GE Nuclear Energy

General Electric Company
175 Curtner Avenue, San Jose, CA 95125

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Docket No. STN 52-001

Chet Poslusny, Senior Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of the Nuclear Reactor Regulation

Subject: Submittal Supporting Accelerated ABWR Review Schedule - **Startup Testing**

Dear Chet:

Enclosed is a SSAR markup of the startup testing portion of Chapter 14. This markup was originally provided to the NRC on October 13, 1992.

Please provide a copy of this transmittal to Frank Talbot.

Sincerely,

Jack Fox

Jack Fox
Advanced Reactor Programs

cc: Norman Fletcher (DOE) w/o enclosure
H. J. Huang (GE) w/o enclosure

See attached list

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14.2.11 Test Program Schedule

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Power ascension testing will be conducted in essentially three phases: 1) Initial fuel loading and open vessel testing; 2) Testing during nuclear heatup to rated temperature and pressure; and, 3) power operation testing from 5% to 100% rated power. Further, power operation testing will be divided into three sequential testing plateaus as shown on Figure 14.2-1. The testing plateaus consist of low power testing at less than 25% power, mid power testing up to about 75% power between approximately the 50% and 75% rod lines, and high power testing along the 100% rod line up to rated power. Thus, there will be a total of five different testing plateaus designated as described on Figure 14.2-1. Table 14.2-1 indicates in which testing plateaus the various power ascension tests will be performed. Although the order of testing within a given plateau is somewhat flexible, the normal recommended sequence of tests would be: 1) core performance analysis; 2) steady state tests; 3) control system tuning; 4) system transient tests; and, 5) major plant transients (including trips). Also, for a given testing plateau, testing at lower power (and flow corner) levels should generally be performed prior to that at higher power (and flow) levels. The detailed testing schedule will be generated by the applicant referencing the ABWR Standard Plant design and will be made available to the NRC prior to actual implementation. The schedule will then be ~~and~~ maintained at the job site so that it may be updated and continually optimized to reflect actual progress and subsequent revised projections.

A detailed description of the specific test conditions (i.e., power and flow levels) and any special requirements for each listed power ascension tests will be provided in the individual test procedure for each such test as described in SSAR Section 14.2.3.

service water systems should be operational, and other required interfacing systems should be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

Performance should be observed and recorded during a series of component and system tests to demonstrate the following:

(a) proper operation of instrumentation and alarms used to monitor system operation and status;

(b) proper operation of active cooling devices, if applicable, such as forced or natural draft towers, spray ponds, etc.; and

(c) the adequacy of intake and discharge structures, including screens or strainers, or other interfaces with the circulating water system, such as freeze protection devices, as applicable.

Operation is acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.2 General Discussion of Startup Tests

Those tests proposed and expected to comprise the startup test phase are discussed in this subsection. For each test a general description is provided for test purpose, test prerequisites, test description and test acceptance criteria, where applicable.

Since additions, deletions, and changes to these discussions are expected to occur as the test program is developed and implemented, the descriptions remain general in scope. In describing a test however, an attempt is made to identify those operating and safety-oriented characteristics of the plant which are being explored and evaluated.

Where applicable, the relevant acceptance criteria for the test are discussed. Some of these relate to the value of process variables assigned in the design or analysis of the plant, component systems, and associated equipment. If a criterion of this nature is not satisfied, the plant will be placed in a suitable hold condition until resolution is obtained. Tests compatible with this hold condition may be continued. Following resolution, applicable tests may be repeated to verify that the requirements of the criterion are ultimately satisfied. Other criteria may be associated with expectations relating to the performance of systems. If this type of criterion is not satisfied, operating and testing plans would not necessarily be altered. However, investigations of the measurements and of the analytical techniques used for the predictions would be started. Specific actions for dealing with criteria failures and other testing exceptions or anamolies will be described in the startup administrative manual.

The specifics of the startup tests relating to test methodology, plant prerequisites, initial conditions, acceptance criteria, analysis techniques, and the likes, will come from the appropriate design and engineering organizations in the form of plant, system and component performance and testing specifications.

14.2.12.2.1 Chemical and Radiochemical Measurements

(1) Purpose

To secure information on the chemistry and radiochemistry of the reactor coolant while verifying that the sampling equipment, procedures and analytic techniques are adequate to supply the data required to demonstrate that the chemistry of all parts of the entire reactor system meet specifications and process requirements.

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedures and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all prerequisite testing complete. Instrumentation has been checked or calibrated as appropriate.

(3) Description

Specific objectives of the test program include evaluation of fuel performance, evaluations of demineralizer operations by direct and indirect methods, measurements of filter performance, confirmation of condenser integrity, demonstration of proper steam separator-dryer operation, measurement and calibration of the offgas system, and evaluation and calibration of certain process instrumentation (including that used to monitor reactor water conductivity). An additional objective [illegible] demonstration, and adjustment if necessary, of the proper functioning of the hydrogen water chemistry system, the oxygen injection system, the zinc injection passivation system and the iron ion injection system. Data for these purposes is secured from a variety of sources such as plant operating records, regular routine coolant analysis, radiochemical measurements of specific nuclides, and special chemical tests.

Prior to fuel loading a complete set of chemical and radiochemical samples will be taken to ensure that all sample stations are functioning properly, if not demonstrated during the preoperational testing, and to determine initial concentrations. Subsequent to fuel loading, during reactor heatup, and at each major power level change, samples will be taken and measurements will be made to determine the chemical and radiochemical quality of reactor water and incoming feedwater, amount of radiolytic gas in the steam, gaseous activities leaving the air ejectors, decay times in the offgas lines, and performance of filters and demineralizers.

Calibrations will be made of monitors in effluent release paths, waste handling systems, and process lines. Proper functioning of such monitors will be verified, as appropriate, including via comparison with independent laboratory or other analyses. In particular, the proper operation of failed fuel detection functions of the main steamline and offgas pretreatment process radiation monitors will be verified. In this regard, sufficient data will be taken to assure proper setting of, or to make needed adjustments to, the alarm and trip settings of the applicable instrumentation.

(4) Criteria

Chemical factors defined in the Technical Specifications must be maintained within the limits specified.

The activity of gaseous and liquid effluents must conform to license limitations.

Water quality should be known at all times and shall remain within the guidelines of the water quality specifications and the requirements of the Fuel Warranty document.

14.2.12.2.2 Radiation Measurements

(1) Purpose

To determine the background radiation levels in the plant environs prior to operation for base data on activity buildup and to monitor radiation at selected power levels to assure the protection of personnel during plant operation.

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedures and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. Instrumentation has been checked or calibrated as appropriate.

(but prior to initial criticality)

(3) Description

A survey of natural background radiation throughout the plant site will be made prior to fuel loading. Subsequent to fuel loading, during reactor heatup, and at several power levels up to and including rated power, gamma dose rate measurements and, where appropriate, neutron dose rate mesurements will be made at specific locations throughout the plant. All potentially high radiation areas will be surveyed including:

(a) containment penetrations;

(b) all accessible areas where intermittent activities have the potential to produce transient high radiation conditions before, during, and after such operations; and

(c) a complete survey of all accessible floor areas within the plant prior to fuel loading, at intermediate powers, and at full power.

(4) Criteria

Level 1

Level 2 not Applicable

The radiation doses of plant origin and the occupancy times of personnel in radiation zones shall be controlled consistent with the guidelines outlined in 10CFR20 "Standards for Protection Against Radiation".

14.2.12.2.3 Fuel Loading

(1) Purpose

To load fuel safely and efficiently to the full core size.

(2) Prerequisites

The plant has received the proper license from the NRC to proceed with fuel loading and plant management has reviewed the applicable procedures and the overall plant readiness, and has approved the initiation of loading.

Additionally, the following requirements will be met prior to commencing fuel loading to assure that this operation is performed in a safe manner:

(a) the status of all systems required for fuel loading will be specified and will be in the status required;

(b) fuel and control rod inspections will be complete. Control rods will be installed and tested;

(c) the required number of neutron detectors will be calibrated and operable, connected to conservatively set high flux scram trips, and located and adjusted to provide acceptable signals during fuel loading;

(d) nuclear instruments will be source checked with a neutron source prior to loading;

(e) the status of secondary containment will be specified and established;

(f) reactor vessel status will be specified relative to internal component placement and this placement established to make the vessel ready to receive fuel;

(g) final functional testing of the reactor protection system to demonstrate proper trip points and logic, as well as the operability of scram breakers and valves, and manual scram functions will have been completed;

(h) final reactor coolant system leak rate test(s) to verify that system leak rates are within specified limits will have been completed;

(i) reactor vessel water level will be established above the minimum level prescribed; and

(j) all other required systems shall be operable as defined by the plant technical specifications and as demonstrated by the applicable surveillance tests.

(3) Description

Fuel loading will commence and proceed according to detailed written procedures in a predetermined sequence that will assure a

vity, with the analytically determined highest worth rod pair fully withdrawn (a rod pair is defined as having a shared accumulator).

14.2.12.2.4 Full Core Shutdown Margin Demonstration

(1) Purpose

To demonstrate that the reactor will be subcritical throughout the first fuel cycle with the highest worth control rod pair (two CRDs with a shared accumulator) fully withdrawn.

(2) Prerequisites

The following prerequisites will be met prior to performing the full core shutdown margin tests:

(a) the predicted critical position will be available;

(b) the Standby Liquid Control System will be available;

(in the non-coincident trip mode)

(c) nuclear instrumentation will be available with the minimum neutron count rate and signal-to-noise ratio as specified by technical specifications; and

(d) high-flux scram trips (and rod block) are set conservatively low.

(3) Description

This test will be performed in the fully loaded core in the xenon-free condition. The shutdown margin test will be performed by withdrawing the control rods from the all-rods-in configuration until criticality is reached. If the highest worth rod pair will not be withdrawn in sequence, other rods may be withdrawn providing that the reactivity worth is equivalent. The difference between the measured K_{eff} and the calculated K_{eff} for the insequence critical will be applied to the calculated value to obtain the true shutdown margin.

(4) Criteria

Level 1

The shutdown margin of the fully loaded, cold (68°F), xenon-free core occurring at the most reactive time during the cycle must be at least that amount required by technical specifications with the analytically strongest rod pair (or the reactivity equivalent) fully withdrawn. If the shutdown margin is determined at some time during the cycle other than the most reactive time, compliance with the above criterion is shown by demonstrating that the shutdown margin is the specified amount plus an exposure dependent correction factor which adjusts for the difference in core reactivity between the most reactive time and the time at which the shutdown margin is demonstrated. ~~Additionally, criticality should occur within the specified tolerance of the predicted critical.~~

Level 2

Criticality should occur within the specified tolerance of the predicted critical.

14.2.12.2.5 Control Rod Drive System Performance

(1) Purpose

To demonstrate that the control rods operate properly over the full range of primary coolant temperatures and pressures from ambient to operating, in both the scram and fine motion control modes, in conjunction with the rod control and information system (RC&IS).

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedures and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. The applicable instrumentation shall be checked or calibrated as appropriate.

(3) Description

The control rod drive (CRD) testing performed during the heatup and power ascension phases of the startup test program is designed as an extension of the testing performed during the preoperational phase.

(3) Description

A survey of natural background radiation throughout the plant site will be made prior to fuel loading. Subsequent to fuel loading, during reactor heatup, and at several power levels up to and including rated power, gamma dose rate measurements and, where appropriate, neutron dose rate mesurements will be made at specific locations throughout the plant. All potentially high radiation areas will be surveyed including:

(a) containment penetrations;

(b) all accessible areas where intermittent activities have the potential to produce transient high radiation conditions before, during, and after such operations; and

(c) a complete survey of all accessible floor areas within the plant prior to fuel loading, at intermediate powers, and at full power.

(4) Criteria

The radiation doses of plant origin and the occupancy times of personnel in radiation zones shall be controlled consistent with the guidelines outlined in 10CFR20 "Standards for Protection Against Radiation".

14.2.12.2.3 Fuel Loading

(1) Purpose

To load fuel safely and efficiently to the full core size.

(2) Prerequisites

The plant has received the proper license from the NRC to proceed with fuel loading and plant management has reviewed the applicable procedures and the overall plant readiness, and has approved the initiation of loading.

Additionally, the following requirements will be met prior to commencing fuel loading to assure that this operation is performed in a safe manner:

(a) the status of all systems required for fuel loading will be specified and will be in the status required;

(b) fuel and control rod inspections will be complete. Control rods will be installed and tested;

(c) the required number of neutron detectors will be calibrated and operable, connected to conservatively set high flux scram trips, and located and adjusted to provide acceptable signals during fuel loading;

(d) nuclear instruments will be source checked with a neutron source prior to loading;

(e) the status of secondary containment will be specified and established;

(f) reactor vessel status will be specified relative to internal component placement and this placement established to make the vessel ready to receive fuel;

(g) final functional testing of the reactor protection system to demonstrate proper trip points and logic, as well as the operability of scram breakers and valves, and manual scram functions will have been completed;

(h) final reactor coolant system leak rate test(s) to verify that system leak rates are within specified limits will have been completed;

(i) reactor vessel water level will be established above the minimum level prescribed; and

(j) all other required systems shall be operable as defined by the plant technical specifications and as demonstrated by the applicable surveillance tests.

(3) Description

Fuel loading will commence and proceed according to detailed written procedures in a predetermined sequence that will assure a

safe and efficient loading. The neutron count rates shall be monitored as the core loading progresses to ensure continuous subcriticality and shutdown margin demonstrations will be performed at specified loading intervals.

(4) Criteria

Level 1

The partially loaded core at the applicable intervals must be subcritical by at least the specified amount (in terms of reacti-

specified on the Cycle Management Report or Vendor's prediction

vity) with the analytically determined highest worth rod pair fully withdrawn (a rod pair is defined as having a shared accumulator).

see 2 (not Applicable)

14.2.12.2.4 Full Core Shutdown Margin Demonstration

(1) Purpose

To demonstrate that the reactor will be subcritical throughout the first fuel cycle with the highest worth control rod pair (two CRDs with a shared accumulator) fully withdrawn.

(2) Prerequisites

The following prerequisites will be met prior to performing the full core shutdown margin tests:

(a) the predicted critical rod position will be available;

(b) the Standby Liquid Control System will be available;

(c) nuclear instrumentation will be available with the minimum neutron count rate and signal-to-noise ratio as specified by technical specifications; and

(d) high-flux scram trips are set conservatively low.

(3) Description

This test will be performed in the fully loaded core in the xenon-free condition. The shutdown margin test will be performed by withdrawing the control rods from the all-rods-in configuration until criticality is reached. If the highest worth rod pair will not be withdrawn in sequence, other rods may be withdrawn providing that the reactivity worth is equivalent. The difference between the measured K_{eff} and the calculated K_{eff} for the insequence critical will be applied to the calculated value to obtain the true shutdown margin.

(4) Criteria

The shutdown margin of the fully loaded, cold (68°F), xenon-free core occurring at the most reactive time during the cycle must be at least that amount required by technical specifications with the analytically strongest rod pair (or the reactivity equivalent) fully withdrawn. If the shutdown margin is determined at some time during the cycle other than the most reactive time, compliance with the above criterion is shown by demonstrating that the shutdown margin is the specified amount plus an exposure dependent correction factor which adjusts for the difference in core reactivity between the most reactive time and the time at which the shutdown margin is demonstrated. Additionally, criticality should occur within the specified tolerance of the predicted critical.

14.2.12.2.5 Control Rod Drive System Performance

(1) Purpose

To demonstrate that the control rods operate properly over the full range of primary coolant temperatures and pressures from ambient to operating, in both the scram and fine motion control modes, in conjunction with the rod control and information system (RC&IS).

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedures and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. The applicable instrumentation shall be checked or calibrated as appropriate.

(3) Description

The control rod drive (CRD) testing performed during the heatup and power ascension phases of the startup test program is designed as an extension of the testing performed during the preoperational phase.

vity, with the analytically determined highest worth rod pair fully withdrawn (a rod pair is defined as having a shared accumulator).

14.2.12.2.4 Full Core Shutdown Margin Demonstration

(1) Purpose

To demonstrate that the reactor will be subcritical throughout the first fuel cycle with the highest worth control rod pair (two CRDs with a shared accumulator) fully withdrawn.

(2) Prerequisites

The following prerequisites will be met prior to performing the full core shutdown margin tests:

(a) the predicted critical rod position will be available;

(b) the Standby Liquid Control System will be available;

(c) nuclear instrumentation will be available with the minimum neutron count rate and signal-to-noise ratio as specified by technical specifications; and

(d) high-flux scram trips are set conservatively low.

(3) Description

This test will be performed in the fully loaded core in the xenon-free condition. The shutdown margin test will be performed by withdrawing the control rods from the all-rods-in configuration until criticality is reached. If the highest worth rod pair will not be withdrawn in sequence, other rods may be withdrawn providing that the reactivity worth is equivalent. The difference between the measured K_{eff} and the calculated K_{eff} for the insequence critical will be applied to the calculated value to obtain the true shutdown margin.

(4) Criteria

The shutdown margin of the fully loaded, cold (68°F), xenon-free core occurring at the most reactive time during the cycle must be at least that amount required by technical specifications with the analytically strongest rod pair (or the reactivity equivalent) fully withdrawn. If the shutdown margin is determined at some time during the cycle other than the most reactive time, compliance with the above criterion is shown by demonstrating that the shutdown margin is the specified amount plus an exposure dependent correction factor which adjusts for the difference in core reactivity between the most reactive time and the time at which the shutdown margin is demonstrated. Additionally, criticality should occur within the specified tolerance of the predicted critical.

14.2.12.2.5 Control Rod Drive System Performance

(1) Purpose

To demonstrate that the control rods operate properly over the full range of primary coolant temperatures and pressures from ambient to operating, in both the scram and fine motion control modes, in conjunction with the rod control and information system (RC&IS).

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedures and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. The applicable instrumentation shall be checked or calibrated as appropriate.

(3) Description

The control rod drive (CRD) testing performed during the heatup and power ascension phases of the startup test program is designed as an extension of the testing performed during the preoperational phase.

Thus, after it is verified that all CRDs operate properly when installed, tests are performed periodically during heatup to assure that there is no significant binding caused by thermal expansion of the core components and no significant effect on performance due to increased pressure, power or flow. Additionally, software functions such as those associated with the RC&IS are tested to the extent that they could not be checked during preoperational testing. Testing will also be conducted to verify proper operation of the SCRRI logic and function. The particular testing of the SCRRI function might be conducted, at least in part, with the RIP trip test described in 14.2.12.2.30 where the planned trip will automatically result in SCRRI actuation.

(4) Criteria

Each CRD shall have a measured scram time that is less than the technical specifications requirements and consistent with safety analysis assumptions during both individual rod pair and full core scrams, as applicable. Each CRD shall have a measured insert/withdrawal speed consistent with specified design requirements including those associated with group or gang movement. Additionally, the CRDs shall meet friction test requirements and those for demonstrating proper operation of rod deceleration devices. Also, all software functions or features shall perform as specified.

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14.2.12.2.6 Neutron Monitoring System Performance

(1) Purpose

To verify response, calibration and operation of startup range neutron monitors (SRNMs), local power range monitors (LPRMs), average power range monitors (APRMs), traversing in-core probes (TIPs), and other hardware and software of the neutron monitoring system during fuel loading, control rod withdrawal, heatup and power ascension.

(2) Prerequisites

The applicable preoperational phase testing is complete and the plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled test iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. The applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Testing of the neutron monitoring system will commence prior to fuel load and will continue at intervals up to and including rated power. The SRNMs and operational sources will be tested during fuel loading and during rod withdrawal on the approach to criticality and heatup to rated temperature and pressure. The LPRMs, APRMs and TIPs will be tested as soon as sufficient flux levels exist and at specified intervals during the ascension to rated power. Testing will include response checks, calibrations and verification of system software calculations using actual core flux levels and other live plant inputs.

(4) Criteria

The SRNMs, in conjunction with the installed neutron sources, shall have count rates and signal-to-noise ratios that meet technical specifications and/or design requirements, as applicable. The respective range functions of the SRNMs and APRMs shall provide for overlapping neutron flux indication as required by plant technical specifications and the applicable design specifications. The APRMs shall be calibrated against core thermal power by means of a heat balance. The accuracy of this calibration ~~should~~ shall be consistent with technical specifications. When technical specifications are not applicable the APRMs ~~should~~ shall conservatively indicate reactor power. The LPRMs ~~should~~ shall be calibrated consistent with design calibration and accuracy requirements. Additionally, all system hardware and software shall function properly in response to actual core flux levels.

Insert F

Coupling test will be performed by withdrawing each drive to the overtravel out position. Each CRD will also be demonstrated insert/withdraw motions in response to rod movement commands from the RCIS, individually and as a ganged group, while in notch driving and continuous driving modes. The scram performance will be demonstrated at cold conditions with ambient pressure and at rated temperature and pressure by both Two-CRD (single HCU) scram tests and full core (all CRDs) scram tests. In addition, the drive line friction will be measured in terms of the pressure under hollow piston for each CRD at cold conditions and again verified on four selected CRDs at rated temperature and pressure conditions during initial heatup of the startup test program.

(4) Criteria

Level 1

Each CRD must have a maximum withdraw speed in the continuous driving mode no greater than the value specified by the CRD System Design Specification.

For vessel pressure between 950 psig and 1050 psig, the maximum scram insertion time of individual fully withdrawn control rods to each specified positions, based on de-energization of scram pilot valve solenoids as time zero, shall be less than or equal to the limits specified on the plant Technical Specifications.

Level 2

Each CRD must have a continuous rod motion speed in insert or withdraw direction as specified by the applicable CRD System Design Specification.

For continuous insert friction tests, the measured drive line friction shall be consistent with the baseline data obtained during pre-operational test (SSAR Section 14.2.12.1.6).

For scram tests at cold conditions with ambient pressure, the 60% scram insertion time for each CRD from fully withdrawn position, based on de-energization of scram pilot valve solenoids as time zero, must be less than or equal to the limit specified by the plant Technical Specifications.

For continuous ganged rod motion, the rods shall move together such that the positions of all rods agree with all other rods in each ganged group within the tolerance specified by the CRD System Design Specifications. A rod block shall be initiated if the rod positions within the rod ganged group disagree by more than this specified tolerance.

Thus, after it is verified that all CRDs operate properly when installed, tests are performed periodically during heatup to assure that there is no significant binding caused by thermal expansion of the core components and no significant effect on performance due to increased pressure, power or flow. Additionally, software functions such as those associated with the RC&IS are tested to the extent that they could not be checked during preoperational testing. Testing will also be conducted to verify proper operation of the SCRRI logic and function. The particular testing of the SCRRI function might be conducted, at least in part, with the RIP trip test described in 14.2.12.2.30 where the planned trip will automatically result in SCRRI actuation.

(4) Criteria

Each CRD shall have a measured scram time that is less than the technical specifications requirements and consistent with safety analysis assumptions during both individual rod pair and full core scrams, as applicable. Each CRD shall have a measured insert/withdrawal speed consistent with specified design requirements including those associated with group or gang movement. Additionally, the CRDs shall meet friction test requirements and those for demonstrating proper operation of rod deceleration devices. Also, all software functions or features shall perform as specified.

14.2.12.2.6 Neutron Monitoring System Performance

(1) Purpose

To verify response, calibration and operation of startup range neutron monitors (SRNMs), local power range monitors (LPRMs), average power range monitors (APRMs), traversing in-core probes (TIPs), and other hardware and software of the neutron monitoring system during fuel loading, control rod withdrawal, heatup and power ascension.

(2) Prerequisites

The applicable preoperational phase testing is complete and the plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled test iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. The applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Testing of the neutron monitoring system will commence prior to fuel load and will continue at intervals up to and including rated power. The SRNMs and operational sources will be tested during fuel loading and during rod withdrawal on the approach to criticality and heatup to rated temperature and pressure. The LPRMs, APRMs and TIPs will be tested as soon as sufficient flux levels exist and at specified intervals during the ascension to rated power. Testing will include response checks, calibrations and verification of system software calculations using actual core flux levels and other live plant inputs.

(4) Criteria

The SRNMs, in conjunction with the installed neutron sources, shall have count rates and signal-to-noise ratios that meet technical specifications and/or design requirements, as applicable. The respective range functions of the SRNMs and APRMs shall provide for overlapping neutron flux indication as required by plant technical specifications and the applicable design specifications. The APRMs shall be calibrated against core thermal power by means of a heat balance. The accuracy of this calibration should be consistent with technical specifications. When technical specifications are not applicable the APRMs should conservatively indicate reactor power. The LPRMs should be calibrated consistent with design calibration and accuracy requirements. Additionally, all system hardware and software shall function properly in response to actual core flux levels.

Insert H

Each SRNM channel will be adjusted for proper alignment between the counting flux and MSV flux ranges while operating at the overlap region. The SRNM reading will also be calibrated to indicate actual thermal power with acceptable tolerance in accordance with the plant Technical Specification requirements. The LPRM channel will first be checked for correct connections during initial heatup. Then, each LPRM channel will be calibrated to make the LPRM readings proportional to the neutron flux in the LPRM water gap at the chamber elevation. Each APRM channel reading will be adjusted to be consistent with the core thermal power as determined from a heat balance. The top and bottom limits for each ATIP channel to start and stop data acquisition will initially be established at cold condition. After the plant reaches rated temperature during initial heatup, the established top and bottom limits of each ATIP channel will be adjusted as necessary based on the comparison against fuel channel spacer dip locations. Proper ATIP alignment will finally be confirmed by determining ATIP uncertainties during power ascension to mid and high power levels. The total ATIP uncertainty (including random noise and geometry uncertainty components) is determined by averaging

Insert H

the uncertainties for all ATIP data sets obtained during the test.

Insert G

Level 1

Each required operable SRNM shall have a count-rate signal with a signal-to-noise ratio of at least 3:1 and a signal count rate of at least 3 counts per second.

Each required operable SRNM shall be calibrated to read actual core thermal power within the tolerance as required by plant Technical Specifications.

Each required operable SRNM shall be adjusted so that a bumpless transfer is achieved when transferring between the counting and MSV flux ranges.

At reactor power ≥ 25% of rated, the APRM channels must be calibrated to read equal to actual core thermal power as calculated by a heat balance within the tolerance specified by plant Technical Specifications.

Level 2

Each SRNM channel shall overlap with the APRMs consistent with the requirements of applicable Neutron Monitoring System Design Specification.

Each LPRM reading will agree with its calibrated value within the accuracy specified by the GE Startup Test Specifications.

Insert G (Cont'd)

The total ATIP uncertainty (including random noise and geometry uncertainty components) shall be less than the limits specified by the GE Startup Test Specifications.

14.2.12.2.7 Process Computer System Operation

(1) Purpose

To verify the ability of the process computer system (PCS) to collect, process, and display plant data, execute plant performance calculations, and interface with

various plant control systems during actual plant operating conditions.

(2) Prerequisites

The applicable preoperational tests have been completed and plant management has reviewed the testing procedure(s) and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete.

(3) Description

INSERT A

During plant heatup and the ascension to rated power the various NSSS and BOP process variables that are monitored by the PCS begin to enter their respective ranges for normal plant operation. During this time it will be verified that the PCS correctly receives, validates, processes, and displays the applicable plant information. Recording and playback features will also be tested. Data manipulation and plant performance calculations using actual plant inputs will be verified for accuracy, using independent calculations for comparison. Also, the ability of the PCS to interface correctly with other plant control systems during operation will be demonstrated.

(4) Criteria

INSERT B

~~The performance of the PCS shall be as specified by the applicable design requirements. Additionally, plant performance calculations, especially those used to demonstrate compliance with core thermal limits, shall meet the accuracy requirements of the applicable plant safety analysis design assumptions.~~

14.2.12.2.8 Core Performance

(1) Purpose

To demonstrate that the various core and reactor performance characteristics such as power versus flow, core power distributions, and those parameters used to demonstrate compliance with core thermal limits and plant license conditions are in accordance with design limits and expectations.

(2) Prerequisites

The applicable preoperational tests have been completed and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete, especially on plant systems to be used for collection or evaluation of pertinent data.

(3) Description

This test will collect data sufficient to demonstrate that reactor and core performance characteristics remain within design limits and expectations for all operational conditions which the plant is normally expected to encounter. Beginning with rod withdrawal and continuing through initial criticality, plant heatup, and the ascension to rated power, pertinent data will be collected at various rod patterns and power and flow conditions sufficient to determine the axial and radial core power distributions, compliance with core thermal limits, and the level of consistency with predicted core reactivity and power versus flow characteristics. Unusual plant conditions such as during control rod sequence exchange or natural circulation will also be investigated, if applicable.

(4) Criteria

Technical specification and license condition requirements involving core thermal limits, maximum power level, total core flow, and any observed reactivity anamolies or core instabilities shall be met when applicable. Other observations should meet predictions and expectations or else ~~should~~ shall be evaluated and explained accordingly.

14.2.12.2.9 Nuclear Boiler Process Monitoring

(1) Purpose

To verify proper operation of various nuclear boiler process instrumention and to collect pertinent data from such instrumenta-

Insert A

Computer system program verifications and calculational validations are accomplished through the implementation of both static and dynamic test cases. Static and simulated dynamic test cases are performed at the computer supplier's site and following delivery to the plant site during the preoperational test phase. Dynamic test cases are performed beginning with plant heatup and continuing through the ascension to rated power and flow conditions.

Insert B

Level 1

Not Applicable

Level 2

The NSSS performance calculation programs that calculate the core performance parameters (MCPR, MAPLHGR, and MLHGR) and LPRM gain adjustment factors shall produce results that agree with an independent method of calculation within the accuracy specified by the GE Startup Test Specifications.

The remaining NSSS and BOP programs will be considered operational upon successful completion of the static and dynamic testing.

various plant control systems during actual plant operating conditions.

(2) Prerequisites

The applicable preoperational tests have been completed and plant management has reviewed the testing procedure(s) and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete.

(3) Description

During plant heatup and the ascension to rated power the various NSSS and BOP process variables that are monitored by the PCS begin to enter their respective ranges for normal plant operation. During this time it will be verified that the PCS correctly receives, validates, processes, and displays the applicable plant information. Recording and playback features will also be tested. Data manipulation and plant performance calculations using actual plant inputs will be verified for accuracy, using independent calculations for comparison. Also, the ability of the PCS to interface correctly with other plant control systems during operation will be demonstrated.

(4) Criteria

The performance of the PCS shall be as specified by the applicable design requirements. Additionally, plant performance calculations, especially those used to demonstrate compliance with core thermal limits, shall meet the accuracy requirements of the applicable plant safety analysis design assumptions.

14.2.12.2.8 Core Performance

(1) Purpose

To demonstrate that the various core and reactor performance characteristics such as power versus flow, core power distributions, and those parameters used to demonstrate compliance with core thermal limits and plant license conditions are in accordance with design limits and expectations.

(2) Prerequisites

The applicable preoperational tests have been completed and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete, especially on plant systems to be used for collection or evaluation of pertinent data.

(3) Description

This test will collect data sufficient to demonstrate that reactor and core performance characteristics remain within design limits and expectations for all operational conditions which the plant is normally expected to encounter. Beginning with rod withdrawal and continuing through initial criticality, plant heatup, and the ascension to rated power, pertinent data will be collected at various rod patterns and power and flow conditions sufficient to determine the axial and radial core power distributions, compliance with core thermal limits, and the level of consistency with predicted core reactivity and power versus flow characteristics. Unusual plant conditions such as during control rod sequence exchange or natural circulation will also be investigated, if applicable.

(4) Criteria

Technical specification and license condition requirements involving core thermal limits, maximum power level, total core flow, and any observed reactivity anamolies or core instabilities shall be met when applicable. Other observations should meet predictions and expectations or else should be evaluated and explained accordingly.

14.2.12.2.9 Nuclear Boiler Process Monitoring

(1) Purpose

To verify proper operation of various nuclear boiler process instrumention and to collect pertinent data from such instrumenta-

Insert D

Level 1

The Maximum Planar Linear Heat Generation Rate (MAPLHGR) shall not exceed the limits specified by the plant Technical Specifications.

The steady-state Minimum Critical Power Ratio (MCPR) shall exceed the minimum limit specified by the plant Technical Specifications.

For any non-GE fuel only, the Maximum Linear Heat Generation Rate (MLHGR) shall not exceed the limits specified by the plant Technical Specifications.

Steady-state reactor power shall be limited to the design rated core thermal power and values on or below the minimum of either rated thermal power or the licensed highest flow control line as shown on the Power-Flow map.

Core flow as indicated by operating data shall not exceed its design rated value.

Level 2

Not Applicable

various plant control systems during actual plant operating conditions.

(2) Prerequisites

The applicable preoperational tests have been completed and plant management has reviewed the testing procedure(s) and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete.

(3) Description

During plant heatup and the ascension to rated power the various NSSS and BOP process variables that are monitored by the PCS begin to enter their respective ranges for normal plant operation. During this time it will be verified that the PCS correctly receives, validates, processes, and displays the applicable plant information. Recording and playback features will also be tested. Data manipulation and plant performance calculations using actual plant inputs will be verified for accuracy, using independent calculations for comparison. Also, the ability of the PCS to interface correctly with other plant control systems during operation will be demonstrated.

(4) Criteria

The performance of the PCS shall be as specified by the applicable design requirements. Additionally, plant performance calculations, especially those used to demonstrate compliance with core thermal limits, shall meet the accuracy requirements of the applicable plant safety analysis design assumptions.

14.2.12.2.8 Core Performance

(1) Purpose

To demonstrate that the various core and reactor performance characteristics such as power versus flow, core power distributions, and those parameters used to demonstrate compliance with core thermal limits and plant license conditions are in accordance with design limits and expectations.

(2) Prerequisites

The applicable preoperational tests have been completed and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete, especially on plant systems to be used for collection or evaluation of pertinent data.

(3) Description

This test will collect data sufficient to demonstrate that reactor and core performance characteristics remain within design limits and expectations for all operational conditions which the plant is normally expected to encounter. Beginning with rod withdrawal and continuing through initial criticality, plant heatup, and the ascension to rated power, pertinent data will be collected at various rod patterns and power and flow conditions sufficient to determine the axial and radial core power distributions, compliance with core thermal limits, and the level of consistency with predicted core reactivity and power versus flow characteristics. Unusual plant conditions such as during control rod sequence exchange or natural circulation will also be investigated, if applicable.

(4) Criteria

Technical specification and license condition requirements involving core thermal limits, maximum power level, total core flow, and any observed reactivity anamolies or core instabilities shall be met when applicable. Other observations should meet predictions and expectations or else ~~should~~ shall be evaluated and explained accordingly.

14.2.12.2.9 Nuclear Boiler Process Monitoring

(1) Purpose

To verify proper operation of various nuclear boiler process instrumention and to collect pertinent data from such instrumenta-

tion at various plant operating conditions in order to validate design assumptions and identify any operational limitations that may exist.

(2) Prerequisites

The applicable preoperational testing has been completed and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete.

(3) Description

During plant heatup and power ascension pertinent parameters such as reactor coolant temperature, vessel dome pressure, vessel water level, and core flow will be monitored at selected intervals and plant conditions. This data will be used to verify proper instrument response to changing plant conditions and to document the relationships amongst these parameters and with other important parameters such as reactor power, feedwater flow and steam flow. The data will also be used to validate design assumptions such as those used in the calibration of vessel level or core flow indication. Additionally, the data will be used to help identify potential operational condition limitations such as excessive coolant temperature stratification in the vessel bottom head region.

Insert I

(4) Criteria

The various nuclear boiler process instrumentation shall operate as designed in response to changes in plant conditions. The observed process characteristics shall be conservative relative to applicable safety analysis assumptions and should be consistent with design expectations.

Insert J

14.2.12.2.10 System Expansion

(1) Purpose

The purpose of the thermal expansion test is to confirm that the pipe suspension system is working as designed and the piping is free of obstructions that could constrain free pipe movement caused by thermal expansion.

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedures and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. The applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

The thermal expansion tests consist of measuring displacements and temperatures of piping during various operating modes. The first power level used to verify expansion shall be as low as practicable. Thermal movement and temperature measurements ~~should~~ Shall be recorded at at least the following test points (following a suitable hold period to assure steady state temperatures):

(a) during reactor pressure vessel heatup at at least one intermediate temperature prior to reaching normal operating temperature, including an inspection of the piping and its suspension for obstructions or inoperable supports;

(b) following reactor pressure vessel heat up to normal operating temperature;

(c) following heatup of other piping systems to normal operating temperature (those systems whose heatup cycles differ from (2) above); and

(d) on subsequent heatup/cooldown cycles, as specified, at the applicable operating and shutdown temperatures, to measure possible shakedown effects.

Thermal expansion shall be conducted on plant systems of the following classifications:

Insert I

At rated temperature and pressure during initial heatup and under steady-state conditions during power ascension, reactor vessel level indication from the various water level instruments will be monitored and recorded. Data collected at various operating conditions will be used to define the effect of core flow velocity, subcooling, and carryunder on indicated wide range level. Additionally, the temperature of the reference legs of reactor vessel water level instrumentation shall be monitored for comparison with the initial calibration assumption

During various operating modes throughout the ascension to rated power conditions, the bottom drain line temperature, reactor coolant temperature, and other applicable indications of reactor coolant temperatures will be monitored and recorded. The collected data will be used to identify any potential stratification in the vessel bottom head region, either with all RIPs in operation or with one or more RIPs inactive.

At several power-flow conditions during ascension to rated power, pertinent data such as: RIP pump deck delta-P, RIP pump speed, core plate delta-P, and other applicable reactor parameters, will be recorded and used as inputs to determine total core flow based on the CPdP (core plate differential pressure) and PDdP (pump deck differential pressure)

methods of flow calculations and conversions. The coefficients used in the CPdP method will be calibrated against the results of the PDdP method. The CPdP flow results are used in both the RFC process control and in safety function trips. The PDdP core flow signal is used as an input to the MCPR calculations in addition to being used as a calibration source of the CPdP core flow.

Level 1

An idle recirculation pump shall not be started unless the temperature difference between vessel bottom coolant temperature and the saturated water temperature inferred from steam dome pressure is within the limit (i.e. 144°F, as specified by SSAR Section 7.7.1.3.(5).

Level 2

The APRM instrument performing the APRM calculations shall provide correct core flow data to Data Communication Function at rated conditions.

The flow reference logic shall provide correct flow-biased setpoint values for the APRM alarm and thermal power trip function of the APRM at rated conditions.

The difference between the actual reference leg temperatu and the value(s) assumed during initial calibration shall be less than that amount which will result in a scale end point error as specified in the GE Startup Test Specifications (i.e., 1% of the instrument span for each range).

With all recirculation pumps in operation at rated core flow and power conditions, the bottom head temperature as measured by the bottom drain line thermocouple shall agree with the saturated water temperature corresponding to steam dome pressure

within the accuracy specified by the GE
Startup Test Specifications.

tion at various plant operating conditions in order to validate design assumptions and identify any operational limitations that may exist.

(2) Prerequisites

The applicable preoperational testing has been completed and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete.

(3) Description

During plant heatup and power ascension pertinent parameters such as reactor coolant temperature, vessel dome pressure, vessel water level, and core flow will be monitored at selected intervals and plant conditions. This data will be used to verify proper instrument response to changing plant conditions and to document the relationships amongst these parameters and with other important parameters such as reactor power, feedwater flow and steam flow. The data will also be used to validate design assumptions such as those used in the calibration of vessel level or core flow indication. Additionally, the data will be used to help identify potential operational condition limitations such as excessive coolant temperature stratification in the vessel bottom head region.

(4) Criteria

The various nuclear boiler process instrumentation shall operate as designed in response to changes in plant conditions. The observed process characteristics shall be conservative relative to applicable safety analysis assumptions and should be consistent with design expectations.

14.2.12.2.10 System Expansion

(1) Purpose

The purpose of the thermal expansion test is to confirm that the pipe suspension systems (both NSSS and Balance-of-Plant (BOP)) is working as designed and the piping is free of obstructions that could constrain free pipe movement caused by thermal expansion.

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedures and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. The applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

(Insert 5)

~~The thermal expansion tests consist of measuring displacements and temperatures of piping during various operating modes. The first power level used to verify expansion shall be as low as practicable. Thermal movement and temperature measurements should (shall) be recorded at at least the following test points (following a suitable hold period to assure steady state temperatures):~~

~~(a) during reactor pressure vessel heatup at at least one intermediate temperature prior to reaching normal operating temperature, including an inspection of the piping and its suspension for obstructions or inoperable supports;~~

~~(b) following reactor pressure vessel heat up to normal operating temperature;~~

~~(c) following heatup of other piping systems to normal operating temperature (those systems whose heatup cycles differ from (2) above); and~~

~~(d) on subsequent heatup/cooldown cycles, as specified, at the applicable operating and shutdown temperatures, to measure possible shakedown effects.~~

~~Thermal expansion shall be conducted on plant systems of the following classifications:~~

(a) ASME Code Class 1, 2, and 3 systems;

(b) high energy piping systems inside Seismic Category I structures;

(c) high energy portions of systems whose failure could reduce the functioning of any Seismic Category I plant features to an unacceptable level; and

(d) Seismic Category I portions of moderate energy piping systems located outside containment.

(4) Criteria

The thermal expansion acceptance criteria are based upon the actual movements being within a prescribed tolerance of the movements predicted by analysis. Measured movements are not expected to precisely correspond with those mathematically predicted. Therefore, a tolerance is specified for differences between measured and predicted movement. The tolerances are based on consideration of measurement accuracy, suspension free play, and piping temperature distributions. If the measured movement does not vary from the predictions by more than the specified tolerance, the piping is expanding in a manner consistent with predictions and is therefore acceptable. Tolerances should be the same for all operating test conditions. The locations to be monitored and the predicted displacements for the monitored locations in each plant will be provided by the applicable design or testing specification.

Insert V

shall

14.2.12.2.11 System Vibration

(1) Purpose

To verify that the vibration of critical plant system components and piping is within acceptable limits during normal steady state power operation and during expected operational transients.

(2) Prerequisites

The applicable preoperational phase testing is complete and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled test iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. The required remote monitoring instrumentation should be calibrated and operational.

Shall

(3) Description

Vibration testing during the power ascension phase will be limited to those systems that could not be adequately tested during the preoperational phase. Systems within the scope of this testing are therefore the same as mentioned in Subsection 14.2.12.1.51. However, the systems that remain to be tested will primarily be those exposed to and affected by steam flow and high rates of core flow. Due to the potentially high levels of radiation present during power operation, the testing will be performed using remote monitoring instrumentation. Displacement, acceleration, and strain data will be collected at various critical steady state operating conditions and during significant transients such as turbine or generator trip, main steamline isolation, SRV actuation and RIP trip (if not already performed). Steady state and transient vibration affecting the RCIC steamline will also be monitored.

(4) Criteria

Criteria will be calculated for those points monitored for vibration for both steady state and transient cases. Two levels of criteria will be generated, one level for predicted vibration and one level based on acceptable values of displacement and acceleration and the associated stress to assure that there will be no failures from fatigue over the life of the plant. Failures to remain within the predicted levels of vibration should be investigated but do not necessarily preclude the continuation of further testing. However, failure to meet the criteria based on stress limits will require immediate investigation and resolution while the plant or affected system is placed in a safe condition.

Insert 5

The NSSS scope of thermal expansion testing consists of measuring displacements, strains, and temperatures of piping as listed below during various modes of plant operations. Additionally, a visual examination for obstructions/interference or evidence thereof, will also be performed on the system piping at appropriate hold points during initial heatup to rated temperature conditions and after three heatup and cooldown cycles. Thermal movement, strain, and temperature measurements will be recorded at least at the following points during power ascension:

(a) Ambient temperature (for baseline data)

(b) 150 psig reactor pressure

(c) 600 psig reactor pressure

(d) Rated reactor water temperature

(e) 100% of rated power

(f) At points (a) and (e) above for a total of 3 times on three separate heatup and cooldown cycles. (to measure possible shakedown effects)

(g) Plant at hot standby conditions following reactor scram and during plant startup with cold feedwater in low flow conditions (i.e., at plant conditions with maximum potential for feedwater temperature stratification in both loop A and loop B piping). This is applicable to feedwater piping only.

The piping systems considered to be within the NSSS scope of thermal expansion testing are:

(a) Main steam piping bounded by the reactor pressure vessel nozzles and the MSIVs outside containment.

(b) SRV discharge piping attached to the main steam lines and bounded by the SRV discharge flange and the quencher in the wetwell.

(c) Feedwater piping bounded by the reactor pressure vessel and the isolation check valves outside containment.

(d) Recirculation Motor cooling (RMC) piping, including RIPs.

(If hot functional test (HFT) has been performed, then recirculation system (RRS) thermal expansion test is not required during power ascension test.)

(e) Small branch piping attached to those portions of the piping defined in Item (a), (b), and (c), are bounded by the large pipe branch connection and the first downstream anchor. Small branch pipes that can not be monitored due to limited access are excluded from the scope of this test.

The Balance-of-plant (BOP) scope of thermal expansion testing consists of measuring displacements of the piping systems at various temperatures using installed test instruments. Visual observations will also be made by a system walkdown to determine acceptability of the system under the conditions existing during the specified test. Thermal movements will be recorded at appropriate temperature increments up to the required test temperature for each of the below listed BOP scope of piping systems:

(a) Main steam piping downstream of the outboard MSIVs.

(b) Feedwater piping outside containment downstream of isolation check valves.

(c) RCIC turbine steam supply and exhaust piping.

(d) RCIC pump suction and discharge piping

(e) RHR suction and discharge piping in shutdown cooling mode

(f) RWCU suction and discharge piping, including the head spray line.

(g) RPV head vent piping.

Additionally, thermal movement due to possible feedwater temperature stratification will also be measured for the feedwater piping outside containment with plant at hot standby conditions following reactor scram and during plant startup with cold feedwater in low flow conditions as described above in the NSSS scope of Testing.

The Level 1 and Level 2 thermal expansion limits and the locations to be monitored are specified in the Piping System Test Requirement Specification. To assure that the criteria are applied at relevant test conditions, the criteria are not applicable prior to the reactor vessel and system piping temperatures being at meaningful values. The designated thermal expansion limits would have been exceeded if readings from any of the installed remote sensors exceed the limits specified.

Level 1

The Level 1 limits are intended to set bounds on pipe motion which, if exceeded, makes a test hold or termination mandatory. If a Level 1 limit is exceeded, the test shall be terminated or the plant shall be placed in a satisfactory hold condition below the Level 1 limit and the cognizant engineering organization shall be advised and reconciliation or corrective action taken prior to moving beyond plant conditions at which thermal expansion has been demonstrated to be acceptable.

Level 2

The Level 2 limits are expected levels of pipe motion which, if exceeded, require that the cognizant engineering organization be advised so that investigation of the measurements and of the criteria and calculations used to generate the pipe motion limit can be initiated. If a Level 2 limit is not satisfied, however, plant operating and startup test plans need not necessarily altered.

Additionally, system walkdown and local measurements will be conducted to look for excessive vibration with the system at the required test conditions.

(a) ASME Code Class 1, 2, and 3 systems;

(b) high energy piping systems inside Seismic Category I structures;

(c) high energy portions of systems whose failure could reduce the functioning of any Seismic Category I plant features to an unacceptable level; and

(d) Seismic Category I portions of moderate energy piping systems located outside containment.

(4) Criteria

The thermal expansion acceptance criteria are based upon the actual movements being within a prescribed tolerance of the movements predicted by analysis. Measured movements are not expected to precisely correspond with those mathematically predicted. Therefore, a tolerance is specified for differences between measured and predicted movement. The tolerances are based on consideration of measurement accuracy, suspension free play, and piping temperature distributions. If the measured movement does not vary from the predictions by more than the specified tolerance, the piping is expanding in a manner consistent with predictions and is therefore acceptable. Tolerances should be the same for all operating test conditions. The locations to be monitored and the predicted displacements for the monitored locations in each plant will be provided by the applicable design or testing specification.

Insert W

14.2.12.2.11 System Vibration

(1) Purpose

To verify that the vibration of critical plant system components and piping is within acceptable limits during normal steady state power operation and during expected operational transients.

(2) Prerequisites

The applicable preoperational phase testing is complete and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled test iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. The required remote monitoring instrumentation ~~should~~ shall be calibrated and operational.

(3) Description

Vibration testing during the power ascension phase will be limited to those systems that could not be adequately tested during the preoperational phase. Systems within the scope of this testing are therefore the same as mentioned in Subsection 14.2.12.1.51. ~~However, the systems that remain to be tested will primarily be those exposed to and affected by steam flow and high rates of core flow.~~ For those monitored locations with- Due to the potentially high levels of radiation present during power operation, the testing will be performed using remote monitoring instrumentation. Displacement, acceleration, and strain data will be collected at various critical steady state operating conditions and during significant transients ~~such as turbine or generator trip, main steamline isolation, SRV actuation and RIP trip (if not already performed). Steady state and transient vibration affecting the RCIC steamline will also be monitored.~~

(4) Criteria

Criteria will be calculated for those points monitored for vibration for both steady state and transient cases. Two levels of criteria will be generated, one level for predicted vibration and one level based on acceptable values of displacement and acceleration and the associated stress to assure that there will be no failures from fatigue over the life of the plant. ~~Failures to remain within the predicted levels of vibration should be investigated but do not necessarily preclude the continuation of further testing. However, failure to meet the criteria based on stress limits will require immediate investigation and resolution while the plant or affected system is placed in a safe condition.~~

Insert X

Insert W

The NSSS scope of vibration displacement and strain measurements will be made during steady state of each of the below listed conditions:

(a) Remote measurements of vibration displacements on the main steam and feedwater piping at,

* 25% ± 5% of rated main steam flow and coincident temperature
* 50% ± 5% of rated main steam flow and coincident temperature
* 75% ± 5% of rated main steam flow and coincident temperature

(b) Remote measurements of vibration displacements and strains on the main steam, feedwater, and SRV discharge line, and RMC piping at the instrumented locations at 100% of rated electrical pwr

(c) Remote measurements of vibration displacements on the recirculation RMC piping at,

* Recirculation at minimum flow and coincident flow
* Recirculation flow at 50% ± 5% of rated on 100% rod line and at operating temperature
* Recirculation flow at 75% ± 5% of rated on 100% rod line and at operating temperature.

The BOP scope of steady-state vibration displacement and strain measurements will be made during the following conditions:

(a) Remote measurements of vibration displacements on the main steam piping downstream of outboard MSIVs at,

* During Plant shutdown with the turbine stop valves closed and 100% bypass steam flow to the condenser.

* Main steam flow at 100% of rated.

(b) Remote measurements of vibration displacements and strains on the feedwater piping outside containment during:

* Feedwater flow at 100% of rated and operating temperature
* Hot standby with cold feedwater at low flow conditions.

(c) Remote vibration displacement measurements on RCIC turbine steam supply line and local measurement using a hand held vibrometer on RCIC turbine exhaust, pump suction and discharge piping while RCIC steam line at 100% of rated flow and coincident temperature. (SSAR Section 14.2.12.2.22)

(d) Remote vibration displacement measurements on the RHR suction and discharge piping while RHR is operating at 100% of rated flow in shutdown cooling mode (SSAR Section 14.2.12.2.20)

(e) Remote vibration displacement measurements on the RWCU suction and discharge (including head spray) piping while RWCU is operating at 100% of rated flow and operating temperatures. (SSAR Section 14.2.12.2.21

Additionally, with the system as near as obtainable to normal operating temperatures and flows, system walkdown and local vibration measurements at the specified locations will be conducted to look for excessive vibrations. Special attention will be given to small attached piping and instrument connections to insure their movements are within limits.

The NSSS scope of transient vibration displacement and strain measurements will be conducted in conjunction with the following plant transient tests:

(a) Transient vibration displacement measurements on main steam, RMC, and SRV discharge line piping and strain measurements on main steam piping upon turbine control or stop valve closure during generator load rejection or turbine trip test. (SSAR Section 14.2.12.2.33)

(b) Transient vibration displacement and strain measurements on main steam, RMC, SRV discharge line, and feedwater piping during plant transient tests that results in SRV discharge (SSAR Sections 14.2.12.2.27, 14.2.12.2.32, 14.2.12.2.33, and 14.2.12.2.34)

(c) Transient vibration displacement and strain measurements for feedwater piping during feedwater pump trip and recovery test. (SSAR Section 14.2.12.2.29)

(d) Transient vibration displacement measurements on RMC piping during RIP trip at 100% of rated flow and recovery tests. (SSAR Section 14.2.12.2.34)

The BOP scope of transient vibration and strain measurements will be performed during the following plant transient tests:

(a) Transient vibration displacement and strain measurements on feedwater piping outside containment during feedwater pump trip and restart tests (SSAR Section 14.2.12.2.29).

(b) Transient vibration displacement measurements on mainsteam piping outside containment upon turbine control or stop valve closure during generator or turbine trip test. (SSAR Section 14.2.12.2.33).

(c) System walkdown (or local vibration measurements) to look for excessive vibration during selected transient, if required by the Piping System Test Requirement Specifications.

Insert X

The Level 1 and Level 2 vibration displacement and strain limits and the locations to be monitored are specified in the applicable Piping System Test Requirement Specifications.

Level 1

(a) Steady-State Vibration: Level 1 limits on steady-state operational vibration displacements and strains are based upon keeping piping stresses and pipe mounted equipment accelerations within safe limits and ASME code limits. If any one of the remote sensors indicate that the prescribed limits are exceeded, the test shall be placed on hold.

(b) Operating Transients: Level 1 limits on transient vibration displacements and strains are based on keeping the loads on piping and suspension components within safe limits and ASME code limits. If any one of the remote sensors indicate that these movements have been exceeded, the test shall be placed on hold.

Level 2

(a) Steady-State Vibration: The evaluation of Level 2 criteria on steady-state vibration takes two forms: limits on vibratory displacement and limits on acceleration. The limits have been set based on consideration of analysis, operating experience and protection of pipe mounted components.

(b) Operating Transients: Remote sensors have been placed near points of maximum anticipated movement. Where movement values have been predicted, tolerances are prescribed for differences between measurements and predictions. Tolerances are based on instrument accuracy and suspension free play. Where no movements have been prescribed, limits on displacements will be prescribed.

14.2.12.2.12 Reactor Internals Vibration

(1) Purpose

To collect information needed to verify the adequacy of the design, manufacture, and assembly of reactor vessel internals with respect to the potential affects of flow induced vibration in accordance with the requirements of Regulatory Guide 1.20.

(2) Prerequisite

The applicable preoperational phase testing is complete, including the required inspections, and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. The necessary special instrumentation ~~should~~ shall be calibrated and operational.

(3) Description

Reactor internal vibration testing subsequent to fuel loading is merely an extension of the program described during the preoperational phase in Subsection 14.2.12.1.52. The vibration measurement portion of that program ~~should be~~ is expanded during the power ascension phase to include intermediate and critical power and flow conditions during steady state operation and anticipated operational transients that are expected to result in limiting or significant levels of reactor internals vibration over and above what was observed during the preoperational phase. Insert Z

(4) Criteria

Insert AA

~~Criteria for limits on reactor internals vibration levels are developed during the vibration analysis portion of the assessment program as described in Subsection 14.2.12.1.52.~~

14.2.12.2.13 Recirculation Flow Control

(1) Purpose

To demonstrate that the stability and response characteristics of the recirculation flow control system are in accordance with design requirements for all applicable modes of control across the span of expected operational conditions.

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. This includes preliminary adjustment and optimization of control system components, as appropriate.

(3) Description

Startup phase testing of the recirculation flow control system is intended to demonstrate that the overall response and stability of the system meets design requirements subsequent to controller optimization. Performance shall be demonstrated at a sufficient number of power and flow points to bound the expected system operational conditions including applicable modes of control (speed, flow and automatic load following) for each such demonstration. Testing will be accomplished by manual manipulation of controllers and/or by direct input of demand changes at various levels of control. Special control features such as those used to maintain a specified margin to the high flux scram setpoint or to avoid regions of potential core instability should also be demonstrated as appropriate.

(4) Criteria

Above all else, system performance shall be stable such that any type of divergent response is avoided. The response should also be sufficiently fast but with any oscillatory modes of response well damped, usually with decay ratios less than .25. The overall response of the system, at all levels of control, should be within design requirements with respect to such standard control system criteria as response time,

Insert Z: The extent to which reactor internals vibration testing is conducted during the power ascension phase is dependent on the classification of the reactor internals as prototype or not in accordance with Regulatory Guide 1.20 as discussed in sections 3.9.2.4 and 3.9.7.1.

Insert Z

To the degree required by Regulatory Guide 1.20, per the applicable prototype designation, testing will include the precritical operation as well as power operation on the 60% and 100% rod lines.

The pre-critical tests shall be performed at least to include balance flow tests at varying flow values, single and 3 RIP pumps trip tests, and unbalance flow tests after 3 RIP pump trip.

The 60% rod line tests will include a total of eight test points minimum, including: balance flow tests at four equally spaced flow points, 3 RIP pump trip tests.

The 100% rod line tests will include a total of nine test conditions minimum, including: balance flow tests at four equally spaced flow points, 3 RIP pump trip tests and rated power turbine trip test.

Based upon the results at each test conditions specified above, the cognizant engineering organization may specify conditions where additional steady-state unbalanced flow vibration measurements are required.

Insert AA

The Level 1 and Level 2 internal vibration limits and the locations to be monitored are specified in the Reactor Internal Vibration Monitoring System Test Specification. A dynamic analysis of instrumented components will be performed to determine peak component stresses as a function of strains and displacements at sensor locations, for each of the lower natural vibration modes of the various components. Based on the analysis, and on the vibration stress limits of the core support structure, or on other component design specifications where applicable, a report specifying acceptance criteria for this vibration measurement program will be prepared. The Level 1 criteria specifies allowable response amplitudes in terms of peak sensor responses, for each of the lower natural modes of the instrumented components. The Level 2 criteria is based on the low stress limit which is suitable for sustained vibration in the reactor environment for the design life of the reactor components.

Level 1

The peak stress intensity may exceed 10,000 psi (single amplitude) when the component deformed in a manner corresponding to one of its normal or natural modes, but the fatigue usage factor must not exceed 1.0.

Level 2

The peak stress intensity shall not exceed 10,000 psi (single amplitude) when the component is deformed in a manner corresponding to one of its normal or natural modes.

14.2.12.2.12 Reactor Internals Vibration

(1) Purpose

To collect information needed to verify the adequacy of the design, manufacture, and assembly of reactor vessel internals with respect to the potential affects of flow induced vibration.

(2) Prerequisite

The applicable preoperational phase testing is complete, including the required inspections, and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. The necessary special instrumentation should be calibrated and operational.

(3) Description

Reactor internal vibration testing subsequent to fuel loading is merely an extension of the program described during the preoperational phase in Subsection 14.2.12.1.52. The vibration measurement portion of that program should be expanded during the power ascension phase to include intermediate and critical power and flow conditions during steady state operation and anticipated operational transients that are expected to result in limiting or significant levels of reactor internals vibration over and above what was observed during the preoperational phase.

The extent to which reactor internals vibration testing is conducted during the power ascension phase is dependent on the classification of the reactor internals as prototype or not in accordance with Regulatory Guide 1.20 as discussed in sections 3.9.2.4 and 3.9.7.1.

(4) Criteria

Criteria for limits on reactor internals vibration levels are developed during the vibration analysis portion of the assessment program as described in Subsection 14.2.12.1.52.

14.2.12.2.13 Recirculation Flow Control

(1) Purpose

To demonstrate that the stability and response characteristics of the recirculation flow control system are in accordance with design requirements for all applicable modes of control across the span of expected operational conditions.

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. This includes preliminary adjustment and optimization of control system components, as appropriate.

(3) Description

Startup phase testing of the recirculation flow control system is intended to demonstrate that the overall response and stability of the system meets design requirements subsequent to controller optimization. Performance shall be demonstrated at a sufficient number of power and flow points to bound the expected system operational conditions including applicable modes of control (speed, flow and automatic load following) for each such demonstration. Testing will be accomplished by manual manipulation of controllers and/or by direct input of demand changes at various levels of control. Special control features such as those used to maintain a specified margin to the high flux scram setpoint or to avoid regions of potential core instability should also be demonstrated as appropriate.

(4) Criteria

Above all else, system performance shall be stable such that any type of divergent response is avoided. The response should also be sufficiently fast but with any oscillatory modes of response well damped, usually with decay ratios less than .25. The overall response of the system, at all levels of control, should be within design requirements with respect to such standard control system criteria as response time.

rise time, overshoot, and settling time. Also, the overall system performance should be in accordance with expectations for anticipated transients.

14.2.12.2.14 Feedwater Control

(1) Purpose

To demonstrate that the stability and response characteristics of the feedwater control system are in accordance with design requirements for applicable system configurations and operational conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. This includes preliminary adjustments and optimization of control system components, as appropriate.

(3) Description

Startup phase testing of the feedwater control system is intended to demonstrate that the overall response and stability of the system meets design requirements subsequent to controller optimization. Testing will begin during plant heatup for any special configurations designed for very low feedwater or condensate flow rates and will continue up through the normal full power line up. Testing should include all modes of control and should encompass all expected plant power levels and operational conditions. Testing will be accomplished by manual manipulation of controllers and/or by direct input of demand changes at various levels of control. System response should also be evaluated under transient operational conditions such as an unexpected loss of a feedwater pump or a rapid reduction in core flow and/or power level and after plant trips such as turbine trip or main steam line isolation. Proper setup of control system components or features designed to handle the nonlinearities or dissimilarities in system response at various conditions should also be demonstrated. The above testing will also serve to demonstrate overall core stability to subcooling changes.

(4) Criteria

Above all else the feedwater control system performance shall be stable such that any type of divergent response is avoided. The response should be sufficiently fast but with any oscillatory modes of response well damped, usually with decay ratios less than 0.25. Additionally, the open loop response of the system should meet design requirements with respect to such standard control system criteria as response time, rise time, overshoot, and settling time. Also, the overall system response should be as expected following major plant transients and trips.

14.2.12.2.15 Pressure Control

(1) Purpose

To demonstrate that the stability and response characteristics of the pressure regulation system are in accordance with the design requirements for all modes of control under expected operating conditions.

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. This includes preliminary adjustment and optimization of control system components, as appropriate.

(3) Description

Startup phase testing of the pressure control system is intended to demonstrate that the overall response and stability of the system meets design requirements, subsequent to control system optimization. Performance

Insert BB

Level 1

The transient response of any recirculation system-related variable to any test input must not diverge as stated in the applicable Recirculation Flow Control System Design Specification.

Level 2

The responses of automated load following (ALF) mode, flow auto mode, and total manual mode to any test input shall be at least quarter-damped, that is, the decay ratio of the second-to-first overshoot for each variable is less than 0.25 as stated in the applicable Recirculation Flow Control System Design Specification.

In the total manual mode, the speed response of a single RIP to speed demand step (10% or greater) and the speed responses of all RIPs to speed demand step (5% or less) shall meet the performance requirements as stated in the applicable Recirculation Flow Control System Design Specification for the following parameters:

- Maximum rate of speed response (in either increasing or decreasing pump speed direction)
- Dead band
- Delay time
- Speed Overshoot
- Speed settling time

- Speed rise time

When operating in the flow auto mode, the response of core inlet flow to flow demand step (5% or less) shall meet the dynamic performance requirements as stated in the applicable Recirculation Flow Control System Design Specification for the following parameters:

- Maximum overshoot
- Response time
- Settling time
- Delay time

In the automated load following (ALF) mode, the dynamic response to a load demand step (10% or greater) shall comply with the maximum rate of steam flow response (i.e., ±20% steam flow change per minute) as stated in the applicable Recirculation Flow Control System Design Specification. Also, the sum of steam flow delay time and response time in response to a load demand step (10% or less) shall be within the limit (i.e., 10 seconds) as stated in the applicable Recirculation Flow Control System Design Specification.

For any of the above test maneuvering, no high flux scram shall result as stated in the applicable Recirculation Flow Control System Design Specification and the trip avoidance margins shall at least comply with the requirements as stated in the GE Startup Test Specifications (i.e, at least 7.5% for APRM and 5.0% for simulated heat flux).

At steady-state during any recirculation flow control mode of operations, the overall limiting cycles (if any) contributed by the RFC system on RIP pump speed and core flow shall be within the allowable range (i.e. ±5%) as stated in the applicable Recirculation Flow Control System Design Specification.

rise time, overshoot, and settling time. Also, the overall system performance should be in accordance with expectations for anticipated transients.

14.2.12.2.14 Feedwater Control

(1) Purpose

To demonstrate that the stability and response characteristics of the feedwater control system are in accordance with design requirements for applicable system configurations and operational conditions.

performance

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. This includes preliminary adjustments and optimization of control system components, as appropriate.

(3) Description

Insert GG

Startup phase testing of the feedwater control system is intended to demonstrate that the overall response and stability of the system meets design requirements subsequent to controller optimization. Testing will begin during plant heatup for any special configurations designed for very low feedwater or condensate flow rates and will continue up through the normal full power line up. Testing should include all modes of control and should encompass all expected plant power levels and operational conditions. Testing will be accomplished by manual manipulation of controllers and/or by direct input of demand changes at various levels of control. System response should also be evaluated under transient operational conditions such as an unexpected loss of a feedwater pump or a rapid reduction in core flow and/or power level and after plant trips such as turbine trip or main steam line isolation. Proper setup of control system components or features designed to handle the nonlinearities or dissimilarities in system response at various conditions should also be demonstrated. The above testing will also serve to demonstrate overall core stability to subcooling changes.

Additionally, steady-state gain curve data will be collected during ascension to rated power for verifying the linearity of the main actuators in controlling water level. Linearization/smoothing of the curve will be done as necessary together with the

(4) Criteria

Insert FF

Above all else the feedwater control system performance shall be stable such that any type of divergent response is avoided. The response should be sufficiently fast but with any oscillatory modes of response well damped, usually with decay ratios less than 0.25. Additionally, the open loop response of the system should meet design requirements with respect to such standard control system criteria as response time, rise time, overshoot, and settling time. Also, the overall system response should be as expected following major plant transients and trips.

14.2.12.2.15 Pressure Control

(1) Purpose

To demonstrate that the stability and response characteristics of the pressure regulation system are in accordance with the design requirements for all modes of control under expected operating conditions.

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. This includes preliminary adjustment and optimization of control system components, as appropriate.

(3) Description

Startup phase testing of the pressure control system is intended to demonstrate that the overall response and stability of the system meets design requirements, subsequent to control system optimization. Performance

Insert GG

Power ascension phase testing of the feedwater control system consists of both open loop and closed loop testings at each selected test conditions. During open loop testing, feedwater flow responses to small and large actuator demand steps will be verified for acceptable stability and response. For closed loop testing, reactor water level setpoint changes of approximately 6 inches and greater will be used to evaluate and adjust if necessary the master level controller settings for all power and feedwater system operating modes. The level setpoint changes also demonstrate core stability to subcooling changes.

Insert FF

Level 1

The transient responses of feedwater flow and vessel level to any test maneuvering must not diverge as stated in the applicable Feedwater Control System Design Specification.

Level 2

The response of feedwater flow (and vessel level) to any test input shall be at least quarter-damped, that is, the ratio of the second-to-first feedwater flow (and vessel level) overshoot is less than 0.25 as stated in the applicable Feedwater Control System Design Specification.

For Open Loop Testing:

The dynamic flow response of the main feedwater actuators (i.e., MDRFP flow control valve and low flow control valve) to small (10% of rated pump flow or less) step disturbances shall be in compliance with the performance requirements stated in the applicable Feedwater Control System Design Specification for the following parameters:

- maximum time to 10% of disturbance
- maximum time from 10% to 90% of step disturbance
- Settling time to 100% ± 5% of step disturbance
- Peak overshoot
- Deadband

For large (20% of rated pump flow or greater) step disturbance, the average rate of feedwater flow response for MDRFP flow control valve and stroke time for low flow control valve shall meet the requirements as stated in the applicable Feedwater Control System Design Specification. Rated pump flow is equivalent to the capacity of a single feedwater pump and the response requirement is assessed by determining the time required to pass linearly through the 10% and 90% response points.

For Closed Loop Testing:

The dynamic response of the master level controller to small step of level disturbances (3 to 6 inches) shall comply with the performance requirements as stated in the applicable Feedwater Control System Design Specification for the following parameters:

- Maximum time to 10% of step disturbance
- Maximum time from 10% to 90% of step disturbance
- Settling time to 100% ± 5% of step disturbance
- Peak overshoot

For large step of level disturbances (6 inches and greater), the average rate of vessel level response shall meet the minimum requirement (i.e., 1 inch/sec, as stated in the applicable Feedwater Control System

Design Specification. The response requirement is assessed by determining the time required to pass linearly through the 10% and 90% response points.

rise time, overshoot, and settling time. Also, the overall system performance should be in accordance with expectations for anticipated transients.

14.2.12.2.14 Feedwater Control

(1) Purpose

To demonstrate that the stability and response characteristics of the feedwater control system are in accordance with design requirements for applicable system configurations and operational conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. This includes preliminary adjustments and optimization of control system components, as appropriate.

(3) Description

Startup phase testing of the feedwater control system is intended to demonstrate that the overall response and stability of the system meets design requirements subsequent to controller optimization. Testing will begin during plant heatup for any special configurations designed for very low feedwater or condensate flow rates and will continue up through the normal full power line up. Testing should include all modes of control and should encompass all expected plant power levels and operational conditions. Testing will be accomplished by manual manipulation of controllers and/or by direct input of demand changes at various levels of control. System response should also be evaluated under transient operational conditions such as an unexpected loss of a feedwater pump or a rapid reduction in core flow and/or power level and after plant trips such as turbine trip or main steam line isolation. Proper setup of control system components or features designed to handle the nonlinearities or dissimilarities in system response at various conditions should also be demonstrated. The above testing will also serve to demonstrate overall core stability to subcooling changes.

(4) Criteria

Above all else the feedwater control system performance shall be stable such that any type of divergent response is avoided. The response should be sufficiently fast but with any oscillatory modes of response well damped, usually with decay ratios less than 0.25. Additionally, the open loop response of the system should meet design requirements with respect to such standard control system criteria as response time, rise time, overshoot, and settling time. Also, the overall system response should be as expected following major plant transients and trips.

14.2.12.2.15 Pressure Control

(1) Purpose

To demonstrate that the stability and response characteristics of the pressure regulation system are in accordance with the design requirements for all modes of control under expected operating conditions.

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. This includes preliminary adjustment and optimization of control system components, as appropriate.

(3) Description

Startup phase testing of the pressure control system is intended to demonstrate that the overall response and stability of the system meets design requirements subsequent to control system optimization. Performance

shall be evaluated across the spectrum of anticipated steam flows for both the pressure regulation and load following modes of control, as applicable. Testing should demonstrate acceptable response with either the turbine control valves or bypass valves in control and for the transition between the two. Testing will be accomplished by manual manipulation of controllers and/or direct input of demand changes at various levels of control. It should also be demonstrated that other affected parameters remain within acceptable limits during such pressure regulator induced transient maneuvers. Overall system response will be evaluated during other plant transients as well. Additionally, proper setup of components or features designed to deal with the nonlinearities or dissimilarities in system response that may exist under various conditions should be demonstrated.

(4) Criteria

Above all else, system performance shall be stable such that any type of divergent response is avoided. The response should be sufficiently fast but with any oscillatory modes of response well damped, usually with decay ratios less than .25. The overall response of the system, for each mode and level of control, should be within design requirements for such standard control system criteria as response time, rise time, overshoot and setting time. Also, the overall system performance should be in accordance with expectations for anticipated transients.

Shall

Shall

Shall

Insert EE

14.2.12.2.16 Plant Automation and Control

(1) Purpose

To verify proper plant performance in automatic modes of control such as during automatic plant startup or automatic load following (ALF) under the direction of the power generation control system (PGCS) and the automatic power regulator (APR).

(2) Prerequisites

The applicable preoperational tests have been completed and plant management has reviewed the testing procedure and has approved the initiation of testing. Affected systems and equipment, including lower level control systems such as RC&IS, recirc flow control, feedwater control and turbine control, as well as monitoring and predicting functions of the plant process computer and/or automation computer, shall have been adequately tested under actual operating conditions.

(3) Description

A comprehensive series of tests will be performed in order to demonstrate proper functioning of the various plant automation and control features. This testing shall include or bound all expected plant operating conditions under all permissable modes of control and shall also verify, to the extent possible, avoidance of prohibited or undesirable conditions or control modes. ALF capabilities will be demonstrated under control of the APR for both control rod movements and core flow changes including anticipated transition regions. Such testing will include demonstration(s) that the dynamic response of the plant to design load swings for the facility, including limiting step and ramp changes as appropriate, is in accordance with design. The ability of the PGCS to properly orchestrate automated plant startup, shutdown and power maneuvering will be shown. Also to be tested are system components or interfaces that perform monitoring, prediction, processing, validation, alarm, protection or control functions.

(4) Criteria

The PGCS, APR and other features and functions of plant automation and control shall perform in accordance with the applicable design and testing specifications. Automatic maneuvering characteristics of plant and systems shall meet the appropriate response and stability requirements. Safety and protection features shall perform consistant with safety analysis assumptions and predictions.

Insert CC

To determine the optimum settings for the pressure control loop and to demonstrate the adequacy of the pressure control system in maintaining a stable and fast pressure response to pressure transients. Additionally, smooth pressure control transition between the turbine control valves and the bypass valves will be demonstrated when the reactor steam generation exceeds the steam flow used by the turbine. ~~Also, the backup capability of the pressure control channel will be demonstrated via simulated failure of the operating pressure control channel.~~ c

c

Insert DD

Plant response to pressure setpoint step change input will be verified for stability and response with recirculation flow control system in various mode of operations. At specified test conditions, the load limit setpoint is set so that the entire pressure transient during the test is handled by turbine control valves, bypass valves, or both. ~~Additionally, the redundant pressure control channel will be verified for proper operation upon simulated failure of the operating controller.~~ The response of the system will be measured and evaluated and the pressure controller settings will be optimized. Turbine control valve linearity (incremental regulation) will be verified over the load range for acceptability throughout the course of optimizing pressure controller settings.

Level 1

The transient response of any pressure control system-related variable to any test input must not diverge as stated in the applicable Steam Bypass and Pressure Control System Design Specification.

Level 2

The response of any pressure control system-related variable to any test input shall be at least quarter-damped, that is, the ratio of the second-to-first overshoot for each variable is less than 0.25 as stated in the applicable Steam Bypass and Pressure Control System Design Specification.

The pressure response time from initiation of pressure setpoint change to the pressure controller sensed pressure peak shall be within the limit (i.e., 10 seconds) as stated in the applicable Steam Bypass and Pressure Control System Design Specification.

Pressure control system deadband, delay, etc., shall be small enough that steady-state limit cycles (if any, magnitude and frequency shall not exceed the requirements as stated in the applicable Steam Bypass and Pressure Control System Design Specification (i.e., less than ± 0.5% rated turbine steam flow in magnitude and greater than 5 seconds in period.)

Insert EE ((cont'd)

For all pressure controller transients, no high flux or vessel pressure scram shall result and the trip avoidance margin shall at least meet the requirements as stated in the GE Startup Test Specifications. (i.e., at least 7.5% for APRM, 5.0% for simulated heat flux and 10 psi for vessel pressure).

The incremental regulation is defined as the ratio of incremental change in steam flow demand and incremental change in steam flow. The maximum variation in incremental regulation, defined as the ratio of the maximum-to-minimum value of incremental regulation for each specified flow ranges, shall not exceed the limits as stated in the applicable Steam Bypass and Pressure Control System Design Specification as following:

% of Steam Flow	Variation in Incremental Regulation
0 to F*	≤ 4:1
F* to 97	≤ 2:1
F* to 99	≤ 5:1

* F is defined to be 85% for full-arc admission turbine and 90% for partial-arc admission turbine.

shall be evaluated across the spectrum of anticipated steam flows for both the pressure regulation and load following modes of control, as applicable. Testing ~~should~~ shall demonstrate acceptable response with either the turbine control valves or bypass valves in control and for the transition between the two. Testing will be accomplished by manual manipulation of controllers and/or direct input of demand changes at various levels of control. It ~~should~~ shall also be demonstrated that other affected parameters remain within acceptable limits during such pressure regulator induced transient maneuvers. Overall system response will be evaluated during other plant transients as well. Additionally, proper setup of components or features designed to deal with the nonlinearities or dissimilarities in system response that may exist under various conditions ~~should~~ shall be demonstrated.

(4) Criteria

Above all else, system performance shall be stable such that any type of divergent reonse is avoided. The response should be sufficiently fast but with any oscillatory modes of response well damped, usually with decay ratios less than .25. The overall response of the system, for each mode and level of control, should be within design requirements for such standard control system criteria as response time, rise time, overshoot and setting time. Also, the overall system performance should be in accordance with expectations for anticipated transients.

14.2.12.2.16 Plant Automation and Control

(1) Purpose

~~To verify proper plant performance in automatic modes of control such as during automatic plant startup & automatic load following (ALF) under the direction of the power generation control system (PGCS) and the automatic power regulator (APR).~~

To verify that the power generation control system (PGCS) will operate properly with automatic power regulator (APR) to support automation of the normal plant startup, shutdown and power range operations.

(2) Prerequisites

The applicable preoperational tests have been completed and plant management has reviewed the testing procedure and has approved the initiation of testing. Affected systems and equipment, including lower level control systems such as RC&IS, recirc flow control, feedwater control and turbine control, as well as monitoring and predicting functions of the plant process computer and/or automation computer, shall have been adequately tested under actual operating conditions.

(3) Description

Insert HH

~~A comprehensive series of tests will be performed in order to demonstrate proper functioning of the various plant automation and control features. This testing shall include or bound all expected plant operating conditions under all permissable modes of control and shall also verify, to the extent possible, avoidance of prohibited or undesirable conditions or control modes. ALF capabilities will be demonstrated under control of the APR for both control rod movements and core flow changes including anticipated transition regions. Such testing will include demonstration(s) that the dynamic response of the plant to design load swings for the facility, including limiting step and ramp changes as appropriate, is in accordance with design. The ability of the PGCS to properly orchestrate automated plant startup, shutdown and power maneuvering will be shown. Also to be tested are system components or interfaces that perform monitoring, prediction, processing, validation, alarm, protection or control functions.~~

(4) Criteria

Insert II

~~The PGCS, APR and other features and functions of plant automation and control shall perform in accordance with the applicable design and testing specifications. Automatic maneuvering characteristics of plant and systems shall meet the appropriate response and stability requirements. Safety and protection features shall perform consistant with safety analysis assumptions and predictions.~~

Insert HH

The PGCS provides a means to automatical or manual operation of the plant startup, shutdown, and power maneuvering in its three basic modes of operations: automatic, semi-automatic, and manual. During ascension to rated power and flow conditions, the following set of performance testings will be conducted:

(a) Plant startup operation with the use of the PGCS and APR functions

(b) Plant shutdown operation with the use of the PGCS and APR functions.

(c) Power range maneuvering with the use of the PGCS and APR functions.

The performance parameters of the total system and its components will be measured at each of the above plant operations. Capability of the PGCS to operate properly with the APR to support automation of the normal plant startup, shutdown, and power range operations is demonstrated by verifying that each parameter is within limits specified.

Capability of automated load following (ALF) under the control of APR function is demonstrated separately in SSAR Section 14.2.12.2.13. Such testing is conducted to assure that the dynamic response of the plant to design load swings, including limiting step and ramp changes, as appropriate, is in accordance with design requirements.

Insert II

Level 1

Not applicable

Level 2

Under normal conditions, no single equipment failure shall result in the disturbance for the plant operation, i.e., the plant shall be operated with-out the PGCS functions.

No single equipment failure shall cause the inadvertent setpoint change switch over the system operation mode.

14.2.12.2.17 Reactro Recirculation System Performance

(1) Purpose

To verify that reactor recirculation system performance characteristics are in accor-

steady-state

Ganged RIP steady-state performance testing with 7 to 10 RIPs in service will be conducted at several power-flow conditions during power ascension test program. Pertinent recirculation system and related performance parameters will be monitored and recorded beginning with the ganged RIPs at minimum speeds and continuing through simultaneously increasing RIP speeds in specified steps until plant rated condition is reached.

dance with design requirements.

(2) Prerequisites

The preoperational testing is complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. Instrumentation has been checked or calibrated, as is appropriate.

(3) Description

Pertinent recirculation system and related parameters will be monitored at a variety of power and flow conditions in order to demonstrate that system operation is in accordance with design. Parameters to be monitored and evaluated should include RIP speeds, pump deck and core plate differential pressures, pump efficiencies, maximum core flow capability, and any number of other variables that may indicate the status of the RIPs and their shafts, motors, or heat exchangers. Data shall also be taken and evaluated during transient conditions such as pump trips and restarts, and during off normal conditions such as one pump out-of-service operation. Of particular interest might be the onset of reverse flow through idle pumps and the calibration of total core flow indictions during both normal and off normal operating conditions.

shall at least

RIP

RIP

will

(4) Criteria

When applicable, measured parameters shall compare conservatively with safety analysis design assumptions. Additionally, test data should demonstrate that system steady state and transient performance meets design requirements.

Insert NN

14.2.12.2.18 Feedwater System Performance

(1) Purpose

To verify that the overall feedwater system operates in accordance with design requirements.

(2) Prerequisites

The preoperational testing is complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. Applicable instrumentation has been checked or calibrated as is appropriate.

(3) Description

Pertinent parameters will be monitored throughout the feedwater system, and condensate system if appropriate, across the spectrum of system flow and plant operating conditions in order to demonstrate that system operation is in accordance with design. Parameters to be monitored may include temperatures, pressures, flow rates, pressure drops, pump speeds and developed heads, and general equipment status. Of special interest will be data that serves to verify design assumptions used in plant transient performance and safety analysis calculations like maximum feedwater runout capabilities and feedwater temperature versus power level relationships. Steady state and transient testing will be conducted as necessary, to assure that adequate margins exist between system variables and setpoints of instruments monitoring these variables to prevent spurious actuations or loss of system pumps and motor-operated valves.

(4) Criteria

When applicable, measured parameters shall compare conservatively with safety analysis design assumptions. Additionally, test data should demonstrate that system steady state and transient performance meets design requirements.

14.2.12.2.19 Main Steam System Performance

(1) Purpose

To verify that main steam system related performance characteristics are in accordance with design requirements.

Insert N/V

Level 1

Not Applicable

Level 2

With all ten RIPs in service, the RIPs performing as a group shall provide a minimum core flow at the flow rate and system operating conditions as stated in the applicable Reactor Recirculation System Design Specification.

With one RIP out of service, the RIPs performing as a group shall provide 100% core flow at least at the flow rate and system operating conditions as stated on the Reactor Recirculation System Process Flow Diagram (SSAR Figure 5.4-5).

At rated power and flow, the measured efficiency for each RIP shall meet or exceed the value as stated in the applicable Reactor Recirculation System Design Specification

At rated power and flow, each RIP, individually, shall be capable of providing the flow and head as stated on the Reactor Recirculation System Process Flow Diagram (SSAR Figure 5.4-5).

At rated power and flow, the measured core pressure drop shall not exceed the predicted value by an amount as required by the GE Startup Test Specifications.

The RFCS shall provide controls to limit each highest RIP pump speed to a maximum speed consistent with the reactor operating conditions and nuclear safety operational analysis requirements (SSAR Section 15.4.5)

dance with design requirements.

(2) Prerequisites

The preoperational testing is complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. Instrumentation has been checked or calibrated, as is appropriate.

(3) Description

Pertinent recirculation system and related parameters will be monitored at a variety of power and flow conditions in order to demonstrate that system operation is in accordance with design. Parameters to be monitored and evaluated should include RIP speeds, pump deck and core plate differential pressures, pump efficiencies, maximum core flow capability, and any number of other variables that may indicate the status of the RIPs and their shafts, motors, or heat exchangers. Data shall also be taken and evaluated during transient conditions such as pump trips and restarts, and during off normal conditions such as one pump out of service operation. Of particular interest ~~might~~ will be the onset of reverse flow through idle pumps and the calibration of total core flow indictions during both normal and off normal operating conditions.

(4) Criteria

When applicable, measured parameters shall compare conservatively with safety analysis design assumptions. Additionally, test data should demonstrate that system steady state and transient performance meets design requirements.

14.2.12.2.18 Feedwater System Performance

(1) Purpose

To verify that the overall feedwater system ~~operates~~ performance characteristics is in accordance with design requirements.

(2) Prerequisites

The preoperational testing is complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. Applicable instrumentation has been checked or calibrated as is appropriate.

(3) Description

Pertinent parameters will be monitored throughout the feedwater system, and condensate system if appropriate, across the spectrum of system flow and plant operating conditions in order to demonstrate that system operation and capacity are in accordance with design. Parameters to be monitored ~~will~~ include temperatures, pressures, flow rates, pressure drops, pump speeds and developed heads, and general equipment status. Of special interest will be data that serves to verify design assumptions used in plant transient performance and safety analysis calculations like maximum feedwater runout capabilities and feedwater temperature versus power level relationships. Steady state and transient testing will be conducted as necessary, to assure that adequate margins exist between system variables and setpoints of instruments monitoring these variables to prevent spurious actuations or loss of system pumps and motor-operated valves. Insert KK

(4) Criteria

~~When applicable, measured parameters shall compare conservatively with safety analysis design assumptions. Additionally, test data should demonstrate that system steady state and transient performance meets design requirements.~~ Insert JJ

14.2.12.2.19 Main Steam System Performance

(1) Purpose

To verify that main steam system related performance characteristics are in accordance with design requirements.

Insert KK

During the data collection process, measured data will be compared against expected values to assure proper instrument calibration and compliance with the design requirements. The measured maximum feedwater flow will also be adjusted to the SSAR pressures before comparing with the SSAR maximum flows. If the SSAR maximum flows are exceeded, the system can either be adjusted so that the licensing assumption is not exceeded or be applied with an additional penalty to the delta-CPR.

Insert JJ

Level 1

The total feedwater flow for all pumps runout shall not exceed the value assumed in SSAR Section 15.1.2.3.1 at the design pressure specified. The change of flow below the pressure specified shall not exceed the sensitivity value stated in the applicable Feedwater Control System Design Specification.

The runout capacity of one feedwater pump shall be greater than the value assumed in SSAR Section 15.1.2.3. at the design pressure specified.

Level 2

Not applicable

dance with design requirements.

(2) Prerequisites

The preoperational testing is complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. Instrumentation has been checked or calibrated, as is appropriate.

(3) Description

Pertinent recirculation system and related parameters will be monitored at a variety of power and flow conditions in order to demonstrate that system operation is in accordance with design. Parameters to be monitored and evaluated should include RIP speeds, pump deck and core plate differential pressures, pump efficiencies, maximum core flow capability, and any number of other variables that may indicate the status of the RIPs and their shafts, motors, or heat exchangers. Data shall also be taken and evaluated during transient conditions such as pump trips and restarts, and during off normal conditions such as one pump out of service operation. Of particular interest ~~might~~ will be the onset of reverse flow through idle pumps and the calibration of total core flow indictions during both normal and off normal operating conditions.

(4) Criteria

When applicable, measured parameters shall compare conservatively with safety analysis design assumptions. Additionally, test data should demonstrate that system steady state and transient performance meets design requirements.

14.2.12.2.18 Feedwater System Performance

(1) Purpose

To verify that the overall feedwater system operates in accordance with design requirements.

(2) Prerequisites

The preoperational testing is complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. Applicable instrumentation has been checked or calibrated as is appropriate.

(3) Description

Pertinent parameters will be monitored throughout the feedwater system, and condensate system if appropriate, across the spectrum of system flow and plant operating conditions in order to demonstrate that system operation is in accordance with design. Parameters to be monitored may include temperatures, pressures, flow rates, pressure drops, pump speeds and developed heads, and general equipment status. Of special interest will be data that serves to verify design assumptions used in plant transient performance and safety analysis calculations like maximum feedwater runout capabilities and feedwater temperature versus power level relationships. Steady state and transient testing will be conducted as necessary, to assure that adequate margins exist between system variables and setpoints of instruments monitoring these variables to prevent spurious actuations or loss of system pumps and motor-operated valves.

(4) Criteria

When applicable, measured parameters shall compare conservatively with safety analysis design assumptions. Additionally, test data should demonstrate that system steady state and transient performance meets design requirements.

14.2.12.2.19 Main Steam System Performance

(1) Purpose

To verify that main steam system related performance characteristics are in accordance with design requirements.

testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all prerequisite testing complete. Applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Pertinent system parameters, such as temperatures, pressures, and flows, will be monitored at various steam flow rates in order to demonstrate that system operation is in accordance with design. The steam flow measuring devices that provide input to feedwater control and/or leak detection logic should be crosschecked to verify the accuracy of design calibration assumptions. If appropriate, the pressure drop developed across critical components should be compared with design values. The quality of the steam leaving the reactor should also be determined to be within design requirements (if not previously tested).

(4) Criteria

When applicable, measured parameters shall compare conservatively with safety analysis design assumptions. Additionally, test data should demonstrate that system steady state and transient performance meets design requirements.

14.2.12.2.20 Residual Heat Removal System Performance

(1) Purpose

To verify that residual heat removal system performance is in accordance with design for actual plant operating conditions.

(2) Prerequisites

The preoperational testing is complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. Instrumentation has been checked or calibrated as appropriate.

(3) Description

Startup phase testing of the RHR system is intended to demonstrate the capabilities of the system beyond what was possible during the preoperational phase due to insufficient temperature and pressure conditions. Pertinent system parameters will be monitored in the suppression pool cooling and shutdown cooling modes to verify that overall system operation and heat removal capabilities are in accordance with design requirements. An attempt should be made to obtain results with flow rates and temperatures near process diagram values. However, due to the relatively low core exposures and decay heat loads expected during the startup program, care should be taken such that the limit on vessel cooldown rate is not exceeded.

(4) Criteria

System performance, especially heat removal capability, shall meet safety analysis requirements. Additionally, measured parameters should indicate that overall system performance is consistent with design expectations.

14.2.12.2.21 Reactor Water Cleanup System Performance

(1) Purpose

To verify that reactor water cleanup system performance, in all modes of operation, is in accordance with design requirements at rated reactor temperature and pressure conditions.

(2) Prerequisites

The preoperational testing is complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. Instrumentation has been checked or calibrated as appropriate.

(3) Description

Insert LL

The total main steam line pressure drop from the reactor vessel steam space to the main steam line header will be evaluated for acceptance while reactor vessel pressure is at the design rated value. The evaluation is accomplished through an additional measurement of steam delivery pressure taken at the pressure tap downstream of outboard MSIVs. The test is to demonstrate that the pressure drops, from the reactor vessel steam space to the pressure tap downstream of outboard MSIVs and from the pressure tap downstream of outboard MSIVs to the pressure tap at main steam line header, are within the design values.

Insert MM

Level 1

Not Applicable

Level 2

The main steam line pressure drops from the reactor vessel steam space to the pressure tap downstream of outboard MSIV and from the pressure tap downstream of outboard MSIV to the pressure tap at main steam line header shall be within the design values as given by the Nuclear Boiler System Process Diagram at rated steam flow conditions. and SSAR Table 10.1-1.

The measured main steam line flow venturi differential pressure at rated steam flow conditions shall be equal to or greater than the design rated value as specified by the applicable Nuclear Boiler System Design Specification.

The accuracy and noise level of the total steam flow measurements obtained from the main steam line flow venturi as compared to the calibrated feedwater flow shall meet the input signal requirements as stated in the applicable Feedwater Control System Design Specification.

testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all prerequisite testing complete. Applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Pertinent system parameters, such as temperatures, pressures, and flows, will be monitored at various steam flow rates in order to demonstrate that system operation is in accordance with design. The steam flow measuring devices that provide input to feedwater control and/or leak detection logic ~~should~~ shall be crosschecked to verify the accuracy of design calibration assumptions. If appropriate, the pressure drop developed across critical components ~~should~~ shall be compared with design values. The quality of the steam leaving the reactor ~~should~~ shall also be determined to be within design requirements (if not previously tested).

(4) Criteria

When applicable, measured parameters shall compare conservatively with safety analysis design assumptions. Additionally, test data should demonstrate that system steady state and transient performance meets design requirements.

14.2.12.2.20 Residual Heat Removal System Performance

(1) Purpose

To verify that residual heat removal system performance is in accordance with design for actual plant operating conditions.

(2) Prerequisites

The preoperational testing is complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. Instrumentation has been checked or calibrated as appropriate.

(3) Description

Startup phase testing of the RHR system is intended to demonstrate the capabilities of the system beyond what was possible during the preoperational phase due to insufficient temperature and pressure conditions. Pertinent system parameters will be monitored in the suppression pool cooling and shutdown cooling modes to verify that overall system operation and heat removal capabilities are in accordance with design requirements. An attempt ~~should~~ shall be made to obtain results with flow rates and temperatures near process diagram values. However, due to the relatively low core exposures and decay heat loads expected during the startup program, care ~~should~~ shall be taken such that the limit on vessel cooldown rate is not exceeded.

(4) Criteria

System performance, especially heat removal capability, shall meet safety analysis requirements. Additionally, measured parameters should indicate that overall system performance is consistent with design expectations.

14.2.12.2.21 Reactor Water Cleanup System Performance

(1) Purpose

To verify that reactor water cleanup system performance, in all modes of operation, is in accordance with design requirements at rated reactor temperature and pressure conditions.

(2) Prerequisites

The preoperational testing is complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. Instrumentation has been checked or calibrated as appropriate.

(3) Description

Startup phase testing of the RWCU system is an extension of the preoperational tests for rated temperature and pressure conditions. System parameters will be monitored in the various modes of operation at critical temperature, pressure and flow conditions.

(Insert K)

~~The performance of system heat exchangers and filter/demineralizer units will be evaluated at hot operating conditions. The ability of the system to reject excess vessel inventory during plant heatup will be verified. Other system features should be demonstrated as appropriate.~~ (Shall)

(4) Criteria

(Insert L)

~~System performance should meet the specified design requirements in all operating modes.~~

14.2.12.2.22 RCIC System Performance

(1) Purpose

To verify proper operation of the RCIC system over its expected operating pressure and flow ranges, and to demonstrate reliability in automatic starting from cold standby with the reactor at power.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

The RCIC system will be tested in two ways, through a full flow test line leading to the suppression pool and by flow injection directly into the reactor vessel. The first set of tests will consist of manual and automatic mode starts and steady state operation, at 150 psig and near rated reactor pressure conditions, in the full flow test mode. During these tests an attempt will be made to throttle pump discharge pressure in order to simulate reactor pressure and the expected pipeline pressure drop. This testing is done to demonstrate general system operability and to make most controller adjustments. Reactor vessel injection tests will follow to complete the controller adjustments. Proper controller adjustment is verified by introducing small step disturbances in speed and flow demand and then demonstrating satisfactory system response and stability. This will be done at both low RCIC pump flow (but above minimum turbine speed) and near rated RCIC pump flow conditions, and at reactor pressures of 150 psig and rated, in order to span the RCIC operating range.

After all controller and system adjustments have been made a defined set of demonstrations will be performed with the final settings. This will include two consecutive successful reactor vessel injections, by automatic initiation from the cold standby condition, to demonstrate system reliability. Cold is defined as a minimum of 72 hours without any kind of RCIC operation. Following these tests, system data will be collected while operating in the full flow test mode to provide a benchmark for comparison with future surveillance tests. Additionally, a demonstration of extended operation of up to two hours (or until the pump and turbine and their auxiliaries have stabilized) of continuous operation at rated flow conditions will be performed. For all testing proper operation of the system and related auxiliaries will be evaluated.

Additionally, proper functioning of the RCIC steamline isolation valves will be verified at rated temperature and pressure and at higher power levels if appropriate. This verification will include proper valve operation and acceptable closure timing in response to an isolation signal. Also, sufficient operating data will be taken in order to verify proper setting of, or to adjust as necessary, the high RCIC steamline flow trip setting of the leak detection and isolation system trip logic.

¶ Also, any RCIC system testing that was not performed during the preoperational test phase, due to the insufficiency of the temporary steam supply source utilized, will be completed as early in the program as is practicable.

Insert K

With the reactor at rated temperature and pressure, process variables will be monitored and recorded when the RWCU system is in steady-state operation in four modes as defined by the System Process Diagram: Normal, Blowdown, Hot Standby, and RPV Spray.

Each heat exchanger will be demonstrated to meet the established heat exchanger rate performance requirements while the system is operating in Normal mode.

When the reactor water is at rated temperature, the entire planned blowdown flow rate will be discharged into the suppression pool to confirm that a stable operation in Blowdown mode can be performed.

During the process of reactor shutdown, 100% system flow rate will be passed into the reactor pressure vessel head spray line and the temperature change of various parts of RPV is measured and recorded to confirm the RPV Spray mode of operation.

With the reactor at hot standby conditions, the cleanup system flow will be recirculated back to reactor without passing the filter demineralizers to confirm that a stable operation in Hot Standby mode can be established in order to minimize difference in reactor water temperature.

Insert L

Level 1

Not Applicable

Level 2

The temperatures at the tube side outlet of the RWCU non-regenerative heat exchangers shall not exceed the limits specified by the applicable RWCU System Design Specification while the system is in the blowdown mode and normal mode of operations.

The total dynamic head (TDH) of the RWCU pump shall meet the design values specified by the applicable RWCU System Design Specification for all modes of system operation.

The measured heat exchange capacity of each RWCU non-regenerative heat exchanger shall meet the established heat exchange rate performance requirement as stated in the applicable RWCU System Design Specification.

The RWCU pump and motor vibration shall be less than or equal to limits given by the Hydraulic Institute Standard during all modes of system operations.

The cooling water supplied to the RWCU non-regenerative heat exchangers shall be within the flow and outlet temperature limits indicated in the RWCU System Process Flow Diagram (SSAR Figure 5.4-13) and applicable RWCU System Design Specification.

testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all prerequisite testing complete. Applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Pertinent system parameters, such as temperatures, pressures, and flows, will be monitored at various steam flow rates in order to demonstrate that system operation is in accordance with design. The steam flow measuring devices that provide input to feedwater control and/or leak detection logic should be crosschecked to verify the accuracy of design calibration assumptions. If appropriate, the pressure drop developed across critical components should be compared with design values. The quality of the steam leaving the reactor should also be determined to be within design requirements (if not previously tested).

(4) Criteria

When applicable, measured parameters shall compare conservatively with safety analysis design assumptions. Additionally, test data should demonstrate that system steady state and transient performance meets design requirements.

14.2.12.2.20 Residual Heat Removal System Performance

(1) Purpose

To verify that residual heat removal system performance is in accordance with design for actual plant operating conditions.

(2) Prerequisites

The preoperational testing is complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. Instrumentation has been checked or calibrated as appropriate.

(3) Description

Startup phase testing of the RHR system is intended to demonstrate the capabilities of the system beyond what was possible during the preoperational phase due to insufficient temperature and pressure conditions. Pertinent system parameters will be monitored in the suppression pool cooling and shutdown cooling modes to verify that overall system operation and heat removal capabilities are in accordance with design requirements. An attempt should be made to obtain results with flow rates and temperatures near process diagram values. However, due to the relatively low core exposures and decay heat loads expected during the startup program, care should be taken such that the limit on vessel cooldown rate is not exceeded.

(4) Criteria

System performance, especially heat removal capability, shall meet safety analysis requirements. Additionally, measured parameters should indicate that overall system performance is consistent with design expectations.

14.2.12.2.21 Reactor Water Cleanup System Performance

(1) Purpose

To verify that reactor water cleanup system performance, in all modes of operation, is in accordance with design requirements at rated reactor temperature and pressure conditions.

(2) Prerequisites

The preoperational testing is complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. Instrumentation has been checked or calibrated as appropriate.

(3) Description

Insert T

Level 1

Not Applicable

Level 2

The RHR system shall be capable of operating in the suppression pool cooling and shutdown cooling modes at the heat exchanger capacity determined by the flow rates and temperature differentials indicated on the RHR System Process Flow Diagram (SSAR Figure 5.4-11).

Startup phase testing of the RWCU system is an extension of the preoperational tests for rated temperature and pressure conditions. System parameters will be monitored in the various modes of operation at critical temperature, pressure and flow conditions.

The performance of system heat exchangers and filter/demineralizer units will be evaluated at hot operating conditions. The ability of the system to reject excess vessel inventory during plant heatup will be verified. Other system features should be demonstrated as appropriate.

(4) Criteria

System performance should meet the specified design requirements in all operating modes.

14.2.12.2.22 RCIC System Performance

(1) Purpose

To verify proper operation of the RCIC system over its expected operating pressure and flow ranges, and to demonstrate reliability in automatic starting from cold standby with the reactor at power.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration the plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

The RCIC system will be tested in two ways, through a full flow test line leading to the suppression pool and by flow injection directly into the reactor vessel. The first set of tests will consist of manual and automatic mode starts and steady state operation, at 150 psig and near rated reactor pressure conditions, in the full flow test mode. During these tests an attempt will be made to throttle pump discharge pressure in order to simulate reactor pressure and the expected pipeline pressure drop. This testing is done to demonstrate general system operability, and to make most controller adjustments. Reactor vessel injection tests will follow to complete the controller adjustments. Proper controller adjustment is verified by introducing small step disturbances in speed and flow demand and then demonstrating satisfactory system response and stability. This will be done at both low RCIC pump flow (but above minimum turbine speed) and near rated RCIC pump flow conditions, and at reactor pressures of 150 psig and rated, in order to span the RCIC operating range.

After all controller and system adjustments have been made, a defined set of demonstrations will be performed with the final settings. This will include two consecutive successful reactor vessel injections, by automatic initiation from the cold standby condition, to demonstrate system reliability. Cold is defined as a minimum of 72 hours without any kind of RCIC operation. Following these tests, system data will be collected while operating in the full flow test mode to provide a benchmark for comparison with future surveillance tests. Additionally, a demonstration of extended operation of up to two hours (or until the pump and turbine and their auxiliaries have stabilized) of continuous operation at rated flow conditions will be performed. For all testing proper operation of the system and related auxiliaries will be evaluated.

Additionally, proper functioning of the RCIC steamline isolation valves will be verified at rated temperature and pressure and at higher power levels if appropriate. This verification will include proper valve operation and acceptable closure timing in response to an isolation signal. Also sufficient operating data will be taken in order to verify proper setting of, or to adjust as necessary, the high RCIC steamline flow trip setting of the leak detection and isolation system trip logic.

Also, any RCIC system testing that was not performed during the preoperational test phase, due to the insufficiency of the temporary steam supply source utilized, will be completed as early in the program as is practicable.

(4) Criteria

The RCIC turbine shall not trip or isolate during the manual or automatic start tests and should avoid the applicable trip or isolation setpoints by the specified margins. For automatic initiations the time to rated flow shall meet technical specification and safety analysis requirements. Overall system operation, and that of the applicable auxiliary equipment, shall meet safety design requirements and should be consistent with performance expectations. The RCIC control system shall not evidence divergent

Insert N

Insert E

, as necessary, and to demonstrate automatic starting from hot standby condition. Subsequently, a reactor vessel injection demonstration at 150 psig reactor pressure, including an automatic mode start and stability demonstration, shall be conducted to verify satisfactory system performance under the final set of optimized controller settings.

Insert N

Level 1

The RCIC turbine shall not trip or isolate during the manual or automatic start tests.

The average pump discharge flow must be equal to or greater than the 100% rated value specified in the RCIC System Process Flow Diagram (SSAR Figure 5.4-9) for all operating modes.

The starting time for the RCIC system from receipt of actuation signal to delivering design flow shall be within the limit specified by the applicable RCIC System Design Specification at any reactor pressure between 150 psig and rated.

Level 2

The RCIC turbine speed and pump flow control loops shall be adjusted so that the RCIC system flow related variable responses to test inputs are at least quarter-damped (i.e., the decay ratio of the second-to-first overshoot of each variable is less than 0.25) as stated in the applicable RCIC System Design Specification.

The RCIC turbine gland seal system shall be capable of preventing significant steam leakage to the atmosphere.

For automatic start tests, in order to provide margins to overspeed and isolation trip setting, the transient start first and subsequent turbine speed peaks shall not exceed the requirement specified by the GE Startup Test Specifications.

The RCIC turbine steam supply line high flow isolation trip shall be calibrated to actuate at the value specified in the plant Technical Specifications.

tendencies and should provide quick but stable response.

14.2.12.2.23 Plant Cooling/Service Water System(s) Performance

(1) Purpose

To verify performance of the various plant cooling/service water systems, including the reactor building cooling water system, the reactor service water system, the turbine building cooling water system and the turbine service water system under expected reactor power operation load conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Power ascension phase testing of plant cooling water systems is necessary only to the extent that fully loaded conditions could not be approached during the preoperational phase. Pertinent parameters should be monitored in order to provide a final verification of proper system flow balancing and heat exchanger performance under near design or special conditions, as is appropriate. This will include extrapolation of results obtained under normal or test conditions as needed to demonstrate required performance at limiting or accident conditions.

(4) Criteria

System performance should be consistent with design requirements. For systems that are taken credit for in the plant safety analysis, performance shall meet the minimum requirements assumed in such analysis.

Insert ZZ

14.2.12.2.24 HVAC System Performance

(1) Purpose

To verify various HVAC systems performance for the loads present during reactor power operation.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Power ascension phase testing of plant HVAC systems is necessary only to the extent that fully loaded conditions could not be approached during the preoperational phase. Pertinent parameters should be monitored in order to provide a final verification of proper system flow balancing and cooler performance under near design or special situation conditions, as is appropriate. This will include extrapolation of results obtained under normal or test conditions as needed to demonstrate required performance at limiting or accident conditions.

(4) Criteria

System performance should be consistent with design requirements. For systems that are taken credit for in the plant safety analysis, performance shall meet the minimum requirements assumed in such analysis.

14.2.12.2.25 Turbine Valve Performance

(1) Purpose

To demonstrate proper functioning of the main turbine control, stop, and bypass valves during reactor power operation.

Insert ZZ

Level 1

Not Applicable

Level 2

The Reactor Building Cooling Water (RCW) System shall be capable of removing heat loads from plant auxiliaries at the heat exchanger capacity determined by the flow rate and temperature differentials indicated in the RCW System Process Flow Diagram (SSAR Figure 9.2-1A) for both normal and emergency operating conditions.

The Turbine Building Cooling Water (TCW) System shall be capable of providing cooling water to the various heat exchangers (listed in SSAR Table 9.2-(2) it serves to maintain system parameters within the design temperature limits specified. (SSAR Section 9.2.14.1.2 and applicable vendor's instructions).

The Reactor Service Water (RSW) system shall be capable of providing cooling water to remove heat from the RCW system heat exchangers while maintaining RCW heat exchanger outlet temperature within the design limits (SSAR Figure 9.2-1A) for both normal and emergency operating conditions.

Insert ZZ (cont'd) 2 of 2

The Turbine Service Water (TSW) system shall be capable of providing cooling water to remove heat from the TCW system heat exchangers to maintain TCW heat exchanger outlet temperatures within the design limits. (SSAR Section 9.2.16.1.2)

tendencies and should provide quick but stable response.

14.2.12.2.23 Plant Cooling/Service Water System(s) Performance

(1) Purpose

To verify performance of the various plant cooling/service water systems, including the reactor building cooling water system, the reactor service water system, the turbine building cooling water system and the turbine service water system under expected reactor power operation load conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Power ascension phase testing of plant cooling water systems is necessary only to the extent that fully loaded conditions could not be approached during the preoperational phase. Pertinent parameters should be monitored in order to provide a final verification of proper system flow balancing and heat exchanger performance under near design or special conditions, as is appropriate. This will include extrapolation of results obtained under normal or test conditions as needed to demonstrate required performance at limiting or accident conditions.

(4) Criteria

System performance should be consistent with design requirements. For systems that are taken credit for in the plant safety analysis, performance shall meet the minimum requirements assumed in such analysis.

14.2.12.2.24 HVAC System Performance

(1) Purpose

To verify various HVAC systems performance for the loads present during reactor power operation.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Power ascension phase testing of plant HVAC systems is necessary only to the extent that fully loaded conditions could not be approached during the preoperational phase. Pertinent parameters should be monitored in order to provide a final verification of proper system flow balancing and cooler performance under near design or special situation conditions, as is appropriate. This will include extrapolation of results obtained under normal or test conditions as needed to demonstrate required performance at limiting or accident conditions.

(4) Criteria

System performance should be consistent with design requirements. For systems that are taken credit for in the plant safety analysis, performance shall meet the minimum requirements assumed in such analysis.

14.2.12.2.25 Turbine Valve Performance

(1) Purpose

To demonstrate proper functioning of the main turbine control, stop, and bypass valves during reactor power operation.

Insert AAA

Level 1

Not Applicable

Level 2

Area ventilation systems shall be capable of maintaining the temperature and relative humidity within the environmental qualification requirements for the affected equipment as stated in SSAR Appendix 3I, Table 3I.3-1 to 3I.3-5.

tendencies and should provide quick but stable response.

14.2.12.2.23 Plant Cooling/Service Water System(s) Performance

(1) Purpose

To verify performance of the various plant cooling/service water systems, including the reactor building cooling water system, the reactor service water system, the turbine building cooling water system and the turbine service water system under expected reactor power operation load conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Power ascension phase testing of plant cooling water systems is necessary only to the extent that fully loaded conditions could not be approached during the preoperational phase. Pertinent parameters should [Shall] be monitored in order to provide a final verification of proper system flow balancing and heat exchanger performance under near design or special conditions, as is appropriate. This will include extrapolation of results obtained under normal or test conditions as needed to demonstrate required performance at limiting or accident conditions.

(4) Criteria

System performance should be consistent with design requirements. For systems that are taken credit for in the plant safety analysis, performance shall meet the minimum requirements assumed in such analysis.

14.2.12.2.24 HVAC System Performance

(1) Purpose

To verify various HVAC systems performance for the loads present during reactor power operation.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Power ascension phase testing of plant HVAC systems is necessary only to the extent that fully loaded conditions could not be approached during the preoperational phase. Pertinent parameters should [Shall] be monitored in order to provide a final verification of proper system flow balancing and cooler performance under near design or special situation conditions, as is appropriate. This will include extrapolation of results obtained under normal or test conditions as needed to demonstrate required performance at limiting or accident conditions.

(4) Criteria

System performance should be consistent with design requirements. For systems that are taken credit for in the plant safety analysis, performance shall meet the minimum requirements assumed in such analysis.

14.2.12.2.25 Turbine Valve Performance

(1) Purpose

To demonstrate proper functioning of the main turbine control, stop, and bypass valves during reactor power operation [and to verify the maximum capacity of the bypass system].

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Early in the startup test phase with the re-

actor at a moderate power level and with the turbine generator on line, the operability of the control, stop, and bypass valves will be demonstrated. This testing should be similar to the individual valve testing required by the technical specification surveillance program. In addition to valve operability the overall plant response will be observed. Since turbine valve testing is required routinely during power operation, it is also desirable to determine the maximum power level at which such tests can safely be performed by observing plant response during such tests at successively higher power levels.

(4) Criteria

All turbine valves shall operate properly and in accordance with applicable technical specification requirements. Valve performance and plant response should be consistent with design requirements. During high power testing, minimum trip avoidance margins should be maintained.

14.2.12.2.26 MSIV Performance

(1) Purpose

To demonstrate proper operation of and to verify closure times for main steamline isolation valves, including branch steamline isolation valves, during power operation.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

At rated temperature and pressure, and then again at an intermediate power level, each MSIV will be individually stroked in the fast closure mode. Valve operability and closure time will be verified and overall plant response observed. Closure times will be evaluated consistent with technical specification and safety analysis requirements. If appropriate, it is also desirable to determine the maximum power level at which such tests can safely be performed by observing plant response during such tests at successively higher power levels. In addition, at rated temperature and pressure, proper functioning and stroke timing of branch steamline isolation valves (e.g. on common drain line) will be demonstrated.

(4) Criteria

MSIV closure times shall be within the limits required by plant technical specifications and those assumed in the plant safety analysis. Overall valve performance should be in accordance with design requirements. During higher power level tests minimum plant trip avoidance margins should be maintained.

14.2.12.2.27 SRV Performance

(1) Purpose

To demonstrate that each safety/relief valve can be opened and closed properly in the relief mode during reactor power operation.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

A functional test of each SRV shall be made as early in the power ascension as is practicable based on the valve manufacturer's recommendations. This is normally the first time the plant reaches rated temperature and pressure. Opening and closing of each valve, as well as evidence of steam flow, will be verified by response of SRV discharge tailpipe sensors and by observed changes in steamflow in the main

Insert P

Additionally, at an intermediate power level during power ascension, the total capacity of installed bypass valves will be measured. After completion of the function test of the bypass system, the bypass steam flow will be increased until the maximum flow capability of the bypass system is determined. Adjustments to reactor power level and/or auxiliary load on the generator may be necessary to achieve this.

(4) Criteria

Level 1

The reactor shall not scram or isolate during full closure testing of individual main turbine control, stop, and bypass valves at power levels up to the maximum allowable power level for conducting such tests as specified by the applicable plant surveillance procedure.

Level 2

During full closure testing of individual turbine control, stop, and bypass valves, the transient peak values of reactor vessel pressure, neutron flux, simulated fuel surface heat flux, and main steamline flow

Insert P (cont'd)

must have adequate scram avoidance margins as required by the GE Startup Test Specifications.

The measured total bypass valve capacity shall be equal to or greater than that used for the nuclear safety operational analysis (NSOA) as shown in SSAR Table 15.0-1.

actor at a moderate power level and with the turbine generator on line, the operability of the control, stop, and bypass valves will be demonstrated. This testing ~~should~~ be similar to the individual valve testing required by the technical specification surveillance program. In addition to valve operability the overall plant response will be observed. Since turbine valve testing is required routinely during power operation, it is also desirable to determine the maximum power level at which such tests can safely be performed by observing plant response during such tests at successively higher power levels.

(4) Criteria

All turbine valves shall operate properly and in accordance with applicable technical specification requirements. Valve performance and plant response should be consistent with design requirements. During high power testing, minimum trip avoidance margins should be maintained.

14.2.12.2.26 MSIV Performance

(1) Purpose

To demonstrate proper operation of and to verify closure times for main steamline isolation valves, including branch steamline isolation valves, during power operation.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

At rated temperature and pressure, and then again at an intermediate power level, each MSIV will be individually stroked in the fast closure mode. Valve operability and closure time will be verified and overall plant response observed. Closure times will be evaluated consistent with technical specification and safety analysis requirements. If appropriate, it is also desirable to determine the maximum power level at which such tests can safely be performed by observing plant response during such tests at successively higher power levels. In addition, at rated temperature and pressure, proper functioning and stroke timing of branch steamline isolation valves (e.g. on common drain line) will be demonstrated.

(4) Criteria

~~MSIV closure times shall be within the limits required by plant technical specifications and those assumed in the plant safety analysis. Overall valve performance should be in accordance with design requirements. During higher power level tests minimum plant trip avoidance margins should be maintained.~~

14.2.12.2.27 SRV Performance

(1) Purpose

To demonstrate that each safety/relief valve can be opened and closed properly in the relief mode during reactor power operation.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

A functional test of each SRV shall be made as early in the power ascension as is practicable based on the valve manufacturer's recommendations. This is normally the first time the plant reaches rated temperature and pressure. Opening and closing of each valve, as well as evidence of steam flow, will be verified by response of SRV discharge tailpipe sensors and by observed changes in steamflow in the main

Insert O

Level 1

MSIV closure time (exclusive of electrical delay), for any individual valve, shall be within the upper and lower closure time limits specified in the plant Technical Specifications.

The reactor shall not scram or isolate during full trip closure of individual MSIV at power levels up to the maximum allowable power level for conducting such test as specified by the applicable plant surveillance procedure.

Level 2

During full trip closure testing of individual MSIV, the transient peak values of reactor vessel pressure, neutron flux, simulated fuel surface heat flux, and main steamline flow must have adequate scram avoidance margins as required by the GE Startup Test Specifications.

actor at a moderate power level and with the turbine generator on line, the operability of the control, stop, and bypass valves will be demonstrated. This testing ~~should~~ will be similar to the individual valve testing required by the technical specification surveillance program. In addition to valve operability the overall plant response will be observed. Since turbine valve testing is required routinely during power operation, it is also desirable to determine the maximum power level at which such tests can safely be performed by observing plant response during such tests at successively higher power levels.

(4) Criteria

All turbine valves shall operate properly and in accordance with applicable technical specification requirements. Valve performance and plant response should be consistent with design requirements. During high power testing, minimum trip avoidance margins should be maintained.

14.2.12.2.26 MSIV Performance

(1) Purpose

To demonstrate proper operation of and to verify closure times for main steamline isolation valves, including branch steamline isolation valves, during power operation.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

At rated temperature and pressure, and then again at an intermediate power level, each MSIV will be individually stroked in the fast closure mode. Valve operability and closure time will be verified and overall plant response observed. Closure times will be evaluated consistent with technical specification and safety analysis requirements. If appropriate, it is also desirable to determine the maximum power level at which such tests can safely be performed by observing plant response during such tests at successively higher power levels. In addition, at rated temperature and pressure, proper functioning and stroke timing of branch steamline isolation valves (e.g. on common drain line) will be demonstrated.

(4) Criteria

MSIV closure times shall be within the limits required by plant technical specifications and those assumed in the plant safety analysis. Overall valve performance should be in accordance with design requirements. During higher power level tests minimum plant trip avoidance margins should be maintained.

14.2.12.2.27 SRV Performance

(1) Purpose

To demonstrate that (there is no major blockages in the relief valve discharge piping, and that) each safety/relief valve can be opened and closed properly in the ~~relief~~ (manual actuation) mode during reactor power operation (, and will reseat properly after operation,).

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

A functional test of each SRV shall be made as early in the power ascension as is practicable based on the valve manufacturer's recommendations. This is normally the first time the plant reaches rated temperature and pressure. Opening and closing of each valve, as well as evidence of steam ~~flow~~ (discharge), will be verified by response of SRV discharge tailpipe (temperature) sensors and by observed changes in steamflow in the main

steamlines downstream of the SRVs. Tailpipe sensors may include temperature indications, pressure switches or acoustic monitors. Downstream indications of SRV operation could be changes in such parameters as turbine valve positions or generator output. Such changes will also be evaluated for anomalies which may indicate a restriction or blockage in a particular SRV tailpipe by making valve to valve comparisons. Tailpipe backpressures should also be evaluated against any bounding design assumptions. Additionally, during applicable plant transient testing, where SRVs are expected to open, operability, opening setpoints, and reset pressures will be verified. as part of these tests.

(4) Criteria

There shall be a positive indication of steam discharge during each manual valve opening. For automatic openings the relief setpoints and reset pressures shall be within technical specification limits. SRV open and close indications, including tailpipe sensors, should function as designed. For manual openings the apparent steam flow through each SRV should not vary significantly from the average for all valves. Tailpipe back pressures should be consistent with design assumptions.

Insert Q

14.2.12.2.28 Loss of Feedwater Heating

(1) Purpose

To demonstrate proper integrated plant response to a loss of feedwater heating event and to verify the adequacy of the modeling and associated assumptions used for this transient in the plant licensing analysis.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

The credible single failure or operator error that has been indentified as resulting in the largest feedwater temperature reduction will be initiated at a significantly high power level, while considering the event analyzed and the predicted results. Core performance and overall plant response will be observed in order to demonstrate proper integrated response and to compare actual results with those predicted. This comparison will take into account the differences between actual initial conditions and observed results and the assumptions used for the analytical predictions.

(4) Criteria

Resultant MCPR shall remain greater than the fuel thermal safety limit and measured results shall compare conservatively with design assumptions and predictions. The overall plant response should be according to design and testing specifications.

14.2.12.2.29 Feedwater Pump Trip

(1) Purpose

To demonstrate the ability of the plant to respond to and survive the loss of an operating feedwater pump from near rated power conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. Applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

From an initial reactor power level near rated, one of the operating feedwater pumps will be tripped and it will be demonstrated that the overall plant response is such that a reactor trip is avoided. Specifically, it ~~should~~ shall be verified that the feedwater control system is sufficiently responsive, in

Insert Q

Level 1

There shall be a positive indication of steam discharge during the manual actuation of each SRV.

Level 2

During opening and closing of each SRV, the responses of pressure control system related variables shall be at least quarter-damped (i.e. the decay ratio of the second-to-first overshoot for each variable is less than or equal to 0.25).

The temperature measured by thermocouples on the discharge side of the safety/relief valves shall return to the temperature recorded before the valve was opened within 10°F range as specified by the GE Startup Test Specification.

During the manual actuation of each SRV, the steam flow discharge through the valve (as measured by change in MWe, BPV position, etc.) shall not differ from the average of all the valve responses by more than the limit as specified in the GE Startup Test Specifications.

with the recirculation flow near its rated value

steamlines downstream of the SRVs. Tailpipe sensors may include temperature indications, pressure switches or acoustic monitors. Downstream indications of SRV operation could be changes in such parameters as turbine valve positions or generator output. Such changes will also be evaluated for anomalies which may indicate a restriction or blockage in a particular SRV tailpipe by making valve to valve comparisons. Tailpipe backpressures ~~should~~ Shall also be evaluated against any bounding design assumptions. Additionally, during applicable plant transient testing, where SRVs are expected to open, operability, opening setpoints, and reset pressures will be verified.

(4) Criteria

There shall be a positive indication of steam discharge during each manual valve opening. For automatic openings the relief setpoints and reset pressures shall be within technical specification limits. SRV open and close indications, including tailpipe sensors, should function as designed. For manual openings the apparent steam flow through each SRV should not vary significantly from the average for all valves. Tailpipe back pressures should be consistent with design assumptions.

14.2.12.2.28 Loss of Feedwater Heating

(1) Purpose

To demonstrate proper integrated plant response to a loss of feedwater heating event and to verify the adequacy of the modeling and associated assumptions used for this transient in the plant licensing analysis.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

The credible single failure or operator error that has been indentified as resulting in the largest feedwater temperature reduction will be initiated at a significantly high power level, while considering the event analyzed and the predicted results. Core performance and overall plant response will be observed in order to demonstrate proper integrated response and to compare actual results with those predicted. This comparison will take into account the differences between actual initial conditions and observed results and the assumptions used for the analytical predictions.

Proper operation of the SCRRI function will also be verified if the difference between actual and reference feedwater temperatures exceeds the delta-T setpoint as a result of the loss of feedwater heating transient.

(4) Criteria

Insert OO

~~Resultant MCPR shall remain greater than the fuel thermal safety limit and measured results shall compare conservatively with design assumptions and predictions. The overall plant response should be according to design and testing specifications.~~

14.2.12.2.29 Feedwater Pump Trip

(1) Purpose

To demonstrate the ability of the plant to respond to and survive the loss of an operating feedwater pump from near rated power conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. Applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

From an initial reactor power level near rated, one of the operating feedwater pumps will be tripped and it will be demonstrated that the overall plant response is such that a reactor trip is avoided. Specifically, it ~~should~~ Shall be verified that the feedwater control system is sufficiently responsive, in

Insert OO

Level 1

The maximum feedwater temperature loss due to single operator error or equipment failure shall not exceed the value assumed in the design basis plant transient analysis as stated in SSAR Section 15.1.1.1.1.

The resultant MCPR due to loss of feedwater heating shall be greater than the fuel thermal safety limit.

The increase in simulated fuel surface heat flux shall not exceed the predicted Level 2 criterion value by more than two percent as specified by the Transient Safety Analysis Design Report (TSADR) document

Level 2

The increase in simulated fuel surface heat flux shall not exceed the predicted value referenced to the actual test values of feedwater temperature drop and power level. The predicted value is provided in the plant transient safety analysis design report (TSADR) and will be used as the basis to which the actual transient is compared.

Insert OO (Cont'd)

SCRRI Selected Control rods run-in) function shall be initiated, if the temperature differential between the actual and reference feedwater temperatures exceeds the delta-T setpoint specified in the applicable Feedwater Control System Design Specification. The reactor power shall be brought to below 80% rod line as shown in the power-flow operating map.

steamlines downstream of the SRVs. Tailpipe sensors may include temperature indications, pressure switches or acoustic monitors. Downstream indications of SRV operation could be changes in such parameters as turbine valve positions or generator output. Such changes will also be evaluated for anomalies which may indicate a restriction or blockage in a particular SRV tailpipe by making valve to valve comparisons. Tailpipe backpressures should also be evaluated against any bounding design assumptions. Additionally, during applicable plant transient testing, where SRVs are expected to open, operability, opening setpoints, and reset pressures will be verified.

(4) Criteria

There shall be a positive indication of steam discharge during each manual valve opening. For automatic openings the relief setpoints and reset pressures shall be within technical specification limits. SRV open and close indications, including tailpipe sensors, should function as designed. For manual openings the apparent steam flow through each SRV should not vary significantly from the average for all valves. Tailpipe back pressures should be consistent with design assumptions.

14.2.12.2.28 Loss of Feedwater Heating

(1) Purpose

To demonstrate proper integrated plant response to a loss of feedwater heating event and to verify the adequacy of the modeling and associated assumptions used for this transient in the plant licensing analysis.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

The credible single failure or operator error that has been indentified as resulting in the largest feedwater temperature reduction will be initiated at a significantly high power level, while considering the event analyzed and the predicted results. Core performance and overall plant response will be observed in order to demonstrate proper integrated response and to compare actual results with those predicted. This comparison will take into account the differences between actual initial conditions and observed results and the assumptions used for the analytical predictions.

(4) Criteria

Resultant MCPR shall remain greater than the fuel thermal safety limit and measured results shall compare conservatively with design assumptions and predictions. The overall plant response should be according to design and testing specifications.

14.2.12.2.29 Feedwater Pump Trip

(1) Purpose

To demonstrate the ability of the plant to respond to and survive the loss of an operating feedwater pump, from near rated power conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. Applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

From an initial reactor power level near rated, one of the operating feedwater pumps will be tripped and it will be demonstrated that the overall plant response is such that a reactor trip is avoided. Specifically, it should be verified that the feedwater control system is sufficiently responsive, in

(the automatic RIP speed runback feature)

conjunction with specified mitigating features to prevent a reactor trip due to the water level transient. Separate tests may be required to demonstrate features such as automatic core flow runback or auto start of a standby feedpump, if appropriate.

(4) Criteria

Insert PP

From normal operating conditions, the reactor should remain operating with adequate margin to a water level setpoint trip.

14.2.12.2.30 Recirculation Pump Trip

(1) Purpose

To demonstrate acceptable plant response and to obtain recirculation system performance data during and subsequent to potential reactor internal pump (RIP) trip transients.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. The applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

A potential threat to plant availability is the reactor trip due to high water level that may result from an unexpected trip of one or more of the RIPs. From near rated power and flow the most limiting, credible RIP trip scenario, for which the plant is designed to remain operating, will be initiated in order to verify proper plant response. Of major concern is the feedwater control systems ability to control reactor water level in time to avoid a high water level trip Also to be demonstrated are the coastdown characteristics of the tripped pump(s), the onset of reverse flow through the idle pump(s), and the ability to restart the pump(s). The coastdown characteristics are of importance especially during a high power turbine or generator trip where the RPT logic actuates to provide increased margin to core thermal limits. Therefore, an evaluation will be made during the testing of Subsection 14.2.12.2.33 to demonstrate that coastdown characteristics are conservative relative to safety analysis assumptions. The testing described will also help to verify proper operation of the SCRRI logic and function in response to actual RIP trip, and will help demonstrate proper overall plant response to events that result in SCRRI actuation.

(4) Criteria

The reactor should not trip following any RIP trip scenario for which it is designed to remain operating. Recirculation system performance and overall plant response should be in accordance with design expectations. RIP and core flow coastdown characteristics shall be conservative relative to safety analysis design assumptions. During all RIP trip and restart scenarios tested, the applicable parameters should maintain the specified minimum margins to their associated trip setpoints.

14.2.12.2.31 Shutdown From Outside the Main Control Room

(1) Purpose

To demonstrate that the reactor can be shut down from normal power operation to the point where a controlled cooldown has been established, via decay heat rejection to the ultimate heat sink, with vessel pressure and water level under control, all using means entirely outside the main control room.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. The applicable instrumentation shall be checked or calibrated as is appropriate. An adequate number of qualified personnel shall be on site to perform the specified testing as well as their normal plant operational duties.

Insert PP

Level 1

Not applicable

Level 2

The reactor shall avoid low water level scram by the margin required by the GE Startup Test Specifications from an initial water level halfway between the high and low level alarm setpoints.

(function, if the three RIPs trip results in a power and flow conditions that fall outside the appropriate SCRRI logic setpoints.)

conjunction with specified mitigating features, to prevent a reactor trip due to the water level transient. Separate tests may be required to demonstrate features such as automatic core flow runback or auto start of a standby feedpump, if appropriate.

(4) Criteria

From normal operating conditions, the reactor should remain operating with adequate margin to a water level setpoint trip.

14.2.12.2.30 Recirculation Pump Trip

(1) Purpose

To demonstrate acceptable plant response and to obtain recirculation system performance data during and subsequent to potential reactor internal pump (RIP) trip transients.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. The applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

(One and three RIP trip tests will be conducted to demonstrate the feedwater control system's)

A potential threat to plant availability is the reactor trip due to high water level that may result from an unexpected trip of one or more of the RIPs. From near rated power and flow the most limiting, credible RIP trip scenario, for which the plant is designed to remain operating, will be initiated in order to verify proper plant response. Of major concern is the feedwater control systems ability to control reactor water level in time to avoid a high water level trip. Also to be demonstrated are the coastdown characteristics of the tripped pump(s), the onset of reverse flow through the idle pump(s), and the ability to restart the pump(s). The coastdown characteristics are of importance especially during a high power turbine or generator trip where the RPT logic actuates to provide increased margin to core thermal limits. Therefore, an evaluation will be made during the testing of Subsection 14.2.12.2.33 to demonstrate that coastdown characteristics are conservative relative to safety analysis assumptions. The testing described will also help to verify proper operation of the SCRRI logic and function in response to actual RIP trip, and will help demonstrate proper overall plant response to events that result in SCRRI actuation.

(A trip test of an RIP M/G set along with three RIPs connected is conducted to confirm RIPs and M/G set coastdown characteristics prior to the high power turbine/generator trip tests (SSAR Section 14.2.12.2.33) and adjacent plant operations.)

(4) Criteria

(Insert QQ)

The reactor should not trip following any RIP trip scenario for which it is designed to remain operating. Recirculation system performance and overall plant response should be in accordance with design expectations. RIP and core flow coastdown characteristics shall be conservative relative to safety analysis design assumptions. During all RIP trip and restart scenarios tested, the applicable parameters should maintain the specified minimum margins to their associated trip setpoints.

14.2.12.2.31 Shutdown From Outside the Main Control Room

(1) Purpose

To demonstrate that the reactor can be shut down from normal power operation to the point where a controlled cooldown has been established, via decay heat rejection to the ultimate heat sink, with vessel pressure and water level under control, all using means entirely outside the main control room.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. The applicable instrumentation shall be checked or calibrated as is appropriate. An adequate number of qualified personnel shall be on site to perform the specified testing as well as their normal plant operational duties.

Insert QQ

Level 1

The reactor shall not scram during RIP trip and recovery transients.

The resultant MCPR after one and three RIP trip must be greater than the fuel thermal limit.

After three RIPs trip, the core flow coastdown transient during the first three seconds must be bounded by the limiting curves defined in the applicable transient/stability performance requirements document.

Level 2

The reactor water level swell during RIP trip transients shall have a minimum scram avoidance margin as required by the GE Startup Test Specifications.

During RIP trip recovery, the scram avoidance margins for neutron flux and simulated fuel surface heat flux shall at least meet the requirements as specified by the GE Startup Test Specifications. *

The SCRRI (selected control rods run-in) feature shall function as designed, if the flow and power setpoints are reached after the three RIPs trip, i.e., the total delay time between start of RIP trip and start of pre-selected control rod motions shall not exceed

the limit specified in the applicable transient/stability performance requirements document and the reactor power shall be brought to below 80% rod line as designed.

conjunction with specified mitigating features, to prevent a reactor trip due to the water level transient. Separate tests may be required to demonstrate features such as automatic core flow runback or auto start of a standby feedpump, if appropriate.

(4) Criteria

From normal operating conditions, the reactor should remain operating with adequate margin to a water level setpoint trip.

14.2.12.2.30 Recirculation Pump Trip

(1) Purpose

To demonstrate acceptable plant response and to obtain recirculation system performance data during and subsequent to potential reactor internal pump (RIP) trip transients.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. The applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

A potential threat to plant availability is the reactor trip due to high water level that may result from an unexpected trip of one or more of the RIPs. From near rated power and flow the most limiting, credible RIP trip scenario, for which the plant is designed to remain operating, will be initiated in order to verify proper plant response. Of major concern is the feedwater control systems ability to control reactor water level in time to avoid a high water level trip. Also to be demonstrated are the coastdown characteristics of the tripped pump(s), the onset of reverse flow through the idle pump(s), and the ability to restart the pump(s). The coastdown characteristics are of importance especially during a high power turbine or generator trip where the RPT logic actuates to provide increased margin to core thermal limits. Therefore, an evaluation will be made during the testing of Subsection 14.2.12.2.33 to demonstrate that coastdown characteristics are conservative relative to safety analysis assumptions. The testing described will also help to verify proper operation of the SCRRI logic and function in response to actual RIP trip, and will help demonstrate proper overall plant response to events that result in SCRRI actuation.

(4) Criteria

The reactor should not trip following any RIP trip scenario for which it is designed to remain operating. Recirculation system performance and overall plant response should be in accordance with design expectations. RIP and core flow coastdown characteristics shall be conservative relative to safety analysis design assumptions. During all RIP trip and restart scenarios tested, the applicable parameters should maintain the specified minimum margins to their associated trip setpoints.

14.2.12.2.31 Shutdown From Outside the Main Control Room

(1) Purpose (in a timely and coordinated manner)

To demonstrate that the reactor can be shut down from normal power operation to the point where a controlled cooldown has been established, via decay heat rejection to the ultimate heat sink, with vessel pressure and water level under control, all using means entirely outside the main control room.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. The applicable instrumentation shall be checked or calibrated as is appropriate. An adequate number of qualified personnel shall be on site to perform the specified testing as well as their normal plant operational duties.

(3) Description

This test ~~should~~ Shall be performed from a low

The hot standby capability demonstration portion of this

initial power level but from one that is sufficiently high such that a majority of plant systems are in their normal configurations at power operation. This test is as much a test of normal and emergency plant procedures and the ability of plant personnel to carry them out as it is a test of plant systems and equipment. Therefore, the test should be performed using the minimum shift crew that would be available during an actual event. Additional qualified personnel will be available in the control room to monitor the progress of the test and to re-establish control of the plant should an unsafe condition develop. These personnel will also perform predefined non-safety related activities to protect plant equipment where such activities would not be required during an actual emergency situation. The test will be initiated by simulating a control room evacuation and then tripping the reactor by means outside of the control room. Achievement and maintenance of the hot standby condition is then demonstrated through control of vessel pressure and water level. The ability to reach cold shutdown is demonstrated by cooling the reactor down to where some form of residual heat removal can be and is initiated by establishing a heat rejection path to the ultimate heat sink, again by means entirely outside of the main control room. The cold shutdown capability does not necessarily have to be demonstrated immediately following the shutdown and hot standby demonstration as long as the total integrated capability is adequately demonstrated. Also, additional personnel, over and above the minimum shift crew, may be utilized for the cold shutdown portion of the test consistent with plant procedure and management's ability to assemble extra help at the plant site in emergency situations.

(4) Criteria

The remote shutdown test should, as a minimum, demonstrate the capability of plant personnel, equipment, and procedures to initiate a reactor trip, to achieve and maintain hot standby conditions for at least 30 minutes, and to initiate decay heat removal such that coolant temperature is reduced by at least 50°F, all from outside the main control room. Additionally, system and plant performance should be consistent with design and testing specification requirements.

14.2.12.2.32 Loss of Turbine Generator and Offsite Power

(1) Purpose

To verify proper electrical equipment response and reactor system transient performance during and subsequent to a turbine generator trip with coincident loss of all offsite power sources.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. Applicable instrumentation shall be checked or calibrated as is appropriate. A sufficient number of qualified personnel shall be available to handle the needs of this test as well as those associated with normal plant operation.

(3) Description

This test should be performed at a relatively low power level early in the power ascension phase, but with the generator on line at greater than 10% load. The test will be initiated in a way such that the turbine generator is tripped and the plant is completely disconnected from all offsite power sources. The plant shall then be maintained isolated from offsite power for a minimum of 30 minutes. During this time, appropriate parameters will be monitored in order to verify the proper response of plant systems and equipment, including the proper switching of electrical equipment and the proper starting and sequencing of onsite power sources and their respective loads.

(4) Criteria

All safety-related equipment and systems, and others judged to be important to safety

Insert TT

Level 1

Not Applicable

Level 2

During a simulated control room evacuation, the hot standby capability demonstration portion of the test must demonstrate that the reactor can be brought down from a normal initial steady-state power level to hot standby condition with reactor vessel pressure and water level under control using minimum shift crew and equipment and controls outside the main control room. The plant shall be maintained at stable hot standby conditions for at least 30 minutes.

The cold shutdown capability demonstration portion of the test must demonstrate that the reactor coolant temperature and pressure can be lowered sufficiently to put the RHR system in shutdown cooling mode of operation and under control from outside the main control room. The reactor coolant temperature shall be reduced at least 50°F at a rate that would not exceed the plant Technical Specifications limit using the RHR system.

initial power level but from one that is sufficiently high such that a majority of plant systems are in their normal configurations for power operation. This test is as much a test of normal and emergency plant procedures and the ability of plant personnel to carry them out as it is a test of plant systems and equipment. Therefore, the test ~~should~~ shall be performed using the minimum shift crew that would be available during an actual event. Additional qualified personnel will be available in the control room to monitor the progress of the test and to re-establish control of the plant should an unsafe condition develop. These personnel will also perform predefined non-safety related activities to protect plant equipment where such activities would not be required during an actual emergency situation. The test will be initiated by simulating a control room evacuation and then tripping the reactor by means outside of the control room. Achievement and maintenance of the hot standby condition is then demonstrated through control of vessel pressure and water level. The ability to reach cold shutdown is demonstrated by cooling the reactor down to where some form of residual heat removal can be and is initiated by establishing a heat rejection path to the ultimate heat sink, again by means entirely outside of the main control room. The cold shutdown capability does not necessarily have to be demonstrated immediately following the shutdown and hot standby demonstration as long as the total integrated capability is adequately demonstrated. Also, additional personnel, over and above the minimum shift crew, may be utilized for the cold shutdown portion of the test consistent with plant procedure and management's ability to assemble extra help at the plant site in emergency situations.

(4) Criteria

The remote shutdown test ~~should~~ shall, as a minimum, demonstrate the capability of plant personnel, equipment, and procedures to initiate a reactor trip, to achieve and maintain hot standby conditions for at least 30 minutes, and to initiate decay heat removal such that coolant temperature is reduced by at least 50°F, all from outside the main control room. Additionally, system and plant performance should be consistent with design and testing specification requirements.

14.2.12.2.32 Loss of Turbine Generator ~~and~~ Offsite Power

(1) Purpose

To verify proper electrical equipment response and reactor system transient performance during and subsequent to a turbine generator trip with coincident loss of all offsite power sources.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. Applicable instrumentation shall be checked or calibrated as is appropriate. A sufficient number of qualified personnel shall be available to handle the needs of this test as well as those associated with normal plant operation.

(3) Description

This test ~~should~~ shall be performed at a relatively low power level early in the power ascension phase, but with the generator on line at greater than 10% load. The test will be initiated in a way such that the turbine generator is tripped and the plant is completely disconnected from all offsite power sources. The plant shall then be maintained isolated from offsite power for a minimum of 30 minutes. During this time, appropriate parameters will be monitored in order to verify the proper response of plant systems and equipment, including the proper switching of electrical equipment and the proper starting and sequencing of onsite power sources and their respective loads.

(4) Criteria

~~All safety-related equipment and systems, and others judged to be important to safety~~

Insert UU

for this event, shall function as designed in accordance with technical specification and safety analysis requirements. All other systems and equipment should perform consistent with applicable design and testing specifications.

14.2.12.2.33 Turbine Trip and Generator Load Rejection

(1) Purpose

To verify that the dynamic response of the reactor and applicable systems and equipment is in accordance with design for protective trips of the turbine and generator during power operation.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

From an initial power level near rated, the main generator will be tripped in order to verify the proper reactor and integrated plant response. The method for initiating the trip should be chosen so that the turbine is subjected to maximum overspeed potential. Reactor parameters such as vessel dome pressure and simulated fuel surface heat flux will be monitored and compared with predictions so that the adequacy and conservatism of the analytical models and assumptions used to license the plant can be verified. Proper response of systems and equipment such as the turbine stop, control, and bypass valves, main steam relief valves, the reactor protection system, and the feedwater and recirculation systems will also be demonstrated. The core flow coastdown characteristics should be evaluated upon actuation of the recirculation pump trip logic. The ability of the feedwater system to control vessel level after a reactor trip should also be verified. Overspeed of the main turbine should also be evaluated since the generator is unloaded prior to complete shutoff of steam to the turbine.

For a turbine trip, the generator remains loaded and there is no overspeed. However, the dynamic response of the reactor may be different if the steam shutoff rate is different. If there is expected to be a significant difference, then it may be necessary to perform a separate demonstration and evaluation, similar to that discussed above, but initiated by a direct trip of the main turbine.

A turbine or generator trip should also be performed at an initial power level that is below that where a direct reactor trip is actuated and within the capacity of the bypass valves. Reactor dynamic response is not as important for this transient except for the ability to remain operating as designed. More important is the demonstration of proper integrated plant and system performance.

(4) Criteria

The reactor shall not scram during turbine or generator trips initiated from power levels within the capacity of the bypass valves and below the point at which the direct scram trip on turbine stop valve closure or control valve fast closure is enabled. For high power turbine or generator trips, reactor dynamic response should be consistent with predictions based on expected system characteristics and shall be conservative relative to safety analysis results based on design assumptions. Of particular importance are vessel dome pressure and simulated fuel surface heat flux. Safety-related and essential equipment and systems shall respond, as applicable, consistent with technical specification and safety analysis requirements. Other plant systems and equipment should perform in accordance with the appropriate design and testing specifications.

Shall

Shall

...provided there are expected to be relevant differences amongst the options available.

Insert UU

Level 1

Reactor protection system actions shall prevent violation of fuel thermal limits.

All safety systems, such as the Reactor Protection System, the diesel-generator, and the ECCS system must function properly without manual assistance, and HPCF and/or RCIC system action, if necessary, shall keep the reactor water level above the initiation level of the Low Pressure Flooder (LPFL) mode of the RHR system, the Auto Depressurization System (ADS), and MSIV closure.

The turbine steam bypass valves shall open after turbine/generator trips and remain operable (i.e., with power available and not isolated due to low condenser vacuum) for at least the minimum time period assumed by the plant transient safety analysis, subsequent to trip of the condenser circulating water pumps.

Level 2

Proper instrument display to the reactor operator shall be demonstrated, including power monitors, vessel pressure, reactor water level, control rod positions, suppression pool temperature, and reactor cooling system status. Displays shall not be dependent on specially installed instrumentati

Temporary interruption of instrument display is acceptable

provided that the operator has sufficient information available for long term operation to properly access the plant status.

(At high power levels, the dynamic response of the reactor is very similiar between the generator and turbine trip transient. Therefore, a separate turbine trip test at high power level is not required.)

for this event, shall function as designed in accordance with technical specification and safety analysis requirements. All other systems and equipment should perform consistent with applicable design and testing specifications.

14.2.12.2.33 Turbine Trip and Generator Load Rejection

(1) Purpose

To verify that the dynamic response of the reactor and applicable systems and equipment is in accordance with design for protective trips of the turbine and generator during power operation.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

From an initial power level near rated, the main generator will be tripped in order to verify the proper reactor and integrated plant response. The method for initiating the trip ~~should~~ shall be chosen so that the turbine is subjected to maximum overspeed potential, (...provided there are expected to be relevant differences amongst the options available. Typically, this trip is initiated by opening of the generator output breakers.) Reactor parameters such as vessel dome pressure and simulated fuel surface heat flux will be monitored and compared with predictions so that the adequacy and conservatism of the analytical models and assumptions used to license the plant can be verified. Proper response of systems and equipment such as the turbine stop, control, and bypass valves, main steam relief valves, the reactor protection system, and the feedwater and recirculation systems will also be demonstrated. The core flow coastdown characteristics should be evaluated upon actuation of the recirculation pump trip logic. The ability of the feedwater system to control vessel level after a reactor trip ~~should~~ shall also be verified. Overspeed of the main turbine ~~should~~ shall also be evaluated since the generator is unloaded prior to complete shutoff of steam to the turbine.

~~For a turbine trip~~ (For a direct trip of the turbine,) the generator remains loaded and there is no overspeed. ~~However, the dynamic response of the reactor may be different if the steam shutoff rate is different. If there is expected to be a significant difference, then it may be necessary to perform a separate demonstration and evaluation, similar to that discussed above, but initiated by a direct trip of the main turbine.~~

A turbine or generator trip should also be performed at an initial power level that is below that where a direct reactor trip is actuated and within the capacity of the bypass valves. ~~Reactor dynamic response is not as important for this transient except for the ability to remain operating as designed. More important is the demonstration of proper integrated plant and system performance.~~

Insert FF

(4) Criteria

~~The reactor shall not scram during turbine or generator trips initiated from power levels within the capacity of the bypass valves and below the point at which the direct scram trip on turbine stop valve closure or control valve fast closure is enabled. For high power turbine or generator trips, reactor dynamic response should be consistent with predictions based on expected system characteristics and shall be conservative relative to safety analysis results based on design assumptions. Of particular importance are vessel dome pressure and simulated fuel surface heat flux. Safety-related and essential equipment and systems shall respond, as applicable, consistent with technical specification and safety analysis requirements. Other plant systems and equipment should perform in accordance with the appropriate design and testing specifications.~~

Insert WW

Insert YY

at low power levels, sufficient reactor protection following the trip is provided, if needed, by high neutron flux and vessel high pressure scrams. Therefore, the protective trip actuated by stop/control valve motion is automatically bypassed at low power levels. However, there will be no significant pressure or power transient as a result of this low power turbine trip and, therefore, no reactor scram should occur for this test.

Insert WW

Level 1

For generator trip at power levels greater than 50% of rated, bypass valve quick opening shall begin no later than the specified time delay following the start of stop/control valve closure, and bypass valves shall be opened to a point corresponding to greater than or equal to 80% of their capacity within the specified time interval from the beginning of stop/control valve closure. The time delay and time interval are specified in the GE Startup Transient Test Specifications.

Feedwater control system settings must prevent flooding of the steam line following generator or turbine trip transients.

The core flow coastdown transient during the first three seconds after either generator or turbine trip at greater than 50% of rated power must be bounded by the limiting curves defined in the plant transient/stability performance requirements document.

The positive change in vessel dome pressure occurring within 30 seconds after either generator or turbine trip at greater than 50% of rated power must not exceed the Level 2 criteria by more than 25 psi as specified by the Transient Safety Analysis Design Report (TSADR) document.

The positive change in simulated fuel surface heat flux shall not exceed the Level 2 criteria by more than 2% as specified by the applicable transient safety analysis design report (TSADR) document.

Level 2

An automatic MSIV isolation shall not occur during the first three minutes of the transient resulting from either turbine or generator trip at greater than 50% of rated power. Operator actions shall not be required during that period to avoid an MSIV closure trip.

(Note: The operator may take action as he desires after the first three minutes, including switch out of RUN mode. The operator may also switch out RUN mode in the first three minutes, if he confirms from the measured data that this action will not prevent an automatic MSIV closure trip due to low reactor water level.)

The reactor shall not scram for turbine/generator trips initiated from initial thermal power values within that bypass value capacity.

The feedwater control system shall be capable of avoiding loss of feedwater pumps due to high reactor water level (Level 8) trip during the event.

Low water level RIP trips and HPCF/RCIC initiations shall not occur during the transient.

If any SRVs open, the temperatures measured by the thermocouples on the discharge side of the actuated SRVs must return to the temperature recorded before the valve was opened within 10°F range as specified by the GE Startup Test Specifications.

The positive change in vessel dome pressure and simulated fuel surface heat flux occurring within the first 30 seconds after the initiation of either turbine or generator trip must not exceed the predicted values referenced to actual test conditions of initial power level and vessel dome pressure and corrected for the measured control rod insertion speed and initiation time. The predicted values are provided in the applicable transient safety analysis design report (TSADR) document based on the beginning-of cycle design basis analysis and shall be used as the basis to which the actual transient is compared.

14.2.12.2.34 Reactor Full Isolation

(1) Purpose

To verify that the dynamic response of the reactor and applicable systems and equipment is in accordance with design for a simultaneous full closure of all MSIVs from near rated reactor power.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

A simultaneous full closure of all MSIVs will be initiated from near rated power in order to verify proper reactor and integrated plant response. Reactor dynamic response, as determined by such parameters as vessel dome pressure and simulated fuel surface heat flux, will be compared with analytical predictions in order to verify the adequacy and conservatism of the models and assumptions used in the plant safety and licensing analysis. Proper response of systems and equipment such as the MSIVs, SRVs, the reactor protection system, and the feedwater and recirculation systems will also be demonstrated.

(4) Criteria

~~The reactor dynamic response should be consistent with predictions based on expected system characteristics and shall be conservative relative to safety analysis results based on design assumptions. Safety-related and essential equipment and systems shall respond, as applicable, consistent with technical specification and safety analysis requirements. Other plant systems and equipment should perform in accordance with the appropriate design and testing specification.~~

Insert VV

14.2.12.2.35 Offgas System

(1) Purpose

To verify proper operation of the various components of the offgas system over the expected operating range of the system.

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing interation, the plant shall be in the appropriate operational configuration with the specified prerequisites testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Proper operation of the offgas system will be demonstrated by monitoring pertinent parameters such as temperature, pressure, flow rate, humidity, hydrogen content, and effluent radioactivity. Data ~~should~~ shall be collected at selected operating points such that each critical component of the system is evaluated over its particular expected operating range. Performance ~~should~~ shall be demonstrated for specific components such as catalytic recombiners, and activated carbon absorbers as well as the various heaters, coolers, dryers and filters. Also to be evaluated are the piping, valving, instrumentation and control that comprise the overall system. Testing of the offgas system is also discussed in 11.3.9.

(4) Criteria

Hydrogen concentration and radioactivity effluents shall not exceed technical specification limits. All applicable system and component parameters should be consistent with design and testing specification requirements.

Insert VV

Level 1

Reactor must scram to limit the severity of the neutron flux and simulated fuel surface heat flux transient.

The feedwater control system settings must prevent flooding of the main steam lines following the full MSIV closure transients.

The recorded MSIV full closure times must be within the limits specified in the plant Technical Specifications.

The positive change in vessel dome pressure occurring within the first 30 seconds after closure of all MSIVs must not exceed the Level 2 criteria by more than 25 psi as specified by the applicable Transient safety analysis design report (TSADR) document.

The positive change in simulated fuel surface heat flux shall not exceed the Level 2 criteria by more than 2% as specified by the applicable transient safety analysis design report (TSADR) document.

Level 2

If any SRVs open, the temperature measured by the thermocouples on the discharge side of the actuated SRVs must return to the temperature recorded before the valve was opened within 10°F range as specified by the GE Startup Test Specifications.

HPCF and RCIC systems shall be initiated automatically, if the low water level (Level 1.5 and 2 respectively) is reached during the initial transient following isolation. The minimum capacity and maximum delay time (including instrumentation delay) between the time vessel water level drops below the setpoint and makeup water enters the vessel shall meet the safety analysis requirements specified in the applicable plant transient/stability performance requirements document.

A trip of four RIPs shall be initiated, as appropriate if the low water level (Level 3) setpoint is reached. Trip of the remaining six RIPs shall be initiated if the low water level (Level 2) setpoint is reached.

The positive changes in vessel dome pressure and simulated fuel surface heat flux occurring within the first 30 seconds after the closure of all MSIV valves must not exceed the predicted values referenced to actual test conditions of initial power level and dome pressure and corrected for the measured control rod insertion speed and initiation time. The predicted values are provided in the applicable transient safety analysis design report (TSADR) based on the beginning-of-cycle design basis and shall be used as the basis to which the actual transient is compared.

During steady-state operation at the specified power and flow level, baseline data will be obtained in the form of cassette recordings and waveform plots for each installed sensor location.

14.2.12.2.36 Loose Parts Monitoring System Baseline Data

(1) Purpose

To collect baseline data for the loose parts monitoring system under normal plant operational conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration for the scheduled testing. Applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Loose parts monitoring system data will be collected at appropriate power and flow conditions to provide a baseline set of data indicative of normal plant operations. The data obtained will be used to help verify the adequacy of, or to facilitate needed changes to, initial alert level settings above normal levels.

(4) Criteria

Sufficient baseline data shall be obtained so as to verify the adequacy of system alert level settings in accordance with design requirements.

14.2.12.2.37 Concrete Penetration Temperature Surveys

(1) Purpose

To demonstrate the acceptability of concrete wall temperatures in the vicinity of selected high temperature penetrations under normal plant operational conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration for the scheduled testing. Applicable instrumentation shall be installed and checked or calibrated as is appropriate.

Level 1

Not applicable

Level 2

Initial baseline data for the Loose Parts Monitoring System has been satisfactorily established for each specified power and flow conditions during steady-state operations.

14.2.12.2.34 Reactor Full Isolation

(1) Purpose

To verify that the dynamic response of the reactor and applicable systems and equipment is in accordance with design for a simultaneous full closure of all MSIVs from near rated reactor power.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with all specified prerequisite testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

A simultaneous full closure of all MSIVs will be initiated from near rated power in order to verify proper reactor and integrated plant response. Reactor dynamic response, as determined by such parameters as vessel dome pressure and simulated fuel surface heat flux, will be compared with analytical predictions in order to verify the adequacy and conservatism of the models and assumptions used in the plant safety and licensing analysis. Proper response of systems and equipment such as the MSIVs, SRVs, the reactor protection system, and the feedwater and recirculation systems will also be demonstrated.

(4) Criteria

The reactor dynamic response should be consistent with predictions based on expected system characteristics and shall be conservative relative to safety analysis results based on design assumptions. Safety-related and essential equipment and systems shall respond, as applicable, consistent with technical specification and safety analysis requirements. Other plant systems and equipment should perform in accordance with the appropriate design and testing specifications.

14.2.12.2.35 Offgas System

(1) Purpose

To verify proper operation of the various components of the offgas system over the expected operating range of the system.

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedure and has approved the initiation of testing. For each scheduled testing interation, the plant shall be in the appropriate operational configuration with the specified prerequisites testing complete. All applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Proper operation of the offgas system [during all design modes of operation] will be demonstrated by monitoring pertinent parameters such as temperature, pressure, flow rate, humidity, hydrogen content, [dew point, dilution steam flow, radiolytic gas production,] and effluent radioactivity. Data ~~should~~ [shall] be collected at selected operating points such that each critical component of the system is evaluated [periodically throughout the power ascension test program while at various steady-state conditions] over its particular expected operating range. Performance ~~should~~ [shall] be demonstrated for specific components such as catalytic recombiners, and activated carbon absorbers as well as the various heaters, coolers, dryers and filters. Also to be evaluated are the piping, valving, instrumentation and control that comprise the overall system. [Testing of the offgas system is also discussed in 11.3.9.]

(4) Criteria

~~Hydrogen concentration and radioactivity effluents shall not exceed technical specification limits. All applicable system and component parameters should be consistent with design and testing specification requirements.~~ [Insert M]

Insert M

Level 1

The release of radioactive gaseous and particulate effluents must not exceed the limits specified by the plant Technical Specifications or License conditions.

Flow of dilution steam to the non-condensing stage must be maintained at an amount no less than the low alarm setpoint as specified in the SSAR Table 11.3-4 when the steam jet air ejectors are operating.

Level 2

The system flow rate, temperature, humidity, and hydrogen concentration shall comply with the Off-gas System Process Flow Diagram in all design modes of operations. (SSAR Figure 11.3-1)

All applicable system components such as: offgas preheater, off-gas recombiner, offgas condensers, cooler condensers, refrigeration units, pre-filters, charcoal adsorbers, and offgas filters shall function properly during all design modes of operation, i.e. there shall be no gross malfunctioning of these components. (SSAR Section 11.3)

14.2.12.2.36 Loose Parts Monitoring System Baseline Data

(1) Purpose

To collect baseline data for the loose parts monitoring system under normal plant operational conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration for the scheduled testing. Applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Loose parts monitoring system data will be collected at appropriate power and flow conditions to provide a baseline set of data indicative of normal plant operations. The data obtained will be used to help verify the adequacy of, or to facilitate needed changes to, initial alert level settings above normal levels.

(4) Criteria

Sufficient baseline data shall be obtained so as to verify the adequacy of system alert level settings in accordance with design requirements.

14.2.12.2.37 Concrete Penetration Temperature Surveys

(1) Purpose

To demonstrate the acceptability of concrete wall temperatures in the vicinity of selected ~~high temperature~~ (high energy fluids piping) penetrations under normal plant operational conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration for the scheduled testing. Applicable instrumentation shall be installed and checked or calibrated as is appropriate.

the ability of natural heat transfer to adequately cool the concrete surrounding the penetrations of high energy fluids piping, including main steam, feedwater, and RHR shutdown cooling pipings.

(3) Description

Concrete temperature data will be collected ~~around selected high temperature penetrations~~ at various power levels and system configurations in order to verify ~~acceptable performance under expected plant operational conditions~~. Penetrations and measurement locations selected for monitoring, as well as the test conditions at which data is to be collected, shall be sufficiently comprehensive so as to include the expected limiting thermal loading conditions on critical concrete walls and structures within the plant.

(4) Criteria

~~The temperature(s) of the concrete at the monitored locations should be consistent with design predictions and shall not exceed design basis requirements or assumptions critical to associated design basis analyses.~~

Level 1

Not Applicable

Level 2

The temperature of concrete around the selected high energy fluid piping penetrations shall be kept below the maximum level specified in the Piping Penetration Design Requirements Specification for long term normal operating conditions.

14.2.12.2.38 Radioactive Waste Systems Performance

(1) Purpose

To demonstrate acceptable performance of gaseous and liquid radioactive waste processing, storage and release systems under normal plant operational conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration for the scheduled testing. The necessary instrumentation shall be checked or calibrated. Appropriate precautions shall be taken relative to activities conducted in the vicinity of radioactive material or potential radiation areas.

(3) Description

Radioactive waste systems operation will be monitored, and appropriate data collected, during the power ascension test phase to demonstrate system operation is an accordance with design requirements. Operation and testing of liquid and gaseous radioactive waste systems is discussed in detail in Sections 11.2 and 11.3, respectively. Testing specific to the main condenser offgas system is also discussed separately in subsection 14.2.12.2.35.

(3) Description

Concrete temperature data will be collected, around selected high temperature penetrations, at various power levels and system configurations in order to verify acceptable performance under expected plant operational conditions. Penetrations and measurement locations selected for monitoring, as well as the test conditions at which data is to be collected, shall be sufficiently comprehensive so as to include the expected limiting thermal loading conditions on critical concrete walls and structures within the plant.

(4) Criteria

The temperature(s) of the concrete at the monitored locations should be consistent with design predictions and shall not exceed design basis requirements or assumptions critical to associated design basis analyses.

14.2.12.2.38 Radioactive Waste Systems Performance

(1) Purpose

To demonstrate acceptable performance of gaseous and liquid radioactive waste processing, storage and release systems under normal plant operational conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration for the scheduled testing. The necessary instrumentation shall be checked or calibrated. Appropriate precautions shall be taken relative to activities conducted in the vicinity of radioactive material or potential radiation areas.

(3) Description

Radioactive waste systems operation will be monitored, and appropriate data collected, during the power ascension test phase to demonstrate system operation is an accordance with design requirements. Operation ~~and testing~~ of liquid and gaseous radioactive waste systems is discussed in detail in Sections 11.2 and 11.3, respectively. Testing specific to the main condenser offgas system is ~~also~~ discussed separately in subsection 14.2.12.2.35.

Radiochemical analysis of liquid and gaseous effluents from radwaste system is done as part of testing discussed in subsection 14.2.12.2.1 Proper operation and performance of radioactive waste system in handling both gaseous and liquid effluents is verified by these two testings. Therefore, a separate radioactive waste system performance test is not required during power ascension test program.

Insert CCC

(4) Criteria

Performance characteristics of the liquid and gaseous radioactive waste systems should be in accordance with the appropriate design and testing specifications, and as discussed in Sections 11.2 and 11.3, respectively. Handling and release of radioactive wastes shall be in conformance with all applicable regulations.

14.2.12.2.39 Steam and Power Conversion Systems Performance

(1) Purpose

To demonstrate acceptable performance of the various plant steam driven auxiliaries and power conversion systems under expected operational conditions, particularly that equipment that could not be fully tested during the preoperational phase due to inadequate steam flow conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration for the scheduled testing. The necessary instrumentation shall be checked or calibrated.

(3) Description

Operation of steam driven plant auxiliaries and power conversion systems will be monitored, and appropriate data collected, during the power ascension test phase to demonstrate system operation is in accordance with design requirements. Systems to be monitored include the main turbine and generator and their auxiliaries, the feedwater heaters and moisture separator/reheaters, the main condenser and condenser evacuation system, and the main circulating water system Operation and testing of power conversion systems is discussed in detail in Chapter 10. The main turbine generator and related auxiliaries are discussed in section 10.2 and other power conversion equipment and systems are discussed in section 10.4. Testing specific to turbine valves is described in subsection 14.2.12.2.25 and plant transient testing involving the main turbine generator is described in subsection 14.2.12.2.33.

(4) Criteria

Performance characteristics of the various systems monitored should be in accordance with the appropriate design and testing specifications, and as discussed in Sections 10.2 and 10.4.

Insert CCC

Level 1

The radioactive waste system shall be capable of collecting, processing, and controlling the gaseous and liquid wastes as designed such that the release of radioactive gaseous and liquid effluents remain within the limits specified by the plant Technical Specifications or license conditions. (SSAR Sections 11.2.1.2 and 11.3.2)

Level 2

Not Applicable.

(4) Criteria

Performance characteristics of the liquid and gaseous radioactive waste systems should be in accordance with the appropriate design and testing specifications, and as discussed in Sections 11.2 and 11.3, respectively. Handling and release of radioactive wastes shall be in conformance with all applicable regulations.

14.2.12.2.39 Steam and Power Conversion Systems Performance

(1) Purpose

To demonstrate acceptable performance of the various plant steam driven auxiliaries and power conversion systems under expected operational conditions, particularly that equipment that could not be fully tested during the preoperational phase due to inadequate steam flow conditions.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration for the scheduled testing. The necessary instrumentation shall be checked or calibrated.

(3) Description

Operation of steam driven plant auxiliaries and power conversion systems will be monitored, and appropriate data collected, during the power ascension test phase to demonstrate system operation is in accordance with design requirements. Systems to be monitored include the main turbine and generator and their auxiliaries, the feedwater heaters and moisture separator/reheaters, the main condenser and condenser evacuation system, and the main circulating water system Operation and testing of power conversion systems is discussed in detail in Chapter 10. The main turbine generator and related auxiliaries are discussed in section 10.2 and other power conversion equipment and systems are discussed in section 10.4. Testing specific to turbine valves is described in subsection 14.2.12.2.25 and plant transient testing involving the main turbine generator is described in subsection 14.2.12.2.33.

(4) Criteria

Performance characteristics of the various systems monitored should be in accordance with the appropriate design and testing specifications, and as discussed in Sections 10.2 and 10.4.

Insert BBB

Insert BBB

Level 1

Not Applicable

Level 2

Each Steam Jet Air Ejector (SJAE), individually, must be able to maintain the main condenser pressure within design limits during normal full load operation. (SSAR Section 10.4.2.2)

The Circulating Water (CW) System shall supply cooling water at a sufficient flow rate to condense the steam in the condenser, as required for optimum heat cycle efficiency. (SSAR Section 10.4.5.1.2)

The feedwater heater system shall heat up the reactor feedwater to a nominal temperature of 420°F during full load operation and to lower temperatures during part load operation. (SSAR Section 10.4.7.1.2)

The feedwater heater drains and vents system shall be capable of maintaining a water level in each of the LP/HP heaters and heater drain tanks within the normal operating limits during power operation. (SSAR Section 10.4.7.2.2)

The MSR shall maintain a balanced steam flow to the LP turbine and feedwater heaters during steady-state and transient operating in accordance with design requirements. (SSAR Figure 10.1-2)

The main condenser shall be capable of maintaining the LP turbine exhaust conditions below the maximum allowable pressure and temperature. (SSAR Section 10.4.1.1.2)

The main condenser hotwell water level control system shall maintain the hotwell water level at nominal operating range during normal full load operation. (SSAR Section 10.4.1.5.1)

The turbine/generator shall be operated with a heat rate compatible with the design value during normal full load operations. (SSAR Figure 10.1-2

14.2.12.2.40 Steam Separator/Dryer Performance Test

(1) Purpose

To verify that the steam separator/dryer system will meet minimum performance requirements at conditions within allowable regions of the power-flow operating map.

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of testing. The plant shall be in the appropriate operational configuration with the specified prerequisite testing complete. The applicable instrumentation shall be checked or calibrated as is appropriate.

(3) Description

Maximum moisture carryover is expected to occur at conditions of high flow and low power, where the steam separator/dryer performance decreases with reduced steam flow. However, the recirculation flow control (RFC) system limits the core flow/power to analyzed allowable regions by providing an automatic RIP speed runback prior to reaching the separator/dryer performance limit as shown on the power-flow operating map. This

test verifies that the analytically established limit is sufficient to prevent excessive moisture carryover of the steam exiting the reactor and that the established separator/dryer performance limit line is adequate to prevent operation outside the allowable region.

With the RIPs at maximum permissible speeds and flows, this test is initiated from a power level just above the most limiting region of the power-flow operating map. At this point, the moisture carryover in the steam exiting the reactor is determined (typically by injecting Na-24 into the feedwater and then measuring the concentration of such that reaches the condenser versus that remains in the reactor coolant). Reactor power will then be gradually lowered by inserting control rods. At each incremental power level, the moisture carryover is again determined. This incremental power reduction and moisture carryover determination is continued until either the separator limit line as shown on the power-flow operating map is reached or excessive moisture carryover (i.e., 0.1% and greater) of the exit steam is determined, whichever occurs first. If the separator performance limit line is reached first, testing may be continued at next lower power level until such time as the 0.1% limit is reached if desired to justify lowering of the established limit. The point at which the RIP speed runback logic is automatically activated during power reduction shall

be recorded. During the performance of this test, the actual RIP speed runback may be temporarily defeated as long as the moisture content of the exit steam is determined to be acceptable. This is to simplify the test without having to recover from a recirculation runback and continue the testing at low power levels.

(4) Criteria

Level 1

Steam separator/dryer exit moisture must not exceed 0.1 % while operating in the analytically allowable region of the power-flow operating map. (i.e, on or above the separator/dryer performance limit line).

Level 2

Further power reduction shall be discontinued once moisture carryover of the exit steam exceed 0.01 %.

The RIP speed runback logic shall be verified to be conservatived established relative to the separator/dryer performance limit line on the power-flow operating map to prevent operation in areas where excessive moisture carryover in exit steam from separator/dryer is predicted to occur.

Table 14.2-1 — POWER ASCENSION TEST MATRIX ✓ — Page 1

Condensate Filter/Demin Performance
RWCU Filter/Demin Performance (No Cleanup Test)

✓* ✓* * at high power/high flow corner

POWER ASCENSION TEST	TESTING PLATEAU OV	HU	LP	MP	HP	NOTES
Chemical and Radiochemical Measurements						
~~Sampling System Functioning~~ Reactor water chem. & Radiol. measurement	✓	✔	✔	✔	✔	
Process Rad Monitoring ~~Functioning~~ Calibration	✔	✔	✔	✔	✔	
~~Steady State Performance Measurements~~ Liquid and Gaseous Effluent Activity Monitoring	~~✔~~	✔	✔	✔	✔	~~Includes verification of water quality~~
~~Steam Separator/Dryer Performance~~				~~✔~~		~~At low power, high flow corner of power flow map~~
Radiation Measurements						
~~Steady State Measurements~~ Background Radiation Survey	✔*	✔*	~~✔~~	~~✔~~	~~✔~~	* Prior to fuel loading and prior to initial criticality
~~Shielding Adequacy Assessment~~ Complete Station Radiation Survey		✓	✓	✔	✔	
Fuel Loading						
Core Loading	✔					
Partial Core S/D Margin	✔					
Full Core Verification	✔					
Full Core Shutdown Margin Demonstration	✔					
Rod ~~Control~~ Drive System Performance						
CRD Functional Testing	✔	~~✔~~				* Including I/W timing, position indication, coupling
Friction Testing	✔	✔*				* 4 selected rods at rated pressure
Rod Pair Scram Testing	✔	✔*				* 4 selected rods @ 6 MPa, 8 MPa and all rods @ rated Pressure
Full Core Scram			~~✔~~	✔*	✔*	*With planned scrams to determine 4 slowest rods
~~SCRRI Functioning~~ Gangal Rod Activity	✓				~~✔~~	~~At low power and at rated and line power unplanned RIP trips and when selected following RIP trips~~
~~Alternate Rod Run-in Functioning~~			~~✔~~	~~✔~~	~~✔~~	~~Full scram verification following planned trips~~

✔ = Testing required in plateau; alternative test conditions or exceptions identified in detailed testing specification

✔* = Testing not specifically required in indicated plateau, but to be done in conjunction with other testing, or at specific testing conditions, generally within indicated plateau; see NOTES column for explanation

OV = Open Vessel HU = Nuclear Heatup LP = Low Power MP = Mid Power HP = High Power

Z-22-241

POWER ASCENSION TEST	OV	HU	LP	MP	HP	NOTES
Neutron Monitoring System Performance						
SRNM Calibration/Response	✔	✔	✔			
LPRM Calibration/Response		✔	✔	✔*	✔*	* at high power/flow only
APRM Calibration/Response		✔*	✔	✔	✔	* Constant th. rate calibration
TIP System Alignment/Response	✔*	✔*	~~✔~~	✔**	✔**	~~Only as needed to complement ...~~ * Cold and hot Alignment ** Reproducibility Test
Process Computer System Operation						
NSS/BOP Monitoring Programs		✔	✔	✔	✔	
~~Annunciation Programs~~		~~✔~~	~~✔~~	~~✔~~	~~✔~~	
~~RWM/RCIS Functioning~~		~~✔~~	~~✔~~		~~✔~~	
Core Performance		✔	✔	✔	✔	
Nuclear Boiler Process Monitoring						
Reactor Coolant Temperature Measurement		✔		✔*	✔*	At MP & HP during steady state and RIP trip testing
Reactor Water Level Measurement & reference leg temp.	~~✔~~	✔	✔	✔	✔	
Core Flow Calibration/Measurement		✔	✔	✔	✔	
System Expansion						
~~Suppression Inspection/Interference Check~~ Visual observation		✔	✔*	✔*	✔*	*Only as needed upon return to cold setting conditions after planned shutdowns subsequent to HU
Displacement Measurements		✔	✔	✔	✔	
System Vibration						
Steady State ~~Measurement~~ Vibrations & Strains		✔	✔	✔	✔	
Transient ~~Response~~ Vibrations & Strains			✔*	✔*	✔*	* During major transients
Reactor Internals Vibration (If Required)	✔*	~~✔~~	~~✔~~	✔**	✔***	~~Cold, zero power, test, if required, will be done with RPV head on during HU~~

* Pre-critical ** along 60% L.L. *** along 100% L.L.

Specified testing may not be required. See 14.2.12.2.12 for discussion of applicability of testing based on classification of reactor internals (i.e., prototype or not) in accordance with RG 1.20.

⇒ [Insert Expanded Legend (see Page 1)]

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Table 14.2-1 POWER ASCENSION TEST MATRIX

MSL Venturi flow Calibration

POWER ASCENSION TEST	OV	HU	LP	MP	HP	NOTES
	TESTING PLATEAU					
Recirculation Flow Control						
Control System Adjustment/Confirmation			✓	✓	✓	
Feedwater Control						
Control System Adjustment/Confirmation		✓*	✓	✓	✓	* Low flow control
Pressure Control						
Control System Adjustment/Confirmation		✓	✓	✓	✓	
Plant Automation and Control						
Plant Startup/ Shutdown		✓	✓*	✓*	✓*	* During plant shutdown, as needed.
~~Load following~~ Power range maneuvering			✓	✓	✓	
Reactor Recirculation System Performance						
Steady State Performance		✓	✓	✓	✓	
RIPs Out of Service				✓*	✓	* In conjunction with internal vibration tests
Pump Restarts				✓*	✓	* In conjunction with internal vibration tests
Feedwater System Performance						
Steady State Performance		✓	✓	✓	✓	
Maximum Runout Flow Determination				~~✓~~	✓	
Main Steam System Performance						
Steady State Performance		✓	✓	✓	✓	
Residual Heat Removal System Performance						
Suppression Pool Cooling		✓*			~~✓~~	*After SRV testing which adds heat to the suppression pool. ~~May not be sufficient heat at lower power levels~~
Shutdown Cooling		~~✓~~			✓*	*May not be sufficient reactor decay heat at lower power levels to demonstrate Hx heat removal capability

System operability must be demonstrated prior to exceeding 25% RTP. However, there...

...to fully demonstrate Hx heat removal capability.

⇒ [Insert Expanded Legend (see Page 1)]

OV - Open Vessel HU - Nuclear Heatup LP - Low Power MP - Mid Power HP - High Power

Table 14.2-1 POWER ASCENSION TEST MATRIX

(Individual CV, SV, BPV Cycling; BPV Capacity measurement) V V* * At max. allowable power level, if applicable

	TESTING PLATEAU					
POWER ASCENSION TEST	OV	HU	LP	MP	HP	NOTES
Reactor Water Cleanup System Performance						
Steady State Performance (Normal, Blowdown, Hot Standby)		✓			✓	
~~Inventory Rejection Mode~~ RPV Head Spray Mode		✓	V*	V*	V*	* Shutdown following major transient, as needed.
~~F/D Performance~~					✓	~~May be accomplished during earlier testing plateaus~~
RCIC System Performance						
~~Low Reactor Pressure~~ System Controller Optimization		✓*				* at rated pressure
~~High Reactor Pressure~~ System Control & Stability Demo		✓*				* at 150 psig & rated pressure
Hot/Cold Quick Starts		✓	✓*			* As needed to complete required quick starts subsequent to TCHU
Plant Cooling/Service Water System Performance						
Steady State Power Operations	V	✓	✓	✓	✓	
Off-Normal Operations		✓	✓		✓*	*During RHR Hx operation, as practicable, may be performed at earlier test conditions.
HVAC System Performance						
Steady State Power Operations		✓	✓	✓	✓	
Off-Normal Operations		✓	✓	✓	✓*	*In individual spaces as conditions allow (i.e. as pertinent equipment is operated), may be performed at earlier test conditions
Turbine Valve Performance		✓	✓	✓	✓	~~Only bypass valves need be tested at HP~~
MSIV Performance						
Individual MSIV Closure/ Timing		✓	✓		✓*	~~Not during nuclear heat high power~~ * At max. allowable power level, if applicable.
~~Branch Line Closure/ Timing~~		✓	✓			
SRV Performance						
Individual Valve Functioning & Flow Demonstration		✓*	✓			* at > 950 psig
~~Automatic Opening Verification~~			✓	✓	✓	~~During planned trips, as applicable~~

[Insert Expanded Legend (see Page 1)]

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POWER ASCENSION TEST	TESTING PLATEAU					NOTES
	OV	HU	LP	MP	HP	
Loss of Feedwater Heating					✔	At 80-90% CTP, 100% Flow during HP
Feedwater Pump Trip					✔	
Recirculation Pump Trip						
One RIP Trip				✔*	✔*	At near rated flow, in conjunction with internal vibration test
~~Two RIP Trip~~				~~✔~~	~~✔~~	~~At near rated flow~~
Three RIP Trip				✔*	✔*	~~At near rated flow~~ * From near rated flow at MP and from a point that will result in SCRRI at HP
Shutdown from Outside the Control Room			✔			At >10% Generator Load
Loss of Turbine Generator and Offsite Power			✔			At 10-20% rated power
Turbine Trip and Generator Load Rejection						
~~Load Rejection~~ Turbine Trip within Bypass Capacity			✔			
~~Turbine Trip~~				~~✔~~		
Full Power (Generator) Load Rejection					✔	
Reactor Full Isolation					✔	
Offgas System Performance		✔	✔	✔	✔	
Power Conversion Equipment Performance		✔	✔	✔	✔	
Loose Parts Monitoring System Baseline Data		✔	✔	✔	✔	
~~Liquid~~ RadWaste Systems Performance			✔		✔	
Concrete Temperature Surveys		✔	✔	✔	✔	
Steam Separator/Dryer Performance Test				✔*		* From high flow/low power corner just above the most limiting region of P-F map.

⇒ [Insert Expanded Legend (see Page 1)]

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