Testing Range
81	N/A	All Rods Out Boron Endpoint Determination
82	N/A	Isothermal Temperature Coefficient Measurement
83	N/A	Bank Worth Measurement
84	N/A	Power-Ascension
85	N/A	Core Power Distribution Map
86	N/A	Nuclear Monitoring System Power Range Flux Calibration
87	N/A	Reactor Coolant System Temperature Instrument Calibration
88	N/A	Reactor Coolant System Flow Calibration
89	N/A	Radiation Shield Survey
90	N/A	Reactor Building Ventilation System Capability
91	N/A	Thermal Expansion
92	N/A	Control Rod Assembly Misalignment
93	N/A	Steam Generator Level Control
94	N/A	Ramp Change in Load Demand
95	N/A	Step Change in Load Demand
96	N/A	Loss of Feedwater Heater
97	N/A	100 Percent Load Rejection
98	N/A	Reactor Trip from 100 Percent Power
99	N/A	Island Mode Test for the First NuScale Power Module

Table 14.2-103: List of Test Abstracts (Continued)

Test Number	System Abbreviation	Test Abstract
100	N/A	Island Mode Test for Multiple NuScale Power Modules
101	N/A	Remote Shutdown Workstation
102	N/A	NuScale Power Module Vibration

Table 14.2-104: Initial Test Program Testing of New Design Features

New System or Component Design	Design Feature Tested in the Initial Test Program	FSAR Section 14.2 Test Number
Containment isolation valves	• valve leak rate test • valve response to manual ESF actuation at hot functional test pressure and temperature • valve response time test at hot functional test pressure and temperature • valve response to manual reactor trip at 100% power	#38.02.01 #56.02.04 #56.02.05 #97
ECCS valve design	• valve response to manual ESF actuation at hot functional test pressure and temperature • test of valve IAB at design pressure	#56.02.04 #56.02.04
ECCS operation	• Containment response to ECCS operation at hot functional test pressure and temperature.	#40.02.01
DHRS valve design	• valve response to manual ESF actuation at hot functional test pressure and temperature • valve response to manual reactor trip at 100% power	#56.02.04 #97
DHRS heat exchanger design	• heat exchanger response to manual ESF actuation at hot functional test pressure and temperature • heat exchanger response to manual reactor trip at 100% power	#41.02.01 #97
CFDS	• automatic fill of containment • automatic drain of containment	#37.02.02 #37.02.01
Containment evacuation system	• establish and maintain containment vacuum • provide RCS leakage detection	#36.02.01 #36.02.03
CNTS level sensors	• provides containment level input for CFDS automatic fill and drain of containment	#37.01.06
RCS flow sensors	• provides RCS flow indication during hot functional testing and power ascension testing	#70 #88
PZR level sensors	• provides input for PZR level control	#33.02.01
Island mode operation	• NPMs can operate independently from offsite transmission grid.	#99 and #100

14.3 Inspections, Tests, Analyses, and Acceptance Criteria

14.3.1 Introduction

This section provides guidance regarding the development of Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC). The scope of ITAAC is sufficient to provide reasonable assurance that, if the ITAAC are successfully completed, the facility has been constructed and can be operated in accordance with the Atomic Energy Act, relevant Nuclear Regulatory Commission (NRC) regulations, and the plant license. The successful completion of ITAAC constitutes the basis for the NRC determination to allow operation of a facility certified under 10 CFR 52, and the ITAAC material expires at initial fuel loading.

The ITAAC are used to verify selected as-built top-level design features. A design feature is a physical attribute or performance characteristic of structures, systems, and components (SSC). Not all top-level design features are verified by ITAAC. Only the design features in the design commitments are verified by ITAAC.

The sections below describe the criteria and methods by which specific top-level design features were identified and selected to be verified by ITAAC. The contents of the design commitments may not directly correspond to these guidelines in all cases because special considerations may warrant a different approach. In this regard, a case-by-case determination is made consistent with the principles inherent in 10 CFR 52 as well as NRC guidance regarding the content of ITAAC.

COL Item 14.3-1: An applicant that references the NuScale Power Plant US460 standard design will provide the site-specific selection methodology and inspections, tests, analyses, and acceptance criteria for emergency planning.

COL Item 14.3-2: An applicant that references the NuScale Power Plant US460 standard design will provide the site-specific selection methodology and inspections, tests, analyses, and acceptance criteria for structures, systems, and components within their scope.

14.3.2 Top-Level Design Features and Inspections, Tests, Analyses, and Acceptance Criteria First Principles

General criteria that provide clarity on the scope of top-level design features and ITAAC are discussed below. These criteria are consolidated and grouped into two sets: (1) top-level design features scope first principles and (2) ITAAC scope first principles.

A first principles approach is considered such that the ITAAC are "necessary and sufficient." Thus, in order to determine the appropriate scope of ITAAC, it is important to apply both the first principles for determining the top-level design features and the first principles for determining whether a design feature needs an ITAAC. Consistent with these first principles, the selection of the top-level design features is based on the safety significance of SSC, their importance in various safety analyses, and their functions for defense-in-depth considerations.

The first principles for determining the scope of top-level design features and ITAAC are described in Section 14.3.2.1 and Section 14.3.2.2.

14.3.2.1 Top-Level Design Features Scope First Principles

Top-level design features are limited to the following:

- design features of safety-related SSC
- design features of safety-related or nonsafety-related SSC that protect safety-related components
- design features of security system physical SSC
- design features of risk-significant, nonsafety-related SSC determined by results of a probabilistic risk assessment (PRA)

Refer to Section 14.3.2.1.1 for further discussion of this principle. Furthermore, top-level design features are limited to include the following:

- Not all safety-related design features are top-level design features. Refer to Section 14.3.2.1.3 for further discussion.
- Not all design features contained in the accident analyses are top-level design features. Refer to Section 14.3.2.1.4 for further discussion.
- Operational programs and post-fuel load testing are not design features. Refer to Section 14.3.2.1.5 for further discussion.
- Some risk-significant design features identified by the PRA do not need to be specifically addressed because they are indirectly addressed by design features that are addressed by other design commitments. Refer to Section 14.3.2.1.6 for further discussion.
- To the extent that SSC are already the subject of a design commitment by reason of a design basis accident mitigation function design feature, a design commitment does not need to address the function of the SSC to mitigate severe accidents. Other design features that are not specifically installed for severe accident mitigation, but are used for severe accident mitigation do not need to be addressed. Refer to Section 14.3.2.1.7 for further discussion.
- Only fixed design features that are installed before fuel loading and that are expected to be in place for the lifetime of the plant are considered for inclusion as top-level design features. Refer to Section 14.3.2.1.8 for further discussion.
- Design features of systems with no safety significance are not considered for inclusion.

14.3.2.1.1 Characteristics of Top-Level Design Features

The following describes the top-level design features for the NuScale Power Plant US460 standard design.

A design feature is either a physical attribute or a performance characteristic of SSC. The top-level design features contained in the ITAAC are associated with the

- reactor coolant pressure boundary.
- containment pressure boundary.
- Portions of the Seismic Category I Reactor Building and Control Building.
- Radioactive Waste Category RW-IIa Radioactive Waste Building.
- control room envelope.
- safety-related equipment qualification.
- nonsafety-related equipment qualification of SSC located within the boundaries of the NuScale Power Module (NPM) that have augmented Seismic Category I or environmental qualification requirements.
- nonsafety-related equipment qualification of SSC that have augmented Seismic Category I or environmental qualification requirements and provide one of the following functions:
  - provides physical support of irradiated fuel
  - provides a path for makeup water to the ultimate heat sink
  - provides containment of the ultimate heat sink water
  - provides monitoring of ultimate heat sink water level
- nonsafety-related equipment qualification of SSC classified as RW-IIa used for processing gaseous radioactive waste.
- safety-related component performance.
- SSC providing protection of safety-related components.
- nonsafety-related SSC that perform a credited function in Chapter 15 analyses.
- safety-related protection systems (reactor trip and engineered safety features actuation systems).
- components providing radiation protection for personnel and safety-related equipment.
- new and spent fuel storage.
- security system physical components.

Examples of physical attributes included in top-level design features are safety-related equipment qualification, location of fire barriers, and attenuation capabilities of radiation shields.

Examples of performance characteristics included in top-level design features are building seismic performance, safety-related piping conformance to American Society of Mechanical Engineers Code Section III requirements, valve stroke time, and safety-related components' automatic response to the module protection system.

14.3.2.1.2 Severe Accident Design Features

The ITAAC are used to verify that the severe accident top-level design features exist. In general, the capabilities of the design features need not be included in the ITAAC. For example, a design commitment may discuss that a severe accident containment flooding system exists, while the acceptance criteria would discuss that the severe accident containment flooding system exists but would not specify the capabilities of associated pumps.

14.3.2.1.3 Safety-Related Design Features

Not all safety-related design features are considered top-level design features and do not need to be explicitly addressed. Examples of safety-related component design features that generally do not warrant inclusion are listed below:

- instrument lines
- fill lines
- drains
- American Society of Mechanical Engineers Code Section III valves that have only a passive function
- piping pressure relief valves associated with thermal expansion and anticipated valve leakage
- interlocks aimed specifically at equipment protection for safety-related components
- local controls for safety-related components
- rebar and concrete properties for Seismic Category I structures

14.3.2.1.4 Top-Level Design Features Verified by Inspections, Tests, Analyses, and Acceptance Criteria

Only the top-level design features are verified by ITAAC. Each ITAAC section includes a table that correlates the top-level design features contained in design commitments with the results of the following plant safety analyses:

- transient and accident analyses
- internal and external hazards analyses
- radiological analyses
- risk-significant design features as determined by the results of a PRA
- design features necessary or important to severe accident mitigation
- fire protection
- physical security

By capturing the top level design features that are based upon results of plant safety analyses, the integrity of the fundamental analyses associated with the design as presented in the FSAR are preserved in ITAAC.

14.3.2.1.5 Operational Programs and Post-Fuel Load Testing

Those aspects of the design that pertain to programs rather than the as-built plant (e.g., Appendix B to 10 CFR Part 50 requires a quality assurance program, and 10 CFR 50.65 requires a maintenance rule program) are not design features and are therefore not included in the ITAAC.

Those aspects of the design that cannot be verified until after fuel loading are not included in ITAAC because 10 CFR 52 requires the ITAAC to be satisfied before fuel loading. For these, the Initial Test Program verifies aspects of the design after fuel load, but before operation. Examples include startup and power ascension test program verifications of fuel, control rod, and core characteristics, as well as system and integrated plant operating characteristics. The treatment of these issues is similar to their treatment at facilities licensed under 10 CFR 50, in that verification of the satisfactory completion of these requirements is a condition of the license.

14.3.2.1.6 Risk-Significant Design Features

Some risk-significant design features identified by the PRA do not need to be specifically addressed because they are indirectly addressed by design features that are addressed by other design commitments. For example, some PRA studies are dependent upon an assessment of the ability of certain SSC to function during seismic events that are more severe than the design basis safe shutdown earthquake. If equipment is designed and qualified for the seismic design basis, the design process is such that the added capability assumed in the PRA is inherently present.

The risk-significant design features that are included in the design commitments and have associated ITAAC are identified.

14.3.2.1.7 Design Features Necessary or Important to Severe Accident Mitigation

There are some SSC that mitigate design basis accidents and provide an important success path for severe accident mitigation. The severe accident mitigation design features that are included in the design commitments and have associated ITAAC are identified.

14.3.2.1.8 Fixed Design Features Installed Before Fuel Loading

Those aspects of the design that pertain to portable items or consumables rather than fixed design features are not included. Because hardware such as fuel cannot be installed in the reactor until after completion of the ITAAC and because the fuel is periodically replaced, fuel is not an appropriate topic for ITAAC.

14.3.2.2 Inspections, Tests, Analyses, and Acceptance Criteria Scope First Principles

The following criteria are considered when determining what information warrants inclusion in the ITAAC entries:

- The design commitment is extracted directly from the ITAAC design descriptions and differences in text are minimized, unless intentional.
- The NRC safety determination is based solely on the FSAR design information. ITAAC are not relied upon for the NRC safety determination provided in a Safety Evaluation Report.
- The ITAAC are an important part of the NRC construction verification program, but do not verify every design and construction feature included in the design. The ITAAC are not meant to be a one-for-one check of detailed design and construction features that are verified by the normal construction quality programs.
- An inspection, test, or analysis, or a combination thereof, can verify one or more provisions in the design commitment, as defined by the ITAAC.

14.3.2.2.1 Design Commitments Only Include Components Required to Perform System Functions in the Inspections, Tests, Analyses, and Acceptance Criteria System Description

Not every element of a design commitment specified in ITAAC has a corresponding verification requirement. For example, the safety classification of SSC are not verified by ITAAC because there is no specific test for this characteristic. Further, some ITAAC verify system function and do not address individual system components that together yield the required system functional performance.

14.3.3 Inspections, Tests, Analyses, and Acceptance Criteria Information

14.3.3.1 Inspections, Tests, Analyses, and Acceptance Criteria Tables

A table of ITAAC entries is provided for each system that has design commitments in the ITAAC design description. A four-column format for the ITAAC table is used with the first column containing numbers to identify the entries' positions in the table. The remaining three columns of the ITAAC table must be read and interpreted together.

The second column of the ITAAC table identifies the design commitment to be verified. This column contains the specific text of the design commitment, which is extracted from the design commitments contained in the ITAAC design description.

The third column of the ITAAC table identifies the proposed method by which the licensee verifies the design commitment described in column 2. The methods used are inspections, tests, analyses, or a combination of the three.

- Inspections are used when verification can be done by visual observation, physical examination, or reviews of records based on visual observation or physical examination that compare a) the SSC condition to one or more design commitments or b) the program implementation elements to one or more program commitments, as applicable. Examples include walkdowns, configuration checks, measurements of dimensions, or nondestructive examinations.
- Tests mean actuation or operation, or establishment, of specified conditions to evaluate the performance or integrity of as-built SSC, unless explicitly stated otherwise, to determine whether an ITAAC acceptance criterion is met.

  In addition to testing equipment at its final location, alternative testing methods can be used including factory testing, test facility testing, and laboratory testing. Testing can also include type testing such as might be performed to demonstrate qualification to meet environmental requirements. Type test means a test on one or more sample components of the same type and manufacturer to qualify other components of the same type and manufacturer. A type test is not necessarily a test of an as-built SSC.
- Analyses are used when verification can be done by calculation, mathematical computation, or engineering or technical evaluations.

The fourth column of the ITAAC table identifies the specific acceptance criteria for the inspections, tests, or analyses described in column 3 that, if met, demonstrate that the licensee has met the design commitments in column 2. Acceptance criteria are objective and clear to avoid confusion over whether or not acceptance criteria have been satisfied.

Using the criteria listed above, ITAAC table entries were developed for each selected system. This was achieved by evaluating the top-level design features and preparing a design commitment and corresponding ITAAC table entry for each design feature that satisfies the above selection criteria.

The ITAAC table was completed by selecting the method to be used for verification (i.e., an inspection, a test, an analysis, or a combination of these) and the acceptance criteria the as-built design features are measured against.

Where ITAAC are verified by a preoperational test, the test is established in accordance with the Initial Test Program described in Section 14.2 and Regulatory Guide 1.68. Conversion or extrapolation of test results from the test conditions to design conditions may be necessary to satisfy specific ITAAC.

Selection of acceptance criteria is dependent upon the specific design characteristic being verified by the ITAAC table entry. In most cases the appropriate acceptance criteria are self-evident. For many of the ITAAC, the acceptance criterion is a statement that the as-built facility has the design feature identified in the design commitment.

A guiding principle for acceptance criteria preparation is the recognition that the criteria are objective and unambiguous. The use of objective and unambiguous terms for the acceptance criteria minimizes opportunities for multiple, subjective (and potentially conflicting) interpretations as to whether an acceptance criterion has, or has not, been met. In some cases, the acceptance criteria can be more general because the detailed supporting information in the FSAR does not lend itself to concise verification.

In some cases, the ITAAC contain numerical values from the FSAR that are not specifically identified in the design commitment column of the ITAAC table. The numerical value in the acceptance criterion is a measurement standard for determining if the as-built facility is in compliance with the design commitment. Numerical values for SSC are specified as ITAAC acceptance criteria when values consistent with the design commitments are possible or when failure to meet the stated acceptance criterion would clearly indicate a failure to properly implement the design or meet the safety analysis.

For numerical values in the acceptance criteria, ranges or tolerances are generally included. This is necessary and acceptable because

- specification of a single-value acceptance criterion is impractical because minute deviations could indicate noncompliance.
- tolerances recognize that legitimate site variations can occur in complex construction projects.
- minor variations in plant parameters within the tolerance bounds have no effect on plant safety.

Where appropriate, the detailed design information provided in the FSAR includes supporting information for various inspections, tests, and analyses that is used to satisfy the acceptance criteria. This information describes an acceptable means of satisfying an ITAAC.

For each ITAAC table, an accompanying table is provided that includes additional information for each entry in the ITAAC table. This information may include:

- locations of detailed design information in the FSAR.
- details and references associated with the design commitment.
- additional details associated with the conduct of the inspections, tests, and analyses.
- details that further define the acceptance criteria.

14.3.4 Treatment of Module-Specific and Shared Structures, Systems, and Components in Inspections, Tests, Analyses, and Acceptance Criteria

14.3.4.1 Inspections, Tests, Analyses, and Acceptance Criteria for Module-Specific Structures, Systems, and Components

Module-specific SSC are specific to and support operation of a single NPM. The module-specific design is identical between NPMs. If a design feature of a module-specific SSC meets the first principles for identification as a top-level design feature and verification through ITAAC as described in Section 14.3.2, then its ITAAC are entered into its associated system's ITAAC table. Chapter 2 of ITAAC includes an entry for each module-specific system that is either fully or partially within the scope of the NuScale Power Plant US460 standard design.

The ITAAC of a given module-specific system are the same for all NPMs and are only recorded once in an ITAAC table.

However, each ITAAC for a given module-specific system must be completed for each NPM.

14.3.4.2 Inspections, Tests, Analyses, and Acceptance Criteria for Shared Structures, Systems, and Components

Shared SSC support multiple NPMs. If a design feature of a shared SSC meets the first principles for identification as a top-level design feature and verification through ITAAC as described in Section 14.3.2, then its ITAAC are entered into its associated system's ITAAC table. Chapter 3 of ITAAC includes an entry for each shared system that is either fully or partially within the scope of the NuScale Power Plant standard design. Additionally, shared ITAAC address non-SSC design activities that are applicable to more than one system or NPM such as human factors engineering.

Shared systems that must be completed to support the operation of the first NPM have their ITAAC completed once. If shared systems require a portion of the system to be completed to support the operation of the first NPM, then the applicable ITAAC is in a module-specific ITAAC table and must be completed for each associated NPM.