Response to

Request for Additional Information No. 77(1187,901,679), Revision 0

10/2/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 14.02 - Initial Plant Test Program - Design Certification and New License Applicants
Application Section: SRP section 14.2
CQVP and EEB Branches

Question 14.02-31:

RG 1.68 Appendix A.5.e states that the conduct of a pseudo-rod-ejection test to validate the rod ejection accident analysis should be conducted; however, the U.S. EPR FSAR does not seem to include a pseudo-rod-eject test in Ch 14.2.12. The NRC staff requests that AREVA revise Ch 14.2.12 to add a pseudo-rod-eject test which will validate the rod ejection accident analysis or justify the reason for not including the test.

Response to Question 14.02-31:

U.S. EPR FSAR Tier 2, Section 14.2.12, Test #192 will be revised to address a pseudo-rod-ejection test.

Also, in the response to RAI 68, additional information was added to U.S. EPR FSAR Tier 2, Section 14.2 related to pseudo-rod-ejection testing:

- Per RAI 68, Question 14.02-21, information was added to U.S. EPR FSAR Tier 2, Section 14.2.1.1.4 to “Perform a pseudo-rod-ejection test to verify calculational models and accident analysis assumptions.”

- Per RAI 68, Question 14.02-22, information was added to U.S. EPR FSAR Tier 2, Section 14.2.1.1.5 explaining why “A pseudo-rod-ejection test will be performed during initial criticality and LPPT and not during power ascension.”

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 14.2.12, Test #192 will be revised as described in the response and indicated on the enclosed markup.

Question 14.02-32:

SRP 14.2.II.5.B states that test abstracts for the initial test program should include acceptance criteria in sufficient detail to establish the functional adequacy of the SSCs and design features tested. SRP 14.2, "Technical Rationale," further states that an objective of the ITP is to verify that SSCs are capable of performing their safety functions as specified in the design and as assumed/credited in safety analyses. RG 1.68.C.4, “Procedures,” states that each test procedure should included acceptance criteria that account for the uncertainties used in transient and accident analysis.

In its review of Subsection 14.2.12 of the EPR FSAR, the staff noted that Section 3, "Test Method," of each test abstract includes a comprehensive list of activities that are needed to ensure functional adequacy of SSCs under test. The staff also noted that Section 5, "Acceptance Criteria," of each test abstract contains pointers to design information in other FSAR chapters, Technical Specifications, and sections of the ASME code. However, most test abstracts also include acceptance criteria under the test method section and/or the acceptance criteria section does not provide explicit values, prescribed limits, or measurable parameters to allow for the determination that the SSCs under test are capable of performing their safety function and that the test objectives have been met.

AREVA needs to review all the test abstracts in Section 14.2.12 to ensure that test method and acceptance criteria information are included in the appropriate sections. In addition, AREVA needs to revise the acceptance criteria section of each test abstract to include explicit, measurable criteria (e.g., values, prescribed limits, or measurable parameters) from the relevant EPR FSAR section(s) that establish the functional adequacy of the SSCs and design features tested, and that provide a direct correlation to the test objective(s) being effectively met.

Response to Question 14.02-32:

A response to this question will be provided by January 15, 2009.

Question 14.02-33:

Regulatory Guide (RG) 1.68 states, in part, that testing should include, as appropriate, verification of redundancy and electrical independence. Appendix A to RG 1.68 provides a representative list of SSCs that should undergo preoperational testing. For many systems such as Chemical Control Systems, Electrical, and Residual Heat Removal Systems, Appendix A to RG 1.68 states that tests should be conducted to verify redundancy and electrical independence of these SSCs.

The staff notes that a number of test abstracts in Section 14.2.12 of the U.S. EPR FSAR do not provide for verification of redundancy and electrical independence, as recommended by RG 1.68. Consistent with this guidance, the staff requests that AREVA revise the applicable test abstracts under Section 14.2.12 to include verification of redundancy and electrical independence of affected SSCs, as appropriate.

Response to Question 14.02-33:

Test abstracts (#001, #003, #004, #012, #014 through #022, #027, #031, #036, #037, #046, #048, #049, #052, #059, #061, #062, #063, #067, #071, #076 through #079, #081 through #086, #088, #100, #104, #105, #106, #110, #112, #115, #116, #117, #121, #126, #130, #140, #141, #142, #145, #146, #147, #138, #148 through #153, and #174) in U.S. EPR FSAR Tier 2, Section 14.2.12 have been revised to include verification of redundancy and electrical independence, where applicable.

In addition, U.S. EPR FSAR Tier 2, Section 14.2.12, Test #182 was re-written because it was inadvertently a copy of Test #183.

FSAR Impact:

U.S. EPR FSAR, Tier 2, Section 14.2.12 will be revised as described in the response and indicated on the enclosed markup.

Question 14.02-34:

R.G. 1.68 Appendix A.5.nn states that the initial test program should demonstrate that the dynamic response of the plant is in accordance with design for the case of full load rejection. FSAR Section 14.2.12.10 (Electrical Systems) on page 14.2-134 identifies testing that will be performed under the initial testing program for electrical systems. However, the staff noticed that 100% load rejection test (island mode) is not included in FSAR Section 14.2.12 (Individual Test Description). Confirm whether US-EPR plans to perform the 100% load rejection test. If not, discuss reason for not performing the test.

Response to Question 14.02-34:

As described in RAI 9, Supplement 1, Question 08.02-6, the U.S. EPR FSAR Tier 2, Section 14.2.12, Tests #221 and #227 were revised to address full load rejection testing.

The U.S. EPR will perform two load rejection tests; U.S. EPR FSAR Tier 2, Section 14.2.12, Test #221 will be performed with off-site power available, and U.S. EPR FSAR Tier 2, Section 14.2.12, Test #227 will be performed without off-site power available with plant auxiliary loads supplied in island mode.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

U.S. EPR Final Safety Analysis Report Markups

- Establishes the prerequisite conditions per individual test requirements. For example, heating, ventilation, air conditioning (HVAC) testing will be done at current environmental conditions, not extremes of design-assumed temperatures.

Include data requirements for individual tests in more detail (as necessary for verifying test objectives).

14.2.12.1 NSSS Support Systems

14.2.12.1.1 Fuel Pool Cooling and Purification System (Test #001)

1.0 OBJECTIVE

1.1 To demonstrate the capability to remove decay heat from the spent fuel pool.

14.02-33

1.2 To demonstrate the capability to purify the spent fuel pool.

1.3 Verify electrical independence and redundancy of power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the fuel pool cooling and purification system (FPCPS) have been completed.

2.2 FPCPS system instrumentation has been calibrated and is functional for performance of the following test.

2.3 Test instrumentation available and calibrated per site procedures.

2.4 Component cooling water system (CCWS) water is available to the fuel pool cooling heat exchanger.

2.5 The leak tests on the following subsystems have been completed.

2.5.1 Fuel pool.

2.5.2 Refueling cavity.

2.5.3 IRWST.

2.5.4 Reactor vessel to refueling cavity seal.

2.6 Support systems required for the operation of the FPCPS are complete and functional.

2.7 The following have been filled to normal level, or shall be during the performance of this test:

2.7.1 Fuel pool.

2.7.2 Refueling cavity.

2.7.3 IRWST.

3.0 TEST METHOD

3.1 Verify the head versus flow curves for pumps.

3.2 Verify that operation of controls, instrument interlocks and alarms using actual or simulated inputs.

3.3 Verify the functionality of the fuel pool gates and quantify gate leakage.

3.4 Verify the anti-siphons holes on the FPCPS suction lines are free of obstructions.

3.5 Verify no leakage of the spent fuel pool by checking the leak detection system (LDS).

3.6 Verify no leakage of the refueling cavity by checking the LDS.

3.7 Verify no leakage of the IRWST by checking the LDS.

3.8 Verify that the purification system meets the design ~~flowrate~~flow rate and filtration capacity when aligned to the following:

3.8.1 Fuel pool.

3.8.2 Refueling cavity.

3.8.3 IRWST.

3.9 Verify performance characteristics of power-operated valves (e.g., thrust, stroke time, fail position upon loss of motive power) as designed (refer to Section 9.1.3).

3.10 Operate control valves remotely while:

a. Observing each valve operation and position indication.

14.02-33

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.11 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Pump head versus flow and operating data for each pump.

4.2 Setpoints of alarms interlocks and controls.

4.3 Flow data through various system flow paths.

4.4 Fuel pool gate leakage data.

4.5 Valve performance data.

4.6 Control valve operation and position.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The FPCPS performs as described in Section 9.1.3.

5.2 Safety-related components meet electrical independence and redundancy requirements.

5.1 The VCT subsystem performs as described in Section 9.3.4.

14.2.12.1.3 CVCS Charging and Seal Injection (Test #003)

1.0 OBJECTIVE

1.1 To verify the proper performance of the CVCS charging subsystem.

14.02-33

1.2 To verify the proper performance of the CVCS seal injection subsystem.

1.3 Verify electrical independence and redundancy of power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the CVCS charging and seal injection subsystems have been completed.

2.2 The CVCS charging and seal injection subsystem instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 The water makeup system subsystem is functional to provide a reliable supply to the charging pump suction.

2.4 The VCT subsystem is functional to supply charging pump suction.

2.5 The reactor vessel is ready to receive water from the charging headers.

2.6 The pressurizer is ready to receive water from the auxiliary spray line.

2.7 RCP are ready to receive seal injection water (pumps are coupled and off the backseat) and stand still seal is open.

2.8 Support systems required for operation of the CVCS charging and seal injection subsystems are functional.

3.0 TEST METHOD

3.1 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.2 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 9.3.4).

3.3 Manually start each charging pump per operating manual instructions.

3.4 Manually start each charging pump. Observe charging pump operation including charging pump alarms and interlocks.

3.5 With a charging pump running, open the seal injection lines, and observe flow.

3.6 With a charging pump running, open the auxiliary spray valve, and observe flow.

3.7 Verify the operation of the RCP seal injection flow control valves.

3.8 Verify the ~~flowrate~~flow rate of the CVCS miniflow path.

3.9 Verify the operation of RCP seal injection header.

14.02-33

3.10 Verify performance, including head and flow characteristics, of the charging pumps.

3.11 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Valve performance data, where required.

4.2 Valve position indication.

4.3 Position response of valves to loss of motive power.

4.4 Charging pump and oil lubrication system performance.

4.5 Charging pump running data.

4.6 Setpoints at which alarms and interlocks occur.

4.7 Seal injection ~~flowrate~~flow rates.

4.8 Auxiliary spray ~~flowrate~~flow rates.

4.9 CVCS charging pump head versus flow.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The CVCS charging subsystem performs as described in Section 9.3.4.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.1.4 CVCS Letdown (Test #004)

1.0 OBJECTIVE

1.1 To verify the proper operation of the CVCS letdown subsystem for normal and emergency conditions.

14.02-33

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the CVCS letdown subsystem have been completed.

2.2 Letdown subsystem instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for the operation of the CVCS letdown subsystem control valves are functional.

2.4 The RCS is operated at HZP pressure and temperature.

3.0 TEST METHOD

3.1 Operate control valves remotely while:

a. Observing each valve operation and position indication, and

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.2 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 9.3.4).

3.3 Verify response of letdown system to simulated pressurizer level signals.

3.4 Simulate a safety injection actuation signal (SIAS) and observe system response.

3.5 Simulate a containment isolation actuation signal (CIAS) and observe system response.

3.6 Simulate an inadvertent dilution event and observe system response.

3.7 Simulate a range of letdown temperatures and observe the response of control valves. Observe alarm and interlock operation.

3.8 Measure system pressure and temperature upstream and downstream of pressure control valves and verify sub-cooled conditions exist.

14.02-33

3.9 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Valve performance data, where required.

4.2 Valve position indication.

4.3 Position response of valves to loss of motive power.

4.4 Response of control valves to simulated pressurizer level changes.

4.5 Response of system and isolation valves to simulated isolation signals.

4.6 Response of control valves to simulated letdown temperature.

4.7 Delta P (ΔP) across letdown flow control.

4.8 Setpoints at which alarms, indications, and interlocks occur.

5.0 ACCEPTANCE CRITERIA

5.1 The CVCS letdown subsystem performs as described in Section 9.3.4.

14.02-33

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.1.5 CVCS Chemical Addition (Test #005)

1.0 OBJECTIVE

1.1 To demonstrate that the chemical addition subsystem can inject liquid chemicals into the suction supply of the charging pumps.

1.2 To verify a flow path from the chemical addition tank to the liquid waste system.

2.0 PREREQUISITES

2.1 Support systems required for operation of the chemical addition subsystem are complete and functional.

2.2 The chemical addition tank has been filled from the makeup system with a predetermined amount of water makeup system.

2.3 The CVCS charging subsystem is functional and the charging pump is operating.

2.4 The associated instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.5 A charging pump is in operation.

3.0 TEST METHOD

3.1 Start the chemical addition pump and observe the chemical addition tank level.

3.2 Drain the chemical addition tank to the nuclear island drain and vent systems (NIDVS) and observe the chemical addition tank level.

4.0 DATA REQUIRED

4.1 Chemical addition tank levels.

5.0 ACCEPTANCE CRITERIA

5.1 Verify the flow path from the chemical addition tank to charging pump suction supply line.

5.2 Verify the flow path from the chemical addition tank to the NIDVS.

5.3 The chemical addition subsystem performs as described in Section 9.3.4.

14.2.12.1.6 Coolant Supply & Storage System (Test #006)

1.0 OBJECTIVE

14.2.12.1.12 Reactor Coolant System (Test #012)

1.0 OBJECTIVE

1.1 To perform the initial venting of the RCPs and the RCS.

1.2 To perform the initial operation of the RCPs.

1.3 To verify RCP performance.

1.4 To verify alarm setpoints.

1.5 To verify the operation of the RCS sample isolation valves.

14.02-33

1.6 To perform checkout of humidity detection system.

1.7 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the RCS, RCPs, and RCS sample isolation system have been completed.

2.2 RCP and RCS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Component cooling water (CCW) to the RCP is available.

2.4 RCP motor initial operation preoperational test has been completed.

2.5 Pre-start RCP activities have been completed, including opening the stand still seal.

2.6 Support systems required for operation of the RCPs and RCS sample isolation valves are functional.

2.7 The humidity detection system has an installed test tube to route humid air to the detection system.

2.8 The humidity detection system humidity cell has been calibrated.

3.0 TEST METHOD

3.1 Simulate temperature, pressure, and flow signals from each RCP and verify alarm setpoints.

3.2 Simulate temperature signals from each RCS RTD and verify alarm setpoints.

3.3 Perform initial venting of RCPs, pressurizer, and reactor vessel.

3.4 Perform initial run of RCPs.

3.5 Vent the RCS after each run is complete.

3.6 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 5.1).

3.7 Verify that the humidity detection system responds to a simulated high humidity.

14.02-33

3.8 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Setpoints at which alarms occur.

4.2 RCP cold performance data.

4.3 Position response of valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 Verify performance and alarms of the RCS and RCPs as described in Section 5.1, 5.2.5, and Section 5.4.1.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.2 Front Line Safety Systems

14.2.12.2.1 Combustible Gas Control System (Test #013)

1.0 OBJECTIVE

1.1 To perform the test described in this abstract on the combustible gas control system (CGCS) in conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.

1.2 To demonstrate that the CGCS is properly installed and is functional prior to fuel loading.

1.3 To demonstrate that the mixing vanes in the upper part of the IRWST reposition on a simulated high containment pressure signal.

1.4 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety related attributes.

2.0 PREREQUISITES

2.1 Construction activities on the CGCS, passive autocatalytic recombiners and mixing vane subsystems, have either been completed or exceptions have been recorded and the impact on the system performance has been determined.

2.2 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

2.3 Factory acceptance tests on the CGCS have been completed and approved.

3.0 TEST METHOD

3.1 Verify that the hydrogen sample bottle with an appropriate hydrogen concentration for system checkout is available.

3.2 Verify the operation of these are within design limits:

3.2.1 Hydrogen sensors.

3.2.2 Instrumentation and controls.

3.2.3 Alarms.

3.3 Simulate a high containment pressure signal and verify that the mixing vanes in the IRWST reposition.

4.0 DATA REQUIRED

4.1 Hydrogen concentration of the sample bottle.

4.2 Upstream and downstream hydrogen concentrations during test.

4.3 Pretest and post-test mixing vane positions.

5.0 ACCEPTANCE CRITERIA

5.1 The containment passive autocatalytic recombiners meet design criteria described in Section 6.2.5.

5.2 The containment mixing vanes perform as described in Section 6.2.5.

14.2.12.2.2 Medium Head Safety Injection (Test #014)

1.0 OBJECTIVE

1.1 To functionally test the operation and performance of each critical component within the medium head safety injection (MHSI) system in conditions that are representative of actual plant conditions or close enough to allow data to be extrapolated to actual conditions.

1.2 To verify proper MHSI response to an SIAS using normal, alternate, and emergency power sources.

1.3 To verify the flow paths through the cold and hot leg MHSI piping to the reactor vessel, which demonstrates that the system is properly installed and is functional prior to fuel loading.

14.02-33

1.4 To ~~perform~~confirm ~~a~~ full flow capability ~~test~~ of the MHSI system with minimum backpressure.

1.5 To verify the MHSI sampling system isolation valves function as designed.

1.6 To verify the elevation of MHSI containment isolation valves (CIV) relative to the IRWST water level to validate NPSH and loop seal design criteria.

1.7 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.

14.02-33

1.8 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the MHSI system have either been completed or exceptions have been recorded and the impact on system performance has been determined.

2.2 Support systems and instrumentation required for operation of the MHSI subsystem are complete and functional or the impact on system performance has been determined.

2.3 The IRWST is filled with sufficient primary makeup water to conduct testing on the MHSI system.

2.4 The reactor vessel head and internals have been removed and the reactor vessel water level has been lowered below the vessel nozzles.

2.5 Test instrumentation to be used for pump performance has been installed and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

2.6 The MHSI system instrumentation is functional and calibrated and is operating satisfactorily prior to performing the following test.

2.7 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

3.0 TEST METHOD

3.1 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.2 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 6.3).

3.3 Start each MHSI pump using an SIAS signal and collect initial pump operating data:

3.3.1 MHSI pumps shall be aligned to discharge to the depressurized RCS (vessel level maintained below the vessel nozzles).

3.3.2 MHSI discharge valves throttled and calibrated instrumentation installed to compare safety injection (SI) pump flow and discharge pressure to the pump manufacturer head-flow curve. ~~3.3.3 Throttle capability of the discharge valve shall be verified over its full operating range.~~

3.3.3 Perform critical (full flow) sections of the test using normal and emergency power sources.

3.3.4 Collect valve data on valves that reposition to perform an accident mitigation function under maximum differential pressure conditions.

3.3.5 Verify adequate suction supply to the MHSI pumps from the IRWST using the suction header under maximum flow conditions, minimum IRWST level, and minimum vessel level.

3.3.6 Compare the measured suction head to the MHSI pump manufacturer NPSH requirements when corrected for IRWST minimum level attainable during an SIAS and maximum IRWST fluid temperature. (Note: it is acceptable to correct available data if design conditions can not be duplicated).

3.3.7 Operate each MHSI pump available for cold leg safety injection (CLSI) through the CLSI header and collect pump operating data.

3.4 Operate each MHSI pump to document the full flow capability.

3.5 Collect fluid samples from each of the MHSI system sampling points.

3.6 Measure the MHSI pump minimum flow recirculation ~~flowrate~~flow rate to the IRWST. Compare the measured ~~flowrate~~flow rate to the required minimum ~~flowrate~~flow rate provided by the pump supplier.

3.7 Record the static head of water in pump discharge lines relative to IRWST level with the valves in the MHSI lines between the IRWST and RCS in the open position.

14.02-33

3.8 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Valve position and position indication.

4.2 Position response of valves to loss of motive power.

4.3 Valve performance data, where required.

4.4 MHSI pump initial functional data including the following:

4.4.1 MHSI pump head versus flow.

4.4.2 MHSI pump suction pressure.

4.4.3 MHSI pumped fluid temperature.

4.4.4 Reactor vessel level.

4.4.5 IRWST level.

4.4.6 Chemistry of the water during the test.

4.4.7 Debris content of the water during the test as identified by sampling.

4.5 Response of MHSI system to SIAS when powered by normal, ~~ly~~ alternate and emergency power sources:

4.5.1 Motor current.

4.5.2 Buss voltage.

4.5.3 Time from signal to rated flow.

5.0 ACCEPTANCE CRITERIA

5.1 The MHSI system performs as described in Section 6.3.

5.2 MHSI system response times are less than those specified in Section 15.6.5.

14.02-33

5.3 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.2.3 Safety Injection Accumulator (Test #015)

1.0 OBJECTIVE

1.1 To perform the test described in this abstract on the safety injection accumulator system in conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.

1.2 To demonstrate that the safety injection accumulator system is properly installed and is functional prior to fuel loading.

1.3 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.

14.02-33

1.4 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the safety injection accumulator subsystem have been completed or exceptions have been recorded and the impact on system performance has been determined.

2.2 Support systems required for the operation of the safety injection accumulator subsystem are complete and functional prior to performing the following test.

2.3 Adequate supply of makeup water from the IRWST is available.

2.4 The reactor vessel head and internals have been removed.

2.5 The reactor vessel is filled above the reactor vessel injection nozzles.

2.6 Safety injection accumulator subsystem instrumentation has been checked and calibrated and is operating satisfactorily prior to performing the following test.

2.7 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

2.8 The combination of reactor vessel and refueling cavity are available to receive the contents of the safety injection accumulator.

3.0 TEST METHOD

3.1 Verify that control valves can be remotely operated while observing valve operation and position indication. Where required, measure valve performance data.

3.2 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 6.3).

3.3 Observe valve interlock and alarm operation.

3.4 Observe level indication and alarm operation while filling the safety injection accumulators from the IRWST.

3.5 Observe pressure indication, control operation and alarms while pressurizing the safety injection tanks with nitrogen.

3.6 Pressurize each safety injection accumulator to its maximum operating pressure and verify each SI accumulator discharge valve open against the maximum differential pressure.

14.02-33

3.7 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Valve position indication during test.

4.2 Valve performance data, where required.

4.3 Position response of valves to loss of motive power.

4.4 Setpoints at which alarms and interlocks occurs.

4.5 Times required for safety injection accumulators to discharge their contents to the RCS.

4.6 Safety injection accumulator pressure when stroking valves.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The safety injection accumulator performs as described in Section 6.3.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.2.4 Residual Heat Removal (Test #016)

1.0 OBJECTIVE

1.1 To perform the test described in this abstract on the RHRS in conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.

1.2 To demonstrate that the RHRS including the residual heat removal (RHR) pumps is properly installed and is functional prior to fuel loading.

14.02-33

1.3 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.

1.4 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the RHR/~~ and~~ low head safety injection (LHSI) system have either been completed or exceptions have been recorded and the impact on system performance has been determined.

2.2 Plant systems required to support testing are functional and temporary systems are installed and functional.

2.3 Permanently installed instrumentation is functional and calibrated and is operating satisfactorily prior to performing the following test.

2.4 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

2.5 All lines in the RHR/~~ and~~ LHSI system have been filled and vented.

2.6 ~~The low temperature overpressure protection (LTOP) valve relief capacity has been verified by bench testing.~~

3.0 TEST METHOD

14.02-33

3.1 Verify adequate minimum flow of each ~~RHR and~~ LHSI pump with minimum flow established.

3.2 Verify ~~RHR and LHSI~~ LHSI pump performance including head and flow characteristics for design flow paths which include the normal decay heat removal flow path and:

3.2.1 RHRS flow to the CVCS for purification during shutdown.

3.2.2 RHRS transfer of refueling water from the refueling cavity to the IRWST.

3.2.3 RHRS capability to cool the IRWST.

3.3 Perform a full flow test of the LHSI system when aligned to take suction from the IRWST and discharging to the reactor vessel, with vessel level below the hot and cold leg nozzles.

3.4 Verify that the operation of the protective devices, controls, interlocks, indications, and alarms using actual or simulated signals is within design limits.

3.5 Verify operation, stroking speed, position indication, and response to interlock of control and isolation valves is as designed.

3.6 Verify motor operated valve (MOV) isolation valves can be opened against design differential pressure. ~~3.7 Verify the setpoint of the LTOP relief valves.~~

3.7 Verify adequate NPSH is available to the RHR ~~and LHSI~~ pumps from suction sources at maximum design ~~flowrate~~flow rates.

14.02-33

3.8 Verify adequate ~~heat removal~~flow capability by the RHR ~~and LHSI~~ heat exchangers.

3.9 Verify that the flow limiting device, if applicable, in the LHSI discharge lines prevents run-out flow when the LHSI system ~~flow control valves are fully open~~is at full flow.

3.10 Verify that each RHR train is capable of being powered by the electrically independent and redundant emergency power supplies.

3.11 Operate each LHSI pump available for hot-leg safety injection (HLSI) through the associated HLSI line and collect pump operating data.

3.12 Verify that the RHR and LHSI power-operated valves fail upon loss of motive power as designed (refer to Section 6.3).

4.0 DATA REQUIRED

14.02-33

4.1 Valve position indications.

4.2 ~~LHSI~~RHR LHSI pump head versus flow.

4.3 Valve performance data, where required.

4.4 Setpoints of alarms and interlocks. ~~4.5 Setpoints of the LTOP relief valves.~~

4.5 Position response of valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

5.1 The RHR /~~and~~ LHSI systems perform~~s~~ as described in Section 6.3.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.2.5 Mid-Loop Operations Verification (Test #017)

1.0 OBJECTIVE

1.1 To perform the test described in this abstract in conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.

1.2 To demonstrate that the mid-loop operations system is properly installed and is functional prior to fuel loading.

1.3 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.

1.4 To verify that installed instrumentation for operations at reduced RCS inventory is accurate and reliable.

14.02-33

1.5 To verify the RHRS pumps can be operated at reduced RCS level without cavitation or excessive pump vibration.

1.6 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the RCS mid-loop instrumentation system have been completed or exceptions have been recorded and the impact on system performance has been determined.

2.2 RCS mid-loop system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for mid-loop operations are completed and functional.

2.4 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

2.5 The RCS is at normal shutdown level, the pressurizer is drained and depressurized.

2.6 The RHR and mid-loop level instrumentation systems are functional.

3.0 TEST METHOD

3.1 Verify operation of the RCS mid-loop level instrumentation, including indication and alarms.

3.2 Verify the operation (e.g., motor current, pump vibration, system flow) of the RHR pumps while operating at mid-loop level.

3.3 Verify that the RHR pumps can operate without cavitation at the minimum mid-loop level and maximum design flow, for mid-loop conditions.

3.4 Verify that the RHR pumps can operate without excessive vibration at the minimum mid-loop level and minimum design flow, for mid-loop conditions.

14.02-33

3.5 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Setpoints of alarms.

4.2 Mid-loop instrumentation data.

4.3 RHR pump flow and vibration data.

4.4 RHR pump performance data for limiting mid-loop design conditions.

5.0 ACCEPTANCE CRITERIA

5.1 The RHR and mid-loop instrumentation systems perform as described in Section 7.7.

14.02-33

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.2.6 Severe Accident Heat Removal System (Test #018)

1.0 OBJECTIVE

1.1 To perform the test described in this abstract on the severe accident heat removal system (SAHRS) simulating conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.

1.2 To demonstrate that the SAHRS is properly installed and is functional prior to fuel loading.

1.3 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.

1.4 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the systems to be tested have either been completed or exceptions have been recorded and the impact on system performance has been determined.

2.2 Plant systems required to support testing are functional or temporary systems are installed and functional.

2.3 Permanently installed instrumentation is functional and calibrated and is operating satisfactorily prior to performing the following test.

2.4 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

2.5 Thermal camera is available to record thermography of SAHRS header with hot air discharged through the spray nozzles.

2.6 Temporary air compressor with more than 1500 cfm capacity (aftercooler must be bypassed) is available.

2.7 Temporary air hoses (minimum of two inch diameter) are installed between the temporary air compressor and the SAHRS header.

3.0 TEST METHOD

3.1 Verify operation of the SAHRS pump with minimum flow established is within design limits.

3.2 Verify SAHRS pump performance including head and flow characteristics for design flow paths that can be tested by practical means.

3.3 Verify valve performance data are within design limits.

3.4 Verify by using the temporary air source that the SAHRS header and nozzles are free of obstructions.

3.5 Verify adequate heat removal capability by the SAHRS heat exchangers.

3.6 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 19.0).

14.02-33

3.7 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Valve position indications.

4.2 SAHRS pump head versus flow characteristics.

4.3 Valve performance data, where required.

4.4 Setpoints at which interlocks and alarms occur.

4.5 Position response of valves to loss of motive power.

4.6 Thermography record that spray nozzles are unobstructed. Thermography evidence shall be conclusive without need for supporting documentation.

5.0 ACCEPTANCE CRITERIA

5.1 The SAHRS meets design criteria described in Section 19.0.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.2.7 Extra Borating System (Test #019)

1.0 OBJECTIVE

1.1 To perform the test described in this abstract on the extra borating system (EBS) in conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.

1.2 To demonstrate that the EBS is properly installed and is functional prior to fuel loading.

1.3 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.

14.02-33

1.4 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the RCS and EBS have either been completed or exceptions have been recorded and the impact on system performance has been determined.

2.2 EBS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

2.4 The EBS boron supply tank is functional to supply the extra borating pump suction.

2.5 The reactor vessel is ready to receive water from the EBS.

2.6 Support systems required for operation of the EBS are functional.

3.0 TEST METHOD

3.1 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.2 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 6.8).

3.3 Verify each EBS pump can be manually and automatically started, using simulated signal.

3.4 Observe EBS pump operation including pump alarms and interlocks.

3.5 Verify the operation of EBS injection header.

14.02-33

3.6 Verify performance, including head and flow characteristics, of the EBS pumps.

3.7 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Valve performance data, where required.

4.2 Valve position indication.

4.3 Position response of valves to loss of motive power.

4.4 EBS pump operating data.

4.5 Setpoints at which alarms and interlocks occur.

4.6 EBS pump head versus flow.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The EBS performs as described in Section 6.8.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.2.8 Emergency Feedwater System (Test #020)

1.0 OBJECTIVE

1.1 To perform the test described in this abstract on the emergency feedwater system (EFWS) in conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.

1.2 To demonstrate that the EFWS is properly installed and is functional prior to fuel loading. This test shall demonstrate the ability of the EFWS to supply feedwater to the steam generators (SG) for design emergency conditions.

1.3 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.

1.4 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the systems to be tested have either been completed or exceptions have been recorded and the impact on system performance has been determined.

2.2 Permanently installed instrumentation is functional and calibrated and is operating satisfactorily prior to performing the following test.

2.3 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

2.4 Plant systems required to support testing are functional, or temporary systems are installed and functional.

3.0 TEST METHOD

3.1 Verify control logic.

3.2 Verify the following head and flow characteristics of emergency feedwater (EFW) pumps:

3.2.1 Pump head versus flow.

3.2.2 Starting time (motor start time and time to reach rated flow).

3.3 Verify design flow paths and verify flow meets design requirement.

3.4 Verify that operation in response to signals from the plant protection system is within design limits.

3.5 Verify that operation in response to signals from the hardwired controls of the safety information and controls system is in accord with design.

3.6 Verify that power operated valves operate within design limits (e.g., stroke time, developed thrust), that operation of power operated valves is within design limits.

3.7 Verify that operation, of these listed using actual or simulated inputs, is within design limits:

3.7.1 Protective devices.

3.7.2 Controls.

3.7.3 Interlocks.

3.7.4 Instrumentation response.

3.7.5 Alarms.

3.8 Verify that pump performance during an endurance test is within design limits.

3.9 Verify that power-operated valves fail upon loss of motive power as designed (refer to Section 10.4.9).

14.02-33

3.10 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 EFWS valve position indications.

4.2 EFWS valve performance data, where required including valve stroke time under design basis differential pressure.

4.3 EFWS pump head versus flow curves.

4.4 ~~Flowrate~~flow rates through venturi.

4.5 Response of EFW pumps to safety-related signals.

4.6 Pump start times.

4.7 Position response of EFWS valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The EFWS meets design criteria described in Section 10.4.9.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.2.9 Emergency Feedwater Storage Pool (Test #021)

1.0 OBJECTIVE

1.1 To perform the test described in this abstract on the EFWS in conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.

1.2 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attribute.

1.3 To demonstrate that the EFW storage pool provides a reliable source of water for the EFWS.

1.4 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITE

2.1 Construction activities on the EFW storage pool have either been completed or exceptions have been recorded and the impact on system performance has been determined.

2.2 The EFW storage pool instrumentation has been calibrated and is functional for performance of the following test.

2.3 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

2.4 Support system required for the operation of the EFW storage pool is complete and functional.

3.0 TEST METHOD

3.1 Verify associated control logic.

3.2 Verify design flow paths.

3.3 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.4 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 10.4.9).

3.5 Verify operation of protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

14.02-33

3.6 Verify the EFW storage pool is maintained at acceptable ~~water~~ dissolved oxygen concentrations.

3.7 Verify flow paths.

3.8 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Pump operating data.

4.2 Valve performance data, where required.

4.3 Valve position indication.

4.4 Position response of valves to loss of motive power.

4.5 Setpoints at which alarms and interlocks occur.

4.6 Applicable chemistry results.

5.0 ACCEPTANCE CRITERIA

5.1 The EFW storage pool meets design criteria described in Section 10.4.9.

14.02-33

5.2 Safety-related components meet electrical independence requirements.

14.2.12.2.10 In-Containment Refueling Water Storage Tank System (Test #022)

1.0 OBJECTIVE

1.1 To demonstrate the proper operation of the following subsystems:

1.1.1 IRWST.

1.1.2 Containment heat removal system (CHRS) supply header.

1.1.3 MHSI supply header.

1.1.4 LHSI supply header.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the IRWST are complete.

2.2 Plant systems required to support testing are functional or temporary systems are installed and functional.

2.3 Permanently installed instrumentation is functional and calibrated.

2.4 Test instrumentation is available and calibrated.

2.5 Refueling cavity integrity can be established.

2.6 The core spreading area can receive water from the IRWST.

3.0 TEST METHOD

3.1 Operate control valves remotely while:

3.1.1 Observing each valve operation and position indication.

3.1.2 Measuring valve performance data (e.g., thrust, opening and closing times).

3.2 Fill the IRWST with reactor makeup water and record volume versus indicated level. Observe level indication and alarms.

3.3 Simulate the full range of IRWST temperatures and observe indications and alarms.

3.4 Verify design flow path from IRWST to the CHRS and to the core spreading area.

3.5 Verify design flow path from IRWST to the safety injection systems (MHSI and LHSI) and to the refueling cavity.

3.6 Verify the level alarms and indication of the reactor cavity.

3.7 Verify the functionality and adequacy of range of the IRWST pressure instrumentation.

3.8 Verify the operation and configuration of the IRWST return screens.

14.02-33

3.9 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Valve position indications.

4.2 Valve opening and closing time, where required.

4.3 Setpoint at which alarms occur.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The IRWST performs as described in Section 6.3 and Section 19.2.

5.2 Safety-related components meet electrical independence requirements.

14.2.12.2.11 Core Melt Stabilization System (Test #023)

1.0 OBJECTIVE

1.1 To demonstrate proper construction of the core melt stabilization system (CMSS).

2.0 PREREQUISITES

1.1 To demonstrate that CIVs can be operated manually and operate in response to automatic actuation.

1.2 To verify that upon loss of actuating power, the valves fail as designed.

1.3 To verify that valves operate in less than the time specified in the system test procedure. The intent is not to perform stroke testing if already performed in individual system tests. For this test a table will be created for each CIV that includes the tested stroke time and the appropriate test reference.

14.02-33

1.4 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the CIVs have been completed.

2.2 Support system required to operate the CIVs are functional.

2.3 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Operate CIVs remotely while:

a. Observing each valve operation and position indication, and

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.2 Verify CIVs fail upon loss of motive power to their position specified in the safety analysis.

3.3 Verify that CIVs reposition to the position specified by design upon initiation of these simulated activation signals:

3.4 CIAS.

3.5 Containment spray actuation signal (CSAS).

3.6 Main steam isolation signal (MSIS).

3.7 Emergency feedwater actuation signal (EFAS).

3.8 Alternate feedwater actuation signal (AFAS).

3.9 High radiation actuation signal (HRAS).

3.10 High humidity actuation signal (HHAS).

3.11 SIAS.

14.02-33

3.12 The CCW low-low surge tank actuation signal.

3.13 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Valve performance data under differential pressure, flow, and temperature conditions as applicable.

4.2 Valve position indications.

4.3 Position response of valves to loss of motive power.

4.4 Valve response to a simulated actuation signal.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The CIVs operate as described in Section 3.1.5 and Section 6.2.4.

5.2 Safety-related components meet electrical independence requirements.

14.2.12.3.5 Containment Isolation Valves Leakage Rate (Test #028)

1.0 OBJECTIVE

1.1 To verify that the measured leakage through each containment penetration isolation valve when summed with the total of other Type B and C LRTs is within the limits as required by the Technical Specifications and 10 CFR 50, Appendix J.

2.0 PREREQUISITES

2.1 Construction activities on the systems to be tested have been completed.

2.2 Temporary pressurization equipment is installed and instrumentation is calibrated.

3.0 TEST METHOD

3.1 Close the individual CIVs by the means provided for normal operation of each individual valve. The valves must be stroked to the closed position by the normal means to perform a valid leakage test.

3.2 Perform 10 CFR 50 Appendix J, Type C test, by local pressurization of each penetration.

4.0 DATA REQUIRED

4.1 Individual penetration leak data.

5.0 ACCEPTANCE CRITERIA

5.1 Verify leak rates, when summed with the total of other Type B and C LRTs, do not exceed the allowable limits as required by the Technical Specifications and 10 CFR 50, Appendix J.

5.2 The CIVs operate as described in Section 3.1.5, Section 3.8.1, and Section 6.2.6.

5.1 The RCS hydrostatic test meets the requirements of ASME BPV Code, Section III.

14.2.12.3.8 Reactor Coolant Pump Motor Initial Operation (Test #031)

1.0 OBJECTIVE

1.1 To verify the proper operation of each RCP motor.

14.02-33

1.2 To collect baseline data for each RCP motor.

1.3 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 The RCP motor instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.2 Each RCP motor and its respective pump are uncoupled.

2.3 Support systems required for operation of each RCP motor are functional.

3.0 TEST METHOD

3.1 Start CCW flow to the RCP motor and observe indicating lights and alarms.

3.2 Rotate the RCP motor and verify that the wiring of motor leads and torque required to rotate the motor is correct using a torque wrench and phase rotation meter.

14.02-33

3.3 Verify the condition and the operation of the anti-rotation ratchet pawls.

3.4 Verify the condition and freedom of movement of the RCP flywheel.

3.5 Jog the RCP motor and verify correct rotation by independent means.

3.6 Start each RCP motor and verify that operation is within design limits.

3.7 Record the motor operating data.

3.8 Determine oil level setpoints of oil reservoirs by draining oil from motor reservoirs and subsequently refilling.

3.9 Simulate oil lift pumps and CCW system starting interlocks preventing RCP motor operation and observe effects.

3.10 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Motor operating data.

4.2 Torque needed to rotate the RCP motors.

4.3 Setpoints at which indications, alarms, and interlocks occur.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The RCP motors, support systems, alarms, indications, and interlocks perform as described in Section 5.4.1.

5.2 Safety-related components meet electrical independence requirements.

14.2.12.3.9 Steam Generator Hydrostatic (Test #032)

1.0 OBJECTIVE

1.1 To hydrostatically test the secondary side of the SG and portions of the following systems that can not be isolated from the SG:

1.1.1 Main steam.

1.1.2 Feedwater.

1.1.3 SG blowdown.

1.1.4 EFWSs.

2.0 PREREQUISITES

2.1 Construction activities on the SG secondary side are complete.

2.2 The RCS is available to be pressurized and the RCPs are functional.

2.3 The main steam safety valves are removed and blind flanges are installed.

2.4 Temporary hydrostatic test pump and relief valves are installed.

2.5 Temporary instrumentation (temperature and pressure) calibrated and installed.

2.6 Systems required to support the operation the RCS and RCPs are available.

2.7 Any permanent plant instrumentation not able to withstand hydrostatic pressure is removed from service.

2.8 Main steam piping has been determined to be capable of supporting water filled lines or temporary supports have been installed.

3.0 TEST METHOD

3.1 Fill and vent the SGs and chemically treat the water, as required.

3.2 Operate the RCS and associated systems as needed to operate the RCPs. Heat the RCS and SGs to the required temperature. The SGs must be sufficiently heated so that the temperature shall not fall below the minimum nil-ductility temperature during the required system hold or examination period.

2.0 PREREQUISITES

2.1 System components and piping supports have been installed in accordance with design drawings for system to be tested.

2.2 System piping has been installed in accordance with design drawings for system to be tested.

2.3 HFT or precritical heatup (or both) for power escalation are underway.

2.4 System piping has been filled and vented for normal operation.

3.0 TEST METHOD

3.1 Perform an assessment of piping system vibration observed during system operation.

4.0 DATA REQUIRED

4.1 Pipe response data to include piping drawings, vibration measurements and operating conditions.

5.0 ACCEPTANCE CRITERIA

5.1 Steady state vibration testing based on limits established by the piping designers.

5.1.1 Acceptance criteria are based on conservatively estimated stresses which are derived from measured velocities and conservatively assumed mode shapes.

5.2 Transient vibration testing based on limits established by the piping designers.

5.2.1 No permanent deformation or damage in any system, structure or component important to nuclear safety is observed.

5.2.2 All suppressors and restraints respond within their allowable ranges, between stops or with indicators on scale.

14.2.12.3.13 Control Rod Drive Mechanism Control (Test #036)

1.0 OBJECTIVE

1.1 To demonstrate proper input signals and proper sequencing of input signals to CRDM coils.

1.2 To demonstrate proper operation of the CRDM control system in functional modes.

14.02-33

1.3 To verify proper operation of the CRDM control system interlocks and alarms.

1.4 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the CRDM control system have been completed and system software is installed.

2.2 Cable continuity tests have been completed.

2.3 Special test instrumentation has been calibrated and is functional.

2.4 Special test equipment is functional.

2.5 RCCAs are installed in dummy or actual fuel assemblies, to allow movement of the RCCAs.

2.6 RCCAs are latched by lifting the drive shaft and observing the weight corresponding to a latched RCCA, prior to installing the reactor head.

2.7 Support systems required for operation of the CRDM control system are functional.

2.8 Reactor head installed, filled and vented to cool the CRDMs or an analysis has been performed to demonstrate that filling the CRDMs is not necessary.

3.0 TEST METHOD

3.1 Energize and latch CRDMs by closing the reactor trip breaker.

3.2 Observe the sequence in which withdraw and insert signals are passed to the appropriate CRDM coil using special test instrumentation.

3.3 Observe operation of the RCCA position indicators.

14.02-33

3.4 Operate the CRDM control system in functional modes.

3.5 Simulate input signals and observe operation of interlocks and alarms.

3.6 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 CRDM coil current traces.

4.2 CRDM control system rod step indications.

4.3 CRDM control system operating data.

4.4 Interlock and alarm actuation points.

5.0 ACCEPTANCE CRITERIA

5.1 The CRDM control system performs as described in Section 7.2.1.

5.2 Safety-related components meet electrical independence requirements.

14.2.12.3.14 Pressurizer Safety Valve (Test #037)

14.02-33

1.0 OBJECTIVE

1.1 To verify the setpoint of the pressurizer safety valves.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the pressurizer have been completed and associated instrumentation has been calibrated and is operating satisfactorily.

2.2 The RCS is at HZP (temperature and pressure).

2.3 Relief valve lifting device with associated support equipment and calibration data is available.

3.0 TEST METHOD

3.1 Increase the lifting force on the safety valve, using a special lifting device, until the safety valve just starts to lift.

3.2 Determine setpoint pressure from the lifting device correlation data.

3.3 Adjust valve setpoint pressure if necessary and retest.

3.4 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Pressurizer pressure and temperature at time of test.

4.2 Pressure applied to the lifting device to lift the safety valve off its seat.

5.0 ACCEPTANCE CRITERIA

5.1 Safety valves perform as described in Section 5.4.1.1.

5.2 Safety-related components meet electrical independence requirements.

14.2.12.3.15 Fuel Handling System (Test #038)

1.0 OBJECTIVE

1.1 To verify the proper operation of the fuel handling system (FHS).

2.0 PREREQUISITES

2.1 Construction activities on the systems to be tested are complete.

3.3 ~~Verify that potable water is supplied at the point of use and meets requirements.~~

3.4 ~~Verify that sanitary water is supplied at the point of use and meets requirements.~~

4.0 DATA REQUIRED

4.1 Pump operating data.

4.2 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

5.1 The potable and sanitary water system performs as described in Section 9.2.4.

14.2.12.5.5 Component Cooling Water System (Test #046)

1.0 OBJECTIVE

1.1 To demonstrate the capability of the CCWS to provide treated cooling water under the following conditions:

1.1.1 Normal unit operation.

1.1.2 During unit cooldown.

1.1.3 During refueling.

1.1.4 During an emergency situation.

14.02-33

1.2 To demonstrate that system response to a simulated ESF actuation signal is as designed.

1.3 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the CCWS have been completed.

2.2 CCWS instrumentation has been calibrated and is functional for performance of the following test.

2.3 Test instrumentation is available and calibrated.

2.4 Plant systems required to support testing are functional, or temporary systems are installed and functional.

3.0 TEST METHOD

3.1 Demonstrate that operation of the surge tanks and their controls is within design limits.

3.2 Demonstrate that system and component flow paths, ~~flowrate~~flow rates, and pressure drops including head versus flow verification for the CCW pumps is within design limits.

3.3 Perform a pump head versus flow verification for CCW pumps.

3.4 Verify the following responses to emergency signals:

a. Non-safety-related headers and the spent fuel pool heat exchangers are isolated on an SIAS.

b. CCW heat exchanger bypass valves close on an SIAS.

3.5 Verify the non-safety-related headers and RCP headers are isolated on a surge tank low-low level signal.

3.6 Verify a low CCW pump differential pressure signal starts the idle pump in each division.

3.7 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.8 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 9.2.2).

3.9 Verify alarms, interlocks, indicating instruments, and status lights are functional.

3.10 Verify pump control from the MCR.

3.11 Demonstrate the ability of the CCWS in conjunction with the RHRS and essential service water system to perform a plant cooldown during HFT.

14.02-33

3.12 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Record pump head versus flow and operating data for each pump.

4.2 Flow balancing data including flow to each component and throttle valve positions.

4.3 Setpoints of alarms interlocks and controls.

4.4 Valve performance data, where required.

4.5 Valve position indication.

4.6 Position response of valves to loss of motive power.

4.7 Temperature data during cooldown.

4.8 Response of CCW System to SIAS, CSAS, low-low surge tank level signal and CCW pump high differential pressure signal.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The CCWS performs as described in Section 9.2.2.

5.2 Safety-related components meet electrical independence requirements.

14.2.12.5.6 Reserved (Test #047)

14.2.12.5.7 Essential Service Water System (Test #048)

1.0 OBJECTIVE

1.1 To demonstrate the ability of the essential service water system (ESWS) to supply cooling water as designed under normal and emergency conditions.

1.2 To demonstrate the ability of the ESWS to provide cooling water to the SAHRS in beyond design basis conditions.

1.3 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the ESWS are complete and the system is functional.

2.2 ESWS instrumentation has been calibrated and is functional for performance of the following test.

2.3 Test instrumentation available and calibrated per applicable procedures.

2.4 CCWS available to provide a heat load.

2.5 Appropriate AC and DC power sources are available.

2.6 Support systems required for operation of the ESWS are complete and functional.

2.7 The Ultimate Heat Sink (UHS) is available and functional.

3.0 TEST METHOD

3.1 Demonstrate that each ESWS can be operated from the MCR.

3.2 Demonstrate that each ESWS starts automatically in response to an emergency signal.

3.3 Verify that the ESWS pumps supply cooling water at the rated flow and design conditions.

3.4 Verify ESWS water flow supplied to components.

3.5 Verify alarms, interlocks, indicating instruments, and status lights are functional.

3.6 Verify head versus flow characteristics for the ESWS water pumps.

3.7 Record valve performance data, where required.

3.8 Record valve position indication.

3.9 Record position response of valves to loss of motive power.

14.02-33

3.10 Verify system baseline performance during HFT (with RHRS in service).

3.11 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Record flows as required to components and throttle valve positions.

4.2 Record alarm, interlocks, and control setpoints.

4.3 Record pump head versus flow and operating data.

4.4 System operating parameters during HFT.

4.5 Flow to CCW heat exchangers using various pump and system alignment combinations.

4.6 Valve diagnostic testing data (e.g., stroke time, developed thrust).

4.7 Valve position upon loss of motive power and valve position indication data.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The ESWS performs as described in Section 9.2.1.

5.2 Safety-related components meet electrical independence requirements.

14.2.12.5.8 Ultimate Heat Sink (Test #049)

1.0 OBJECTIVE

1.1 To verify that the UHS is maintained by its associated support systems.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the UHS have been completed.

2.2 UHS makeup source available, as required.

2.3 UHS blowdown path available, as required.

2.4 The UHS system instrumentation has been calibrated and is functional for performance of the following test.

2.5 Test instrumentation available and calibrated per applicable procedures.

3.0 TEST METHOD

3.1 Simulate a range of temperature inputs and verify UHS response.

3.2 Verify that control logic starts forced draft fans and aligns critical components for UHS operation.

3.3 Perform valve performance tests (e.g., valve position response of valves to loss of motive power, thrust, stroke time)

3.4 Demonstrate that UHS makeup ~~flowrate~~flow rate meets design flow requirements.

3.5 Demonstrate that UHS blowdown ~~flowrate~~flow rate meets design flow requirements.

3.6 Demonstrate the operation of UHS level and temperature instruments and alarms.

14.02-33

3.7 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 UHS makeup, blowdown, and air flow rates.

4.2 Valve performance data, where required.

4.3 Valve position indication.

4.4 Temperature and relative humidity trend data.

4.5 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The UHS performs as described in Section 9.2.5.

5.2 Safety-related components meet electrical independence requirements.

14.2.12.5.9 Reserved (Test #050)

14.2.12.6 General Supply Systems

14.2.12.6.1 Reserved (Test #051)

14.2.12.6.2 Safety Chilled Water (Test #052)

1.0 OBJECTIVE

1.1 To demonstrate proper operation of the safety chilled water system (SCWS).

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the SCWS have been completed.

2.2 SCWS instrumentation has been calibrated and is functional for performance of the following test.

2.3 Test instrumentation available and calibrated per applicable procedures.

2.4 The CCWS is available for chiller operation, where necessary.

2.5 Appropriate AC and DC power sources are available.

3.0 TEST METHOD

3.1 Verify pump performance characteristics (e.g., head versus flow, motor current) for the SCWS pumps.

3.2 Demonstrate that each SCWS division can be operated from its local and remote manual control station.

3.3 Demonstrate that each SCWS division starts automatically in response to each appropriate signal.

3.4 Verify that the chillers supply chilled water at the rated flow and design conditions.

3.5 Verify chilled water flow to each supplied component.

3.6 Verify alarms, interlocks, indicating instruments, and status lights are functional.

3.7 Verify system baseline performance during HFT.

14.02-33

3.8 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Record flows as required to components and throttle valve positions.

4.2 Record alarm, interlocks, and control setpoints.

4.3 Record chiller normal operating parameters.

4.4 Record pump head versus flow and operating data.

4.5 System operating parameters during HFT.

5.0 ACCEPTANCE CRITERIA

5.1 The SCWS operates as described in Section 9.2.8.

5.2 Safety-related components meet electrical independence requirements.

2.2 Support systems required for operation of the GFES are complete and functional.

2.3 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify markup drawings showing the location of areas protected by GFES equipment.

3.2 Verify alarms, indicating instruments, and status lights are functional.

4.0 DATA REQUIRED

4.1 As-built drawings showing the location of areas protected by GFES equipment.

5.0 ACCEPTANCE CRITERIA

5.1 The GFES operates as described in Section 9.5.1.

14.2.12.6.8 Reserved (Test #058)

14.2.12.7 Power Conversion Systems

14.2.12.7.1 Feedwater System (Test #059)

1.0 OBJECTIVE

1.1 To demonstrate that the FWS, including startup feedwater pump, is capable of supplying feedwater to the SGs for normal operation.

14.02-33

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the FWS have been completed.

2.2 FWS instrumentation has been calibrated and is functional for performance of the following test.

2.3 Support systems required for operation of the FWS are complete and functional.

2.4 Test instrumentation available and calibrated.

2.5 Condensate system functional.

2.6 Main condenser functional.

2.7 Appropriate AC and DC power available.

3.0 TEST METHOD

3.1 Demonstrate design flow paths including economizer, downcomer, and cleanup recirculation (during HFT or PAT).

3.2 Demonstrate that startup feedwater valve alignments and flow paths function as designed.

3.3 Verify the starting, head, and flow characteristics of the motor-driven startup feedwater pump.

3.4 Demonstrate minimum flow recirculation protection using simulated inputs.

3.5 Verify operation of protective devices, controls, interlocks, instrumentation, and alarms using actual or simulated inputs function as designed.

3.6 Verify the starting, head, and flow characteristics of motor-driven feedwater pumps.

3.7 Operate feedwater isolation valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, stroke times).

3.8 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.9 Verify the feedwater isolation valves fail upon loss of motive power to the position indicated in Section 10.4.7.

14.02-33

3.10 Verify the feedwater isolation valves close in response to a MSIS.

3.11 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Motor-driven startup feedwater pump head versus flow data.

4.2 Motor-driven feedwater pump head versus flow data.

4.3 Valve performance data, where required.

4.4 Valve position indication.

4.5 Position response of valves to loss of motive power.

4.6 Setpoints at which alarms and interlocks occur.

4.7 Feedwater isolation valve data.

5.0 ACCEPTANCE CRITERIA

5.1 The FWS (including startup feedwater) operates as described in Section 10.4.7.

5.2 The feedwater isolation valves meet the test acceptance criteria as described in Section 10.4.7.

14.02-33

5.3 Safety-related components meet electrical independence requirements.

14.2.12.7.2 Feedwater Heating System (Test #060)

1.0 OBJECTIVE

1.1 To demonstrate that the feedwater heating system (FWHS) is capable of heating the FWS to the design temperature for normal plant operation. This test can only be performed during HFT or similar plant conditions.

1.2 To demonstrate the FWHS alarms and controls operate as designed.

1.3 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the FWHS have been completed.

2.2 Construction activities on the feedwater heater drains system have been completed.

2.3 FWHS instrumentation has been calibrated and is functional for performance of the following test.

2.4 Feedwater heater drains system instrumentation has been calibrated and is functional for performance of the following test.

2.5 Individual feedwater and main steam component testing is complete.

2.6 The power conversions systems are operating as required to support the test.

3.0 TEST METHOD

3.1 Verify the setpoints of alarms and interlock.

3.2 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.3 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 10.4.7).

3.4 Record the feedwater temperature to the SGs at maximum attainable feedwater flow and compare the readings to those predicted by the secondary model for similar conditions.

3.5 Demonstrate that the high pressure feedwater heating system level controls maintain level as designed and drain to the deareator.

3.6 Demonstrate that the low pressure feedwater heaters level controls maintain level as designed and drain to the main condenser.

4.0 DATA REQUIRED

4.1 Valve performance data, where required.

4.2 Valve position indication.

4.3 Position response of valves to loss of motive power.

4.4 Setpoints at which alarms and interlocks occur.

4.5 Feedwater temperature and feedwater ~~flowrate~~flow rate for each heater group.

4.6 Level controllers trend data.

5.0 ACCEPTANCE CRITERIA

5.1 The FWHS performs as described in Section 10.4.7.

14.2.12.7.3 Main Steam – Turbine Bypass Systems (Test #061)

1.0 OBJECTIVE

1.1 To demonstrate the operation of the main steam system (MSS).

14.02-33

1.2 To demonstrate the operation of the turbine bypass system (TBS).

1.3 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the MSS have been completed.

2.2 Construction activities on the TBS have been completed.

2.3 MSS and TBS instrumentation has been calibrated and is functional for performance of the following test.

2.4 Support systems required for operation of the MSS and TBS are complete and functional.

2.5 Test equipment is available and test instrumentation is calibrated.

3.0 TEST METHOD

3.1 Demonstrate automatic drain valve operation.

3.2 Demonstrate flow paths.

3.3 Verify opening of the turbine bypass valves in response to a signal simulating turbine trip and steam pressure above setpoint.

3.4 Verify the functionality of the main steam relief train (MSRT) valves at HZP steam pressure during HFT.

3.5 Verify the functionality of the turbine bypass valves at no-load steam pressure during HFT.

3.6 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.7 Verify the turbine bypass valves fail upon loss of motive power as designed (refer to Section 10.4.4).

3.8 Verify that operation of designated components such as protective devices, controls, interlocks, instrumentation, and alarms using actual or simulated inputs function as designed.

14.02-33

3.9 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Valve performance data, where required.

4.2 Valve position indication.

4.3 Position response of valves to loss of motive power.

4.4 Setpoints at which alarms and interlocks occur.

4.5 Flow path data.

5.0 ACCEPTANCE CRITERIA

5.1 The MSS performance as described in Section 10.4.4.

5.2 Turbine bypass valves open in response to a signal simulating turbine trip and controls steam pressure, as described in Section 10.4.4.

5.3 Turbine bypass valves fail upon loss of motive power as designed (refer to Section 10.4.4).

5.4 Safety-related components meet electrical independence requirements.

14.2.12.7.4 Main Steam Safety Valve (Test #062)

1.0 OBJECTIVE

1.1 To verify the popping pressure of the MSS safety valves during HFT.

14.02-33

1.2 To verify an acceptable alternative method is to perform the setpoint verification at a certified testing facility.

1.3 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the main steam safety valves have been completed.

2.2 MSS instrumentation has been calibrated and is functional for performance of the following test.

2.3 Support systems required for operation of the main steam safety valves are complete and functional.

2.4 Test instrumentation is available and calibrated.

2.5 MSS is at HZP (pressure and temperature), which is a suitable temperature and pressure for valve testing.

2.6 Lifting device with associated support equipment and calibration data is available.

3.0 TEST METHOD

3.1 Increase the lifting force on the safety valve, using the lifting device until the safety valve starts to simmer.

3.2 Determine popping set pressure.

3.3 Adjust valve popping set pressure if necessary and retest.

3.4 Repeat until three consecutive pops within the required range are obtained.

14.02-33

3.5 Verify safety valves have no seat leakage.

3.6 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 MSS pressure and temperature.

4.2 Pressure applied to the lifting device to lift the safety valve off its seat.

4.3 Popping pressure of each main steam safety valve.

5.0 ACCEPTANCE CRITERIA

5.1 The main steam safety valves perform as described in Section 10.3.

5.2 Safety-related components meet electrical independence requirements.

14.2.12.7.5 Main Steam Isolation Valves and MSIV Bypass Valves (Test #063)

1.0 OBJECTIVE

1.1 To demonstrate the functional performance of the main steam isolation valves (MSIV) and MSIV bypass valve controls.

1.2 To demonstrate the proper operation of the MSIVs at normal operating temperatures, during HFT.

1.3 Verify electrical independence and redundancy of safety-related power supplies.

14.02-33

2.0 PREREQUISITES

2.1 Construction activities on the MSIVs have been completed.

2.2 MSS instrumentation has been calibrated and is functional for performance of the following test.

2.3 Support systems required for operation of the MSIVs are complete and functional.

2.4 Test equipment is available and test instrumentation is calibrated.

3.0 TEST METHOD

3.1 Operate MSIV and MSIV bypass valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, stroke times) at ambient and HFT conditions.

3.2 Verify the MSIVs and MSIV bypass valves fail upon loss of motive power to the position indicated in Section 10.3.

3.3 Verify MSIV and MSIV bypass valve controls, alarms, and interlocks.

3.4 Verify MSIV and MSIV bypass valve response to MSIS.

3.5 Verify MSIV and MSIV bypass valve seat leakage.

3.6 Perform MSIV drift test.

3.7 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 MSIV and MSIV bypass valve performance data at ambient and HFT conditions.

4.2 Valve position indication.

4.3 Position response of valves to a loss of motive power.

4.4 Setpoints at which alarms and interlocks occur.

4.5 MSIV and MSIV bypass valve seat leakage.

4.6 MSIV and MSIV bypass valve response to MSIS.

4.7 MSIV drift data.

5.0 ACCEPTANCE CRITERIA

5.1 The MSIVs and MSIV bypass valves operate as described in Section 10.3.

5.2 The MSIVs and MSIV bypass valves meet the test acceptance criteria described in Section 10.3.

14.02-33

5.3 Safety-related components meet electrical independence requirements.

14.2.12.7.6 Turbine Gland Sealing System (Test #064)

1.0 OBJECTIVE

1.1 To verify that the turbine gland sealing system (TGSS) provides adequate sealing to the turbine shaft against leakage of air to the turbine casings and escape of steam to the Turbine Building.

2.0 PREREQUISITES

2.1 Construction activities on the TGSS have been completed.

2.2 TGSS instrumentation has been calibrated and is functional for performance of the following test.

2.3 Test instrumentation is available and calibrated.

2.4 Plant systems required to support the test including auxiliary steam, the condenser, and turbine cooling water system are functional.

2.5 Plant conditions for the following subsystems allow operation of the sealing steam system.

2.5.1 Main turbine.

2.5.2 Main feed pumps.

2.5.3 Turbine control valves.

3.0 TEST METHOD

3.1 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.2 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 10.4.3).

4.1 Head versus flow performance and pump operating data.

4.2 Valve performance data, where required.

4.3 Valve position indication.

4.4 Position response of valves to loss of motive power.

4.5 Setpoints at which alarms and interlocks occur.

4.6 Setpoints of the hotwell level controls.

4.7 Setpoints of the pumps minimum flow recirculation protection.

5.0 ACCEPTANCE CRITERIA

5.1 The CS operates as described in Section 10.4.7.

14.2.12.7.9 Steam Generator Blowdown System (Test #067)

1.0 OBJECTIVE

14.02-33

1.1 To verify the proper operation of the SG blowdown system (SGBS).

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the SGBS have been completed.

2.2 The SGBS instruments have been calibrated and are functional for performance of the following test.

2.3 Support systems required for operation of the SGBS are complete and functional.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify the flow paths for generator blowdown and subsequent condensate recycle during HFT.

3.2 Verify blowdown flow path ~~flowrate~~flow rates during HFT.

3.3 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.4 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 10.4.8).

3.5 Verify that operation of the flash tank, valves, and heat exchanger in operational modes and flow paths function as designed.

3.6 Verify that the operation of protective devices, controls, interlocks, and alarms using actual or simulated inputs meet design requirements.

3.7 Verify system response to the following:

3.7.1 The CIAS meets design requirements.

3.7.2 EFAS.

14.02-33

3.8 Verify SG wet layup system operations.

3.9 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Valve performance data, where required.

4.2 Valve position indication.

4.3 Position response of valves to loss of motive power.

4.4 Setpoints at which alarms and interlocks occur.

4.5 Response to MSIS, CIAS and EFAS.

4.6 SG blowdown flow path ~~flowrate~~flow rates.

5.0 ACCEPTANCE CRITERIA

5.1 The SGBS operates as described in Section 10.4.8.

5.2 Safety-related components meet electrical independence requirements.

14.2.12.7.10 Steam Turbine (Test #068)

1.0 OBJECTIVE

1.1 To demonstrate functional performance of the steam turbine controls.

1.2 To demonstrate functional performance of the steam turbine support system.

1.3 To perform initial operation of the steam turbine system (HFT and PAT).

1.4 To verify the steam turbine generator trips in response to the following:

1.4.1 Simulated reactor trip signal.

1.4.2 Simulated loss of condenser vacuum signal.

2.0 PREREQUISITES

2.1 Construction activities on the steam turbine system are complete.

2.2 Steam turbine system instrumentation has been calibrated and is functional for the performance of the following test.

14.02-33

process systems to sample stations for chemical and radiological analysis during operation, cooldown and standby operation.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the systems to be tested have been completed.

2.2 Systems being sampled are at or near normal operating pressure and temperature.

2.3 Calibrating gases and solutions are available.

2.4 Test instrumentation is available and calibrated.

2.5 SECSS instrumentation has been calibrated and is functional for performance of the following test.

3.0 TEST METHOD

3.1 Withdraw fluid at each sample point, verifying adequate sample flow.

3.2 Verify that operation of alarms and interlocks meets design requirements.

3.3 Verify that operation of pump and heat exchangers in normal operation using normal flow paths meets design requirements.

3.4 Verify the analytical instrumentation provides indication and response that meet the design requirements.

3.5 Calculate the holdup times using the as-built piping lengths, piping volume and measured ~~flowrate~~flow rate for the following:

3.5.1 SG samples.

3.5.2 Blowdown demineralizer samples.

3.6 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.7 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 9.3.2).

14.02-33

3.8 Verify that operation of continuous monitors and verify flow meets design requirements.

3.9 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Setpoints at which alarms and interlocks occur.

4.2 Sampling ~~flowrate~~flow rate from each sample point.

4.3 Analytical instrument data.

4.4 Valve performance data, where required.

4.5 Valve position indication.

4.6 Position response of valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The SECSS performs as described in Section 9.3.2.

5.2 Safety-related components meet electrical independence requirements.

14.2.12.7.14 Steam Generator Blowdown Demineralizing System (Test #072)

1.0 OBJECTIVE

1.1 To verify the ability of SG blowdown demineralizing system (SGBDMS) to clean the SG blowdown by a combination of filtration and ion exchange.

2.0 PREREQUISITES

2.1 Construction activities on the systems to be tested have been completed.

2.2 Systems being sampled are at or near normal operating pressure and temperature.

2.3 Calibrating gases and solutions are available.

2.4 Test instrumentation is available and calibrated.

2.5 Secondary sampling system instrumentation has been calibrated and is functional for performance of the following test.

3.0 TEST METHOD

3.1 Verify by physical inspection that the filter housing is constructed and assembled in a manner that doesn't permit bypass flow paths.

3.2 Verify that operation of alarms and interlocks meet design requirements.

3.3 Verify the analytical instrumentation provides indication and response that meets design requirements of ion exchanger outlet chemistry.

3.4 Operate control valves remotely while:

a. Observing each valve operation and position indication.

3.6 Verify that operation of the ventilation exhaust units and fans meet design requirements.

3.7 Verify that operation of the equipment compartment cooling units meets design requirements.

3.8 Verify that operation of the equipment compartment ventilation units meets design requirements.

3.9 Verify HEPA filter efficiency, carbon absorber efficiency, and air flow capacity.

3.10 Verify the system rated air flow and air balance.

3.11 Verify that operation of protective devices, controls, interlocks instrumentation, and alarms using actual or simulated inputs meet design requirements.

3.12 Verify that operation of the reactor containment building cooling and ventilation system to associated radiation monitors meets design requirements.

4.0 DATA REQUIRED

4.1 Air balancing verification.

4.2 Fan and damper operating data.

4.3 Temperature data of building area.

4.4 Setpoints of alarms, interlocks, and controls

4.5 Reactor Containment Building negative pressurization data.

4.6 HEPA filter and carbon absorber data.

4.7 CBVS performance data in response to radiation monitors.

5.0 ACCEPTANCE CRITERIA

5.1 The CBVS operate as described in Section 9.4.7.

5.2 The CBVS performs as designed to radiation monitors described in Section 7.3.1.

14.2.12.8.4 Containment Purge (Test #076)

1.0 OBJECTIVE

1.1 To demonstrate the capability of the containment purge systems, both low-flow and full-flow, to maintain the containment air quality and cleanliness at the required value during normal operation (low-flow), inspection, testing, maintenance, and refueling operations.

14.02-33

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities in the containment have been completed and acceptable levels of cleanliness established.

2.2 Construction activities on the containment purge systems have been completed.

2.3 Containment purge system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.4 Support systems required for operation of the containment purge systems are complete and functional.

2.5 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Demonstrate manual and automatic system controls.

3.2 Verify alarms, indicating instruments and status lights are functional.

3.3 Verify design air flows for high purge, low purge and two containment cleanup systems.

3.4 Perform HEPA filters and carbon absorber efficiency tests.

3.5 Demonstrate system responses to a high radiation signal and high relative humidity signal.

3.6 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.7 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 9.4.7).

3.8 Simulate the following and observe isolation valve response:

3.8.1 CIAS.

3.8.2 HHAS.

3.8.3 HRAS.

14.02-33

3.9 Verify that operation of containment purge system radiation monitors meets design requirements.

3.10 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Air balancing verification.

4.2 Fan operating data for low purge and high purge fans.

4.3 HEPA filter and carbon absorber data for exhaust filter trains.

4.4 Valve performance data, where required.

4.5 Valve position indication.

4.6 Position response of valves to loss of motive power.

4.7 Setpoints at which alarms and interlocks occur.

4.8 Temperature of air supply (outside) to high purge supply and discharge into containment.

4.9 Valves respond to the following simulated signals:

4.9.1 CIAS.

4.9.2 HHAS.

4.9.3 HRAS.

4.10 Containment purge system radiation monitors performance data.

5.0 ACCEPTANCE CRITERIA

5.1 The containment purge system performs as described in Section 9.4.7.

14.02-33

5.2 The containment purge system responds as required to the radiation monitors described in Section 7.3.1.

5.3 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.8.5 Annulus Ventilation System (Test #077)

1.0 OBJECTIVE

1.1 To demonstrate the capability of the annulus ventilation system (AVS) to produce and maintain a negative pressure in the annulus following a loss of coolant accident (LOCA).

1.2 To minimize the release of radioisotopes following a LOCA by filtering large volumes of annulus air prior to discharge to the plant vent stack.

1.3 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the containment wall and shield wall are complete with penetrations sealed in place.

2.2 Construction activities on the AVS have been completed.

2.3 AVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.4 Support systems required for operation of the AVS are complete and functional.

2.5 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify control logic, including response to ESFAS.

3.2 Verify that operation, failure mode, stroke speed and position indication of control valves and dampers meets design requirements.

3.3 Demonstrate that the AVS shall achieve a negative pressure in the Annulus within the design requirements:

3.3.1 Greater than or equal to the required inches water gauge.

3.3.2 Within the required elapsed time since actuation.

3.4 Verify that operation of protective devices, controls, interlocks, instrumentation and alarms meet design requirements.

14.02-33

3.5 Verify design air flow for normal and emergency operation.

3.6 Perform HEPA filter and carbon absorber efficiency tests.

3.7 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Setpoints at which alarms, interlocks, and controls occur.

4.2 Valve and damper operating data.

4.3 Air balancing verification.

4.4 Fan operating data.

4.5 HEPA filter and carbon absorber efficiency data.

4.6 Annulus negative pressurization data: Annulus pressure and drawdown time response curve.

5.0 ACCEPTANCE CRITERIA

5.1 The AVS operates as described in Section 6.2.3.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.8.6 Electrical Division of Safeguard Building Ventilation System (Test #078)

1.0 OBJECTIVE

1.1 To demonstrate the operation of the electrical division of safeguard building ventilation system (SBVSE):

1.1.1 Vital instrument and equipment room ventilation subsystems.

1.1.2 Computer room ventilation subsystems.

1.1.3 Operations support center ventilation subsystem.

1.1.4 Shift and assembly offices ventilation subsystem.

1.1.5 CAS and SEC group ventilation subsystem.

1.1.6 Personnel decontamination room ventilation subsystem.

1.1.7 The battery room ventilation subsystem.

1.1.8 Break room ventilation subsystem.

14.02-33

1.1.9 Electrical and mechanical equipment room HVAC units.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities in the Safeguard Building controlled area are complete with penetrations sealed.

2.2 Construction activities on the SBVSE have been completed.

2.3 SBVSE instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.4 Support systems required for operation of the SBVSE are functional.

2.5 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify control logic.

3.2 Verify the operation of the computer room air handling units or fans or both.

3.3 Verify the operation of the operations support center air handling units or fans or both.

3.4 Verify the operation of the shift and assembly offices air handling units or fans or both.

3.5 Verify the operation of the CAS and SEC group air handling units or fans or both.

3.6 Verify the operation of the battery room air handling unit and fan.

3.7 Verify the operation of the personnel decontamination room air handling units or fans or both.

3.8 Verify the operation of the break room air handling units or fans or both.

3.9 Verify the operation of the electrical and mechanical equipment room air handling units or fans or both.

3.10 Verify operation of the smoke purge fans.

3.11 Verify alarms, indicating lights and status lights are functional.

3.12 Perform air flow balancing of the SBVSE.

3.13 Verify that operation of dampers meet design requirements.

14.02-33

3.14 Verify that operation of the vital instrument and equipment room HVAC units or fans or both meet design requirements.

3.15 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Damper operating data.

4.2 Air flow and balancing verification.

4.3 Setpoints at which alarms, center backs and control occur.

4.4 Temperature data for each of the SBVSE.

5.0 ACCEPTANCE CRITERIA

5.1 The SBVSE operates as described in Section 9.4.6.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.8.7 Nuclear Auxiliary Building Ventilation System (Test #079)

1.0 OBJECTIVE

1.1 To demonstrate the operation of the nuclear auxiliary building ventilation system (NABVS).

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities in the nuclear auxiliary building are complete with penetrations sealed.

2.2 Construction activities on the NABVS have been completed.

2.3 NABVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.4 Support systems required for operation of the NABVS are functional.

2.5 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify control logic.

3.2 Verify the operation of the air handling units or fans or both.

3.3 Verify alarms, indicating lights and status lights are functional.

3.4 Perform air flow balancing of the NABVS.

3.5 Verify that operation of dampers meets design requirements.

14.02-33

3.6 Perform HEPA filter and carbon absorber efficiency tests.

3.7 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Damper operating data.

4.2 Air flow and balancing verification.

4.3 Setpoints at which alarms and control occur.

4.4 Temperature data for each of the NABVS.

4.5 HEPA filter and carbon absorber efficiency data.

5.0 ACCEPTANCE CRITERIA

5.1 The NABVS operates as described in Section 9.4.3.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.8.8 Radioactive Waste Building Ventilation System (Test #080)

1.0 OBJECTIVE

1.1 To demonstrate the proper operation of the radioactive waste building ventilation system (RWBVS) to maintain design condition.

2.0 PREREQUISITES

2.1 Construction activities on the RWBVS have been completed.

2.2 RWBVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the RWBVS are complete and functional.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify control logic.

3.2 Verify that operation, stroking speed and position indication of dampers meets design requirements.

3.3 Verify the capacity of the HVAC system to maintain the area temperature.

3.4 Verify the system maintains the Radioactive Waste Processing Building at a negative pressure.

3.5 Verify that operation of the general ventilation supply units and fans meets design requirements.

3.6 Verify that operation of the general ventilation exhaust units and fans meets design requirements.

3.7 Perform HEPA filter and carbon absorber efficiency tests.

3.8 Verify the systems rated air flow and air balance.

3.9 Verify that operation of protective devices, controls, interlocks instrumentation and alarms using actual or simulated inputs meets design requirements.

3.10 Verify that operation of the RWBVS response to high radiation monitor signal meets design requirements.

4.0 DATA REQUIRED

4.1 Air balancing verification.

4.2 Fan and damper operating data.

4.3 Temperature data.

4.4 Setpoints of alarms interlocks and controls.

4.5 The Radioactive Waste Building negative pressure readings.

4.6 RWBVS performance data in response to radiation monitor signals.

4.7 HEPA filter and carbon absorber efficiency data.

5.0 ACCEPTANCE CRITERIA

5.1 The RWBVS operates as described in Section 9.4.8.

5.2 The RWBVS responds as designed to radiation monitor signals described in Section 9.4.8.

14.2.12.8.9 Fuel Building Ventilation System (Test #081)

1.0 OBJECTIVE

14.02-33

1.1 To demonstrate the proper operation of the fuel building ventilation system (FBVS) to maintain design conditions.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the FBVS have been completed.

2.2 FBVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the FBVS are complete and functional.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify control logic.

3.2 Verify that operation, stroke speed and position indication of dampers meet design requirements.

3.3 Verify the system maintains the Fuel Building at a negative pressure.

3.4 Verify that operation of the ventilation supply units and fans meet design requirements.

3.5 Verify that the operation of the fuel handling area ventilation exhaust units and fans meet design requirements.

3.6 Verify that operation of the heating and cooling units meet design requirements.

3.7 Verify HEPA filter efficiency, carbon absorber efficiency, and air flow capacity.

3.8 Verify the systems rated air flow and air balance.

3.9 Verify that operation of protective devices, controls, interlocks instrumentation, and alarms using actual or simulated inputs.

3.10 Verify system response to a high radiation signal.

14.02-33

3.11 Verify that operation of the FBVS radiation monitor meets design requirements.

3.12 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Air balancing verification.

4.2 Fan and damper operating data.

4.3 Temperature data in the Fuel Building.

4.4 Setpoints at which alarms, interlocks, and controls occur.

4.5 Fuel Building negative pressurization data during normal and postulated emergency conditions.

4.6 Filter and carbon absorber data.

4.7 FBVS performance data in response to radiation monitor signals.

5.0 ACCEPTANCE CRITERIA

5.1 The FBVS operates as described in Section 9.4.2.

5.2 The FBVS responds as designed to radiation monitor signals described in Section 9.4.2.

5.3 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.8.10 Main Control Room Air Conditioning System (Test #082)

1.0 OBJECTIVE

1.1 To verify that operation of the main control air conditioning (CRACS) system establishes that a proper environment for personnel and equipment under postulated conditions in the following areas:

1.1.1 MCR.

1.1.2 Technical Support Center.

14.02-33

1.1.3 Other offices and equipment areas of the control room envelope (CRE).

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities in the MCR complex have been completed and penetrations sealed.

2.2 Construction activities on the CRACS have been completed.

2.3 The CRACS system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.4 Support systems required for operation of the CRACS are complete and functional.

2.5 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify control logic.

3.2 Verify that operation, stroke speed and position indication of dampers meet design requirements.

3.3 Verify in manual operating mode that system rated air flow and air balance meet design requirements.

3.4 Demonstrate in automatic mode the transfer to emergency-operations as a result of the following:

3.4.1 Radiation detection.

3.4.2 Smoke detection.

3.4.3 Toxic chemical detection~~, if applicable~~.

3.4.4 Safety injection actuation signals (SIAS).

3.5 Verify the HEPA filter efficiency, carbon absorber efficiency, and filter bank air flow capacity.

3.6 Verify that operation of protective devices, controls, interlocks, instrumentation, and alarms using actual or simulated inputs meets design requirements.

3.7 Verify that the system maintains the CRE at the required positive pressure relative to the outside atmosphere during system operation. ~~in the pressurized mode as required by the Technical Specifications.~~

3.8 Verify the isolation capability of the CRE on detection of toxic gas at the intakes meets the requirements of RG ~~1.95~~1.78~~, if applicable~~.

3.9 Demonstrate the operation of the battery room exhaust fans.

3.10 Verify the CRE air in-leakage rate when aligned in the emergency mode.

14.02-33

3.11 Verify that operation of CRACS in response to radiation monitors meets design requirements.

3.12 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Air balancing verification.

4.2 Fan and damper operating data.

4.3 Temperature and humidity data in the CRE.

4.4 Response to radioactivity, toxic gas ~~(if applicable)~~, and products of combustion.

4.5 Setpoints of alarms, interlocks, and controls.

4.6 Pressurization data for the CRE.

4.7 Filter and carbon absorber data.

4.8 CRE in-leakage rate when aligned in the emergency mode.

4.9 The CRACS response to radiation monitors.

5.0 ACCEPTANCE CRITERIA

5.1 The CRACS operates as described in Section 9.4.1.

5.2 The CRACS radiation monitors perform as described in Section 9.4.1.

5.3 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.8.11 Safeguard Building Controlled Area Ventilation System (Test #083)

1.0 OBJECTIVE

1.1 To demonstrate the operation of the safeguard building controlled area ventilation system (SBVS):

1.1.1 Hot mechanical area serviced by the SBVS.

1.1.2 SBVS air supply subsystem.

1.1.3 SBVS air exhaust subsystem.

1.1.4 Electric air heating convectors (area heaters).

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities in the safeguard building mechanical area are complete with penetrations sealed.

2.2 Construction activities on the SBVS have been completed.

2.3 Safeguard building mechanical area ventilation subsystem instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.4 Support systems required for operation of the SBVS are functional.

2.5 Test instrumentation is available and calibrated.

14.02-33

3.0 TEST METHOD

3.1 Verify control logic.

3.2 Verify the operation of air handling units or fans or both.

3.3 Verify operation of the operational air exhaust mode in the mechanical area.

3.4 Verify operation of the accident air exhaust mode in the mechanical area.

3.5 Verify operation of the electric air convectors (area heaters).

3.6 Verify operation of the filter air heaters, prefilters, HEPA filters, and adsorbers.

3.7 Verify operation of the recirculation cooling units.

3.8 Verify alarms, indicating lights and status lights are functional.

3.9 Perform air flow balancing of the SBVS.

3.10 Verify that operation of dampers meet design requirements.

3.11 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Damper operating data.

4.2 Air flow and balancing verification.

4.3 Setpoints at which alarms, center backs and control occur.

4.4 Temperature data for each of the SBVS.

5.0 ACCEPTANCE CRITERIA

5.1 The SBVS operates as described in Section 9.4.5.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.8.12 Emergency Power Generating Building Ventilation (Test #084)

1.0 OBJECTIVE

1.1 To demonstrate proper operation of the emergency power generating building ventilation system (EPGBVS).

1.2 To demonstrate proper operation of the EPGBVS.

1.3 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the EPGBVS have been completed.

2.2 EPGBVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the EPGBVS are complete and functional.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify control logic.

3.2 Verify design air flow with each EPGBVS in operation.

3.3 Verify design temperature can be maintained in each Emergency Power Generating Building.

3.4 Verify alarms, indicating instruments, and status lights are functional.

3.5 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Fan and damper operating data.

4.2 Air flow verification

4.3 Setpoint at which alarms, interlocks, and controls occur.

4.4 Temperature data of each Emergency Power Generating Building.

5.0 ACCEPTANCE CRITERIA

5.1 The EPGBVS operates as described in Section 9.4.9.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.02-33

14.2.12.8.13 Smoke Confinement System (Test #085)

1.0 OBJECTIVE

1.1 To demonstrate the operation of the smoke confinement system (SCS) for NI.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities in the SCS are complete with penetrations sealed.

2.2 Construction activities on the SCS have been completed.

2.3 SCS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.4 Support systems required for operation of the SCS.

2.5 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify control logic.

3.2 Verify the operation of the air handling units or fans or both.

3.3 Verify operation of the smoke purge fans.

3.4 Verify alarms, indicating lights and status lights are functional.

14.02-33

3.5 Perform air flow balancing of the SCS.

3.6 Verify that operation of dampers meets design requirements.

3.7 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Fan operating data for each of the air handling units and the smoke purge fans.

4.2 Damper operating data.

4.3 Air flow and balancing verification.

4.4 Setpoints at which alarms and control occur.

4.5 Temperature data for each of the SCS.

5.0 ACCEPTANCE CRITERIA

5.1 The SCS operates as described in Section 9.4.13.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.8.14 ~~Station Blackout Room~~Switchgear Building Ventilation System (Test #086)

1.0 OBJECTIVE

1.1 To demonstrate proper operation of the ventilation to the station ~~blackout room ventilation system (SBORVS)~~diesel generator divisions located inside the Switchgear Building.

14.02-33

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the switchgear building ventilation system (SGBVS)~~SBORVS~~ have been completed.

2.2 ~~SBORVS~~SGBVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the ~~SBORVS~~SGBVS are complete and functional.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify control logic.

3.2 Verify design air flow with each ~~SBORVS~~SGBVS in operation.

3.3 Verify design temperature can be maintained in each station blackout diesel ventilation area.

14.02-33

3.4 Verify alarms, indicating instruments, and status lights are functional.

3.5 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Fan and damper operating data.

4.2 Air flow verification.

4.3 Setpoint at which alarms, interlocks, and controls, occur.

4.4 Temperature data of each station blackout diesel area with and without diesel operating.

5.0 ACCEPTANCE CRITERIA

5.1 The ~~SBORVS~~SGBVS operates as described in Section 9.4.10.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.8.16 Essential Service Water Pump Building Ventilation System (Test #088)

1.0 OBJECTIVE

1.1 To verify the essential service water pump building ventilation system (ESWPBVS) can maintain the space temperature as required.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the ESWPBVS have been completed.

2.2 ESWPBVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the ESWPBVS are complete and functional.

2.4 Test Instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify control logic and interlock.

3.2 Verify design air flow of each fan.

3.3 Verify alarms, indicating instruments and status lights are functional.

3.4 Verify design temperatures can be maintained in the structure.

14.02-33

3.5 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Temperature data for the structure from each fan unit.

4.2 Fan operating data.

4.3 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

5.1 The ESWPBVS operates as described in Section 9.4.11.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.8.17 Reserved (Test #089)

14.2.12.8.18 Reserved (Test #090)

14.2.12.8.19 Access Building Ventilation System (Test #224)

1.0 OBJECTIVE

14.02-33

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the systems to be tested have been completed.

2.2 Systems being sampled are at or near normal operating pressure and temperature.

2.3 Calibrating gases and solutions are available.

2.4 Test instrumentation is available and calibrated.

2.5 NSS instrumentation has been calibrated and is functional for performance of the following test.

3.0 TEST METHOD

3.1 Verify adequate flow from each sample location.

3.2 Verify that operation of alarms and interlocks meet design requirements.

3.3 Verify that operation of pump and heat exchangers in normal operating modes and flow paths meets design requirements.

3.4 Verify the analytical instrumentation provides indication and response as designed.

3.5 Calculate the holdup times using the as-built piping lengths, piping volume and measured ~~flowrate~~flow rate for the following:

3.5.1 RCS samples.

3.5.2 Pressurizer samples.

3.6 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.7 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 9.3.2).

14.02-33

3.8 Verify that operation of continuous monitors and verify adequate flow meet design requirements.

3.9 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Setpoints at which alarms and interlocks occur.

4.2 Sampling ~~flowrate~~flow rate from each sample point.

4.3 Analytical instrument data.

4.4 Valve performance data, where required.

4.5 Valve position indication.

4.6 Position response of valves to loss of motive power.

4.7 Calculated holdup time for RCS and pressurizer samples.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The NSS performs as described in Section 9.3.2.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.9.11 Station Blackout Diesel Generator Set (Test #101)

1.0 OBJECTIVE

1.1 To demonstrate the station blackout diesel generator (SBODG) set system operates reliably.

2.0 PREREQUISITES

2.1 Construction activities on the SBODG system have been completed. This includes, but is not limited to the following:

2.1.1 SBODG fuel oil system.

2.1.2 SBODG engine lube oil system.

2.1.3 SBODG cooling system.

2.1.4 SBODG starting air system.

2.1.5 SBODG air intake and exhaust systems.

2.2 SBODG system instrumentation has been calibrated and is functional for performance of the following test.

2.3 Support systems required for operation of the SBODG system are complete and functional.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Demonstrate that each SBODG can be started in automatic and manual from the MCR, the remote shutdown panel, and the local control station.

3.2 Demonstrate that the following mechanical and electrical trips are functional (includes protective trips bypass tests).

3.2.1 Engine over speed (electrical and mechanical).

5.0 ACCEPTANCE CRITERIA

5.1 The SBODG engine fuel oil system operates as described in Section 8.4.

5.2 The SBODG engine cooling water system operates as described in Section 8.4.

5.3 The SBODG engine starting air system operates as described in Section 8.4

5.4 The SBODG engine lube oil system operates as described in Section 8.4.

14.2.12.9.14 Emergency Diesel Generator Set (Test #104)

1.0 OBJECTIVE

1.1 To demonstrate the emergency diesel generator (EDG) set system operates reliably.

14.02-33

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the EDG system have been completed. This includes, but is not limited to the following:

2.1.1 EDG fuel oil system (refer to Section 9.5.4).

2.1.2 EDG engine lube oil system (refer to Section 9.5.7).

2.1.3 EDG cooling system (refer to Section 9.5.5).

2.1.4 EDG starting air system (refer to Section 9.5.6).

2.1.5 EDG air intake system (refer to Section 9.5.8).

2.1.6 EDG exhaust system (refer to Section 9.5.8).

2.2 EDG system instrumentation has been calibrated and is functional for performance of the following test.

2.3 Support systems required for operation of the EDG system are complete and functional.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Demonstrate that each EDG can be started in automatic and manual from the MCR and the remote shutdown panel.

3.2 Demonstrate that the following mechanical and electrical trips are functional (includes protective trips bypass tests).

3.2.1 Engine over speed (electrical and mechanical).

3.2.2 Generator differential protection.

3.2.3 Low-low lube oil pressure.

3.2.4 Generator electrical protection.

3.2.5 Essential service water supply low pressure.

3.2.6 Low expansion tank level.

3.2.7 High pressure crankcase.

3.2.8 Fuel oil low pressure.

3.2.9 High-high temperature lube oil out.

3.2.10 High-high temperature jacket water.

3.2.11 Low-low lube oil sump tank level.

3.2.12 Stop button located near engine.

3.2.13 Electronic governor failure.

3.3 Demonstrate that the following parameters are correctly monitored in the control room and at the local panel:

3.3.1 Lube oil temperature and pressures.

3.3.2 Bearing temperatures.

3.3.3 Cooling water temperatures and pressures.

3.3.4 Speed (rpm).

3.3.5 Starting air pressure.

3.4 Demonstrate the operation of the following status indications:

3.4.1 Cooling water not available.

3.4.2 EDG breaker racked out.

3.4.3 EDG over speed.

3.4.4 Loss of control power.

3.4.5 Generator fault.

3.4.6 Low air and oil pressure.

3.4.7 Maintenance mode.

3.5 Demonstrate 25 consecutive starts and loading capability.

3.6 Demonstrate full load capability.

14.02-33

3.7 Demonstrate EDG speed control.

3.8 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 EDG engine operating parameters.

4.2 EDG engine consecutive starts and loading data.

4.3 Setpoints of EDG trips.

4.4 EDG governor operating data.

4.5 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The EDG mechanical system performs as described in Section 8.3.1.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.9.15 Emergency Diesel Generator Electrical (Test #105)

1.0 OBJECTIVE

1.1 To verify the EDGs can supply power at the rated load, voltage, and frequency under design conditions.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the EDG system have been completed.

2.2 EDG mechanical system test is completed (Test #104).

2.3 EDG system instrumentation has been calibrated and is functional for performance of the following test.

2.4 Support systems required for operation of the EDG system are complete and functional.

2.5 Test instrumentation is available and calibrated.

2.6 Electrical testing is complete as needed to allow the buses to be energized.

2.7 EDG electrical voltage tests are complete.

2.8 Engineered safety feature (ESF) loads are available to be loaded onto the bus.

2.9 EDG ventilation system test is completed. (Test #084).

3.0 TEST METHOD

3.1 Demonstrate control logic and controls including the EDG sequencer and response to ESF actuation signals.

3.2 Demonstrate 90 to 100 percent of the continuous rating of the emergency diesel generator, for an interval of not less than one hour and until temperature equilibrium has been attained.

3.9.5 That mechanical systems such as fuel, lubrication, and cooling function within design limits.

3.9.6 Operation of the air handling units or fans or both.

3.9.7 Area temperatures are maintained within design limits.

3.10 Demonstrate hot restart functional capability at full-load temperature conditions (after it has operated for 2 hours at full load).

3.11 Verify that the EDG starts on a manual or automatic start signal.

3.12 Verify that the EDG attains the required voltage and frequency within acceptable limits and time, and operates for longer than five minutes.

3.13 NOTE: Perform this testing immediately after the full load carrying capability demonstration.

3.14 Demonstrate the ability to synchronize the EDG unit with offsite power.

3.15 Transfer this load to the offsite power while the unit is connected to the emergency load.

3.16 Isolate the EDG, and restore it to standby status.

3.17 Demonstrate that with the EDG operating in a test mode while connected to its bus, a simulated SIAS overrides the test mode by returning the EDG to standby operation, and automatically energizing the emergency loads from offsite power.

3.18 Demonstrate that, by starting and running redundant EDG units simultaneously, potential common failure modes that may be undetected in single EDG unit tests do not occur.

14.02-33

3.19 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Starting and loading sequence timing.

4.2 Test data traces for starting, stopping and load shedding.

4.3 Running data for the parameters monitored during each of the required testing sequences.

4.4 Verification of field performance data versus shop data.

4.5 Periodic area temperatures, collected at least once per hour.

5.0 ACCEPTANCE CRITERIA

5.1 The EDG electrical system performs as described in Section 8.3.1.

14.02-33

5.2 The EDG ventilation system performs as described in Section 9.4.9.

5.3 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.9.16 Emergency Diesel Generator Auxiliaries (Test #106)

1.0 OBJECTIVE

1.1 To confirm whether or not the EDG fuel oil system provides a reliable and adequate supply to each EDG.

1.2 To confirm whether or not the operation of the EDG engine cooling water system is adequate.

1.3 To confirm whether or not the EDG engine starting air system provides adequate amount of air for five consecutive starts of its EDG without makeup air.

14.02-33

1.4 To confirm whether or not the operation of the EDG engine lube oil system is adequate.

1.5 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the EDG auxiliary systems have been completed.

2.2 EDG auxiliary systems instrumentation has been calibrated and is functional for performance of the following test.

2.3 Support systems required for operation of the EDG auxiliary systems are complete and functional.

2.4 Test instrumentation is available and calibrated.

2.5 The EDGs are available for a loaded run to measure fuel consumption and to perform consecutive starts.

3.0 TEST METHOD

3.1 Demonstrate the operation of the fuel oil automatic transfer feature from the storage tanks to the day tank.

3.2 Demonstrate the operation of the fuel oil and day tank level alarms.

3.3 Demonstrate the day tank can be filled manually.

3.4 Demonstrate the operation of the fuel oil booster pump.

3.5 Demonstrate the operation of the fuel oil recirculation system.

3.6 Demonstrate by performing a loaded run of the EDG with its day tank filled to its low level alarm point, that the day tank provides sufficient fuel for at least 60 minutes of EDG operation with the EDG supplying the power requirements of the most limiting design basis accident.

3.7 Demonstrate by performing a loaded run of the EDG and analysis of EDG fuel storage capacity, that each EDG has sufficient fuel storage capacity to operate for a period of no less than seven days with the

EDG supplying the power requirements of the most limiting design basis accident.

3.8 Demonstrate the operation of the EDG cooling water system keep warm pump.

3.9 Demonstrate the operation of EDG cooling system heaters.

3.10 Demonstrate the operation of the EDG cooling system alarms.

3.11 Demonstrate the operation of EDG starting air compressors.

3.12 Demonstrate that each EDG starting air system has sufficient volume available to perform five consecutive starts of its EDGs.

3.13 Demonstrate the EDG starting air system operates the EDG pneumatic controls as designed.

3.14 Demonstrate the EDG starting air alarm interlocks and automatic operation.

3.15 Demonstrate the operation of the EDG lube oil pre-lube pump.

3.16 Demonstrate the operation of EDG lube oil heaters.

3.17 Demonstrate the operation of EDG lube oil alarms.

3.18 Demonstrate the operation of the EDG lube oil transfer pump.

14.02-33

3.19 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 9.5).

3.20 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 EDG fuel oil consumption rate.

4.2 Setpoints of alarms, interlocks, and controls.

4.3 Operating data for pumps and compressors.

4.4 Operating data for the heaters.

4.5 EDG starting air volume parameters after consecutive starts.

4.6 Position response of valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

5.1 The EDG engine fuel oil system operates as described in Section 9.5.4.

5.2 The EDG engine cooling water system operates as described in Section 9.5.5.

5.3 The EDG engine starting air system operates as described in Section 9.5.6.

5.4 The EDG engine lube oil system operates as described in Section 9.5.7.

14.02-33

5.5 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.9.17 Auxiliary Steam Generating System (Test #107)

1.0 OBJECTIVE

1.1 To demonstrate the auxiliary steam generating system (ASGS) provides the steam to various plant components at designed pressures and flow.

2.0 PREREQUISITES

2.1 Construction activities on the ASGS have been completed.

2.2 ASGS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the ASGS are completed and functional.

2.4 Test Instrumentation is available and calibrated.

2.5 Sufficient loads are available to allow loading to the auxiliary boiler to its designed capacity.

3.0 TEST METHOD

3.1 Verify that operation of designated components such as protective devices, controls, interlocks, instrumentation and alarms, using actual or simulated inputs meets design requirements.

3.2 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., failure position to loss of power, thrust, stroke time), if required.

3.3 Verify power–operated valves fail upon loss of motive power to their appropriate position.

3.4 Verify that operation of system pumps meets design requirements.

3.5 Perform measurements of the auxiliary boiler performance using ASME PTC-4.1, “Steam Generators Units.”

4.0 DATA REQUIRED

4.1 Boiler operating data per PTC-4.1.

4.2 Valve performance data, where required.

4.3 Valve position indication.

4.4 Response of power-operated valves to loss of motive power.

4.5 Setpoints at which alarms and interlocks occur.

4.0 DATA REQUIRED

4.1 Main generator operating data at load.

4.2 Unit transformer operating data.

4.3 Unit auxiliary transformer operating data.

4.4 Setpoints of alarms interlocks and controls.

5.0 ACCEPTANCE CRITERIA

5.1 The unit main power system operates as described inSection 8.2.1.

14.2.12.10.3 Class 1E Uninterruptible Power (Test #110)

1.0 OBJECTIVE

14.02-33

1.1 To demonstrate the Class 1E DC power systems supply power as designed in required operating modes.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the Class 1E DC power system have been completed.

2.2 Class 1E DC power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the Class 1E DC power system are completed and functional.

2.4 Test instrumentation is available and calibrated.

2.5 Batteries are fully charged.

2.6 Load banks are available for discharge test.

2.7 Operation of breakers and cables has been verified.

2.8 Ventilation systems are in operation, as needed.

3.0 TEST METHOD

3.1 Demonstrate that the batteries and battery chargers meet design capacities by performing discharge and charging tests.

3.2 Verify that minimum bank and individual cell limits are not exceeded during battery discharge test.

3.3 Verify that operation of the inverters, manual transfer switches, frequency synchronization, and blocking diodes meets design requirements.

3.4 Verify that the inverters automatically transfer input to the battery upon loss of preferred power while maintaining uninterrupted power output.

3.5 Place the battery chargers on equalize and verify that DC equalizing voltage shall not result in driving the inverter or relieving the rectifier from carrying the inverter load.

3.6 Verify that operation of protective devices, controls, interlocks, alarms, computer inputs, and ground detection meet design requirements.

3.7 Verify that operation of the vital instrumentation and control power status information subsystem meets design requirements.

14.02-33

3.8 Verify that operation of bus transfer devices meet design requirements.

3.9 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Battery voltage and load current without charger.

4.2 Record of the charger float voltage and current.

4.3 Test discharge recordings of voltage, current, temperature, capacity in ampere hours, and individual cell voltages.

4.4 Charger voltage and current as battery eliminator.

4.5 Inverter voltage, frequency, and current from preferred source.

4.6 Inverter voltage, frequency, and current from battery source.

4.7 Setpoint at which alarms, interlocks, and controls occur.

4.8 System status information subsystem indications.

5.0 ACCEPTANCE CRITERIA

14.02-33

5.1 The Class 1E uninterruptible power system supplies the loads as described in Section 8.3.2.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.10.4 Non–Class 1E Uninterruptible Power (Test #111)

1.0 OBJECTIVE

1.1 To demonstrate the operation of the following systems:

1.1.1 The 250 Vdc auxiliary power system.

2.0 PREREQUISITES

4.7 Setpoint at which alarms, interlocks, and controls occur.

5.0 ACCEPTANCE CRITERIA

5.1 The non-Class 1E uninterruptible power system supplies the loads as described in Section 8.3.2.

14.2.12.10.5 Control Rod Drive Power (Test #112)

1.0 OBJECTIVE

14.02-33

1.1 To demonstrate the operation of the control rod drive power system.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the control rod drive power system have been completed.

2.2 The control rod drive power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the control rod drive power systems are completed and functional.

2.4 Test instrumentation is available and calibrated.

2.5 Applicable equipment has been visually inspected.

3.0 TEST METHOD

3.1 Demonstrate the functionality of the control rod drive source and reactor trip breakers locally and remotely.

3.2 Demonstrate the functionality of the bus interlocks alarms and protective relays.

3.3 Verify the operation of indication and automatic responses.

14.02-33

3.4 Perform energization of control rod drive power system.

3.5 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Setpoints at which alarms, interlocks, and protective relays occur.

5.0 ACCEPTANCE CRITERIA

5.1 The control rod drive power system operates as described in Section 8.3.1.

14.02-33

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.10.6 Normal Lighting (Test #113)

1.0 OBJECTIVE

1.1 To demonstrate the operation of the normal lighting system.

2.0 PREREQUISITES

2.1 Construction activities on the normal lighting system have been completed.

2.2 Normal lighting system instrumentation has been calibrated and is operating satisfactorily prior to performing the test, if applicable.

2.3 Support systems required for operation of the normal lighting system are completed and functional.

2.4 Test instrumentation is available and calibrated.

2.5 Equipment has been visually inspected.

2.6 Normal lighting system power is available.

3.0 TEST METHOD

3.1 Demonstrate the functionality of the source and feeder circuit breakers locally and remotely.

3.2 Demonstrate the functionality of the bus interlocks alarms and protective relays.

3.3 Verify the operation of indication and automatic responses.

3.4 Verify normal lighting levels for each system with other lighting systems de-energized.

4.0 DATA REQUIRED

4.1 Setpoints at which alarms, interlocks, and protective relays occur.

5.0 ACCEPTANCE CRITERIA

5.1 Normal lighting systems operate as described in Section 9.5.3.

14.2.12.10.7 Security Lighting (Test #114)

1.0 OBJECTIVE

1.1 To demonstrate that the security lighting systems provide adequate illumination for plant operations.

2.0 PREREQUISITES

2.1 Construction activities on the security lighting system have been completed.

2.2 Test instruments are calibrated per applicable procedures and available.

3.0 TEST METHOD

3.1 Place the security plant lighting in service and check that illumination levels are adequate.

3.2 Demonstrate that a single circuit failure shall not cause the loss of lighting in a room which requires normal access.

3.3 Demonstrate that loss of normal power results in activation of the security lighting system for each affected room, where required to monitor isolation zones, and outdoor areas within the plant protected perimeter as designed.

3.4 Demonstrate the security lighting system provides adequate illumination levels, including, but not limited to, those required to support plant closed circuit TV security functions.

4.0 DATA REQUIRED

4.1 Illumination levels in designated areas.

5.0 ACCEPTANCE CRITERIA

5.1 The security lighting systems operate as described in Section 13.6.

14.2.12.10.8 Emergency Lighting (Test #115)

1.0 OBJECTIVE

14.02-33

1.1 To demonstrate that the emergency lighting system provides adequate illumination to operate equipment during emergency operations.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the emergency lighting system have been completed.

2.2 Test instruments are calibrated per applicable procedures and available.

3.0 TEST METHODS

3.1 Demonstrate that the emergency lighting system provides levels of illumination as required in designated control areas.

3.2 Demonstrate that the emergency lighting system provides levels of illumination in other designated areas of the plant.

3.3 Demonstrate that the emergency lighting system comes on upon loss of normal lighting.

3.4 Demonstrate that the battery operated emergency lights provide adequate illumination at designated locations.

14.02-33

3.5 Demonstrate that the battery operated emergency lights are capable of providing lighting for the designated amount of time.

3.6 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Illumination levels in designated areas.

4.2 Battery powered lighting data.

5.0 ACCEPTANCE CRITERIA

5.1 The emergency lighting system operates as described in Section 9.5.3.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.10.9 6.9 kV Class 1E Emergency Power (Test #116)

1.0 OBJECTIVE

1.1 To demonstrate the operation of 6.9 kV Class lE systems.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the 6.9 kV Class lE emergency power system have been completed.

2.2 The 6.9 kV Class 1E emergency power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the 6.9 kV Class 1E emergency power system are completed and functional.

2.4 Test Instrumentation is available and calibrated.

2.5 All 6.9 kV feeders and buses voltage tested with acceptable results.

2.6 6.9 kV power is available from the normal and alternate ESF transformer sources.

2.7 Switchgear assembly, breakers, control and protective equipment, and circuits have been inspected and tested and are capable of being placed into service.

2.8 The EDG and emergency AC sources are available.

3.0 TEST METHOD

3.1 Demonstrate the functionality of the feeder and cross-tie protective circuit breakers locally and remotely.

3.2 Demonstrate the functionality of the bus interlocks, alarms, and protective relays.

3.3 Verify the operation of indication and automatic responses.

3.4 Load the systems to the extent practical and verify full load voltage is within system design parameters.

3.4.1 Verify the capability of bus loads to start and operate as designed when connected to the Class 1E 6.9 kV buses at ±10 percent nominal voltage.

3.5 Verify the 6.9 kV and 480 V safety-related systems load shed as designed on under voltage.

3.6 Verify the 6.9 kV Class 1E buses can be energized from the following power sources:

3.6.1 Respective emergency auxiliary transformer.

3.6.2 Respective EDG.

3.6.3 Respective alternate AC source.

14.02-33

3.7 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Full load bus voltage data.

4.2 Setpoints at which alarms, interlocks, and protective relays occur.

4.3 System response to low bus voltage.

5.0 ACCEPTANCE CRITERIA

5.1 The 6.9 kV Class 1E emergency power system operates as described in Section 8.3.1.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.10.10 480 Volt Class 1E Emergency Power (Test #117)

1.0 OBJECTIVE

1.1 To demonstrate the operation of the 480 V Class 1E emergency power system.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the 480V Class 1E emergency power system have been completed.

2.2 The 480 V Class 1E emergency power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the 480V Class 1E emergency power systems are completed and functional.

2.4 Test instrumentation is available and calibrated.

2.5 Buses and equipment meggered with acceptable results.

2.6 Applicable equipment has been visually inspected.

14.02-33

3.0 TEST METHOD

3.1 Demonstrate the functionality of the 480 Vac source and feeder circuit breakers locally and remotely.

3.2 Demonstrate the functionality of the bus interlocks alarms and protective relays.

3.3 Verify the operation of indication and automatic responses.

3.4 Perform energization of 480 Vac Class 1E emergency power system.

3.5 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Setpoints at which alarms, interlocks, and protective relays occur.

5.0 ACCEPTANCE CRITERIA

5.1 The 480 V Class 1E emergency power system operates as described in Section 8.3.1.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.10.11 13.8 kV Normal Power (Test #118)

1.0 OBJECTIVE

1.1 To demonstrate the operation of the 13.8 kV normal power system.

2.0 PREREQUISITES

2.1 Construction activities on the 480 V normal power systems have been completed.

2.2 480 V normal power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the 480 V normal power systems are completed and functional.

2.4 Test instrumentation is available and calibrated.

2.5 Buses and equipment have been meggered with acceptable results.

2.6 Equipment has been visually inspected.

2.7 The 6.9 kV normal auxiliary power supply is available.

3.0 TEST METHOD

3.1 Demonstrate the functionality of the 480 Vac source and feeder circuit breakers locally and remotely.

3.2 Demonstrate the functionality of the bus interlocks alarms and protective relays.

3.3 Verify the operation of indication and automatic responses.

3.4 Perform energization of 480 Vac normal power system.

4.0 DATA REQUIRED

4.1 Setpoints at which alarms, interlocks, and protective relays occur.

5.0 ACCEPTANCE CRITERIA

5.1 The 480 V normal power system operates as described in Section 8.3.1.

14.2.12.10.14 Class 1E DC Power (Test #121)

1.0 OBJECTIVE

14.02-33

1.1 To demonstrate the operation of the Class 1E DC power system.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the Class 1E DC power systems have been completed.

2.2 Class 1E DC power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the Class 1E DC power systems are completed and functional.

3.4 Verify that operation and installation of peak recording accelerographs meet design requirements.

3.5 Verify that factory acceptance testing has been completed.

3.6 Verify proper operation of alarm, control and indication functions.

3.7 Verify that the SMS system operates over the design range using actual or simulated signals.

3.8 Verify that the SMS system responds as designed to actual or simulated limiting malfunctions or failures.

3.9 Verify that the SMS system response meets the accident analysis assumptions, such as time response, accuracy, and control stability.

3.10 Verify redundancy and electrical independence of the SMS design.

4.0 DATA REQUIRED

4.1 Record sensor response to simulated seismic inputs.

5.0 ACCEPTANCE CRITERIA

5.1 The as-built location of the SMS equipment is as shown on the plant layout drawings.~~The SMS operates as described in Section 3.7.4.~~

5.2 The SMS system can compute the cumulative absolute velocity (CAV) and provide indication of the CAV in the Main Control Room (MCR).

5.3 The SMS has sufficient dynamic range.

5.4 The SMS has a sufficient bandwidth.

5.5 The SMS has a sufficient sampling rate.

5.6 The SMS has a sufficient trigger level.

5.7 The SMS backup battery has sufficient capacity to power its instruments for continuous operation as described in the equipment specification.

14.2.12.11.3 Boron Concentration Measurement System (Test #126)

1.0 OBJECTIVE

1.1 To demonstrate proper operation of the safety-related boron concentration measurement system (BCMS). The system measures the nuclear cross-section of CVCS fluid and calculates a corresponding boron concentration.

14.02-33

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 The BCMS has been calibrated and is operating satisfactorily prior to performing the following test.

2.2 Support systems required for BCMS operation are complete and functional.

2.3 Verify that factory acceptance testing has been completed.

2.4 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

3.1 Observe boron cross-section measurement indications using the built-in test features.

3.2 Formulate sample concentrations of 500 ppmB, 1000 ppmB, 1500 ppmB and 2000 ppmB using naturally occurring boron-10 isotopic enrichments.

3.3 Flush test samples through the boron instrumentation system while observing system response.

3.4 Formulate sample concentrations of 500 ppmB, 1000 ppmB, 1500 ppmB and 2000 ppmB using 37 percent enriched boron-10.

3.5 Flush the samples through the charging pump suction pipe while observing system response.

3.6 Verify that the BCMS system operates over the design range using actual or simulated signals.

3.7 Verify that the BCMS system responds as designed to actual or simulated limiting malfunctions or failures.

14.02-33

3.8 Verify that the BCMS system response meets the accident analysis assumptions, such as time response, accuracy, and control stability.

3.9 Verify redundancy and electrical independence and redundancy of the BCMS design.

4.0 DATA REQUIRED

4.1 Pulse rates and boron cross-section measurement output (boron concentration).

4.2 Alarm setpoints and actuation levels.

5.0 ACCEPTANCE CRITERIA

5.1 The BCMS equipment is installed in the locations shown on the plant layout drawings.~~The BCMS performs as described in Section 9.3.4 and Section 7.1.1.~~

5.2 The BCMS provides input signals for the engineered safety feature function described in the equipment specification. Also refer to the U.S. EPR FSAR Tier 2 Section 7.1.1.5.4 for additional description of BCMS operation.

5.3 The Class 1E BCMS equipment receives power from its respective Class 1E division.

4.0 DATA REQUIRED

4.1 Setpoints under which alarms and interlocks occur.

4.2 PICS functional data (input data and corresponding output).

5.0 ACCEPTANCE CRITERIA

5.1 The PICS provides monitoring and control of process systems.~~The PICS operates as described in Section 7.1.1.~~

5.2 The PICS provides the status of the automatic reactor trip and engineered safety features.

5.3 The PICS provides the manual reset of automatic reactor trip and engineered safety features.

5.4 The PICS provides manual component control of safety-related process systems via the PAS and the PACS.

5.5 The PICS provides safety parameter display system (SPDS) functions.

5.6 The PICS displays the Type A-E post-accident monitoring (PAM) variables.

5.7 The PICS provides monitoring and control of systems required to mitigate severe accidents.

5.8 The PICS displays bypassed and inoperable status of safety systems.

5.9 The PICS provides alarm management capability.

5.10 The PICS provides the capability to archive plant data.

5.11 The PICS provides the interface to external I&C computers.

5.12 The PICS provides an interface to external computers via a unidirectional firewall.

14.2.12.11.7 Communication System (Test #130)

1.0 OBJECTIVE

1.1 To demonstrate the adequacy of the intra-plant communication system to provide communications between vital plant areas.

1.2 To demonstrate the offsite communication system to provide communications with exterior entities.

14.02-33

1.3 Verify that safety-related portions of the communication system function as designed to malfunctions or failures.

1.4 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the intraplant communication system have been completed.

2.2 Support systems required for operation of the intraplant communication system are complete and functional.

2.3 Plant equipment that contributes to the ambient noise level shall be in operation.

3.0 TEST METHOD

3.1 Verify the intraplant portable wireless communication system functions as designed.

3.2 Verify that the intraplant (PABX) telephone system functions as designed.

3.3 Verify the intraplant sound powered telephone system functions as designed.

3.4 Verify the intraplant public address system functions as designed.

3.5 Verify that the intraplant cell telephone system functions as designed.

3.6 Verify the security radio system functions as designed at locations throughout the plant.

3.7 Verify the normal offsite telephone system functions as designed.

3.8 Verify the emergency telephone system (emergency notification system, health physics network and ring down phone system) function as designed.

3.9 Verify that the communication system responds as designed to actual or simulated limiting malfunctions or failures.

3.10 Verify redundancy and electrical independence of the communication system.

14.02-33

3.11 Verify that the communication system's response meets the accident analysis assumptions.

3.12 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Record the results of communication attempts from each system and its locations.

5.0 ACCEPTANCE CRITERIA

5.1 The portable wireless communication system provides radio coverage throughout the plant, except in areas restricted due to potential EMI/RFI considerations.~~The intraplant and offsite communication system operates as described in Section 9.5.2.~~

5.2 The portable wireless communication system provides an interconnection to the public switched telephone network (PSTN) to allow offsite communications.

5.3 The digital telephone system provides plant-wide intercom capability.

5.4 The digital telephone system provides an interconnection to the public switched telephone network (PSTN) to allow offsite communications.

5.5 The public address and alarm system operates as described in the design specification.

5.6 The sound powered system operates as described in the design specification.

5.7 The security communication system operates as described in the design specification.

5.8 The communication system provides communication with the emergency notification system and the health physics network.

14.02-33

5.9 The communication equipment is capable of operating under maximum noise conditions.

5.10 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.11.8 Vibration Monitoring System~~Reserved~~ (Test #131)

1.0 OBJECTIVE

1.1 To verify that the operation of the non-safety-related vibration monitoring system meets the design requirements.

1.2 To verify that the vibration monitoring setpoints are suitable for initial power operation.

2.0 PREREQUISITES

2.1 Construction activities on the vibration monitoring system are completed.

2.2 Sensors, cables, and conditioning electronics are installed and functional.

2.3 Power cabinets, test circuits, and amplifiers are ready to support testing.

2.4 Required test equipment is functional.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Verify the response of the vibration monitoring channels by simultaneously monitoring equipment operation with calibrated portable instrumentation.

3.2 Verify alarm functions.

3.3 Establish baseline data for a cold subcritical plant.

~~4.1 Simulated normal and abnormal accident data.~~

~~5.0 ACCEPTANCE CRITERIA~~

~~5.1 The accident monitoring system performs as described in Sections 7.1.2 and 7.5.2.~~

~~**14.2.12.11.15 Reserved (Test #139)**~~

14.2.12.11.15 Remote Shutdown Station (Test #140)

1.0 OBJECTIVE

1.1 To verify proper operation of the remote shutdown station (RSS).

14.02-33

1.2 To determine transfer of control occurs and that the plant can be controlled and cooled down from the RSS.

1.3 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 All construction activities on the RSS have been completed.

2.2 The RSS instrumentation has been calibrated and is functional for performing the following test.

2.3 The communication systems between the MCR and RSS location have been demonstrated to be functional.

2.4 Verify that factory acceptance testing has been completed.

2.5 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Simulate signals to verify that operation of RSS instrumentation meets design requirements.

3.2 Perform a full transfer of control from the MCR during the performance of the HFT.

3.3 Perform a controlled cooldown from the remote shutdown panel during the performance of the HFT.

3.4 Verify that the RSS operates over the design range using actual or simulated signals.

3.5 Verify that the RSS responds as designed to actual or simulated limiting malfunctions or failures.

3.6 Verify that the RSS response meets the accident analysis assumptions, such as time response, accuracy, and control stability.

3.7 Verify redundancy and electrical independence of the RSS.

14.02-33

3.8 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 RCS temperatures and pressures.

5.0 ACCEPTANCE CRITERIA

5.1 The ability to cooldown using remote shutdown instrumentation and controls has been demonstrated.

5.2 The RSS transfer switches provide the capability to transfer control from the Main Control Room (MCR) to the RSS.~~The RSS performs as described in Sections 6.4.2, 7.4.1, and 7.4.3.~~

14.02-33

5.3 Electrical isolation is provided between the MCR and the RSS.

5.4 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.11.16 Incore Instrumentation (Test #141)

1.0 OBJECTIVE

1.1 To measure fixed incore cable insulation resistance.

1.2 To verify proper amplifier operation.

1.3 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the incore instrumentation system are complete. However, detectors (instrument lances) do not need to be installed.

2.2 Fixed incore nuclear signal channel instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Special test instrumentation has been calibrated.

2.4 Incore instrumentation system support systems are functional.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Measure and record cabling insulation resistance.

3.2 Simulate incore signals into the signal conditioning circuits using external test instrumentation.

3.3 Test each amplifier for as designed operation in accordance with the manufacturer instruction manual using the internal test circuits.

3.4 Simulate variable inputs to the amplifier and record its values displayed by the DPS.

3.5 Verify that the incore system operates over the design range using actual or simulated signals.

3.6 Verify that the incore system responds as designed to actual or simulated limiting malfunctions or failures.

3.7 Verify that the incore system response meets the accident analysis assumptions, such as time response, accuracy, and control stability.

14.02-33

3.8 Verify redundancy and electrical independence of the incore design.

3.9 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Cabling insulation resistance readings.

4.2 Status and performance of the internal test circuits.

4.3 Values of simulated input and derived output signals for correlation purposes.

5.0 ACCEPTANCE CRITERIA

5.1 The incore instrumentation is arranged as shown on the plant layout drawings. Reference U.S. EPR FSAR Tier 2 Figure 4.4-8 for additional information.~~The incore instrumentation cables and instrumentation perform as described in Section 7.1.1.~~

5.2 The self-powered neutron detectors generate neutron flux measurement signals as input to the protection system using simulated signals.

5.3 The core outlet thermocouples generate core outlet temperature measurement signals as input to the safety automation system using simulated signals.

14.02-33

5.4 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.11.17 Excore Instrumentation (Test #142)

1.0 OBJECTIVE

1.1 To verify the proper functional performance of the excore instrumentation system.

1.2 To verify the proper performance of audio and visual indicators.

14.02-33

1.3 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the excore instrumentation system have been completed.

2.2 Excore instrumentation system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 External test equipment has been calibrated and is functional.

2.4 Support systems required for operation of the excore instrumentation system are functional.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

3.1 Simulate and vary input signals to the startup, safety, and control channels of the excore instrumentation system using appropriate test instrumentation.

3.2 Monitor and record output signals as a function of variable inputs provided by test instrumentation.

3.3 Record the performance of audio and visual indicators in response to changing input signals.

3.4 Verify that the excore system operates over the design range using actual or simulated signals.

3.5 Verify that the excore system responds as designed to actual or simulated limiting malfunctions or failures.

3.6 Verify that the excore system response meets the accident analysis assumptions, such as time response, accuracy, and control stability.

14.02-33

3.7 Verify redundancy and electrical independence of the excore design.

3.8 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Values of input and output signals for correlation purposes, as required.

4.2 Values of output signals triggering audio and visual alarms.

5.0 ACCEPTANCE CRITERIA

5.1 The excore instrumentation is arranged as illustrated on the plant layout drawings. Reference U.S. EPR FSAR Tier 2 Figure 7.1-15 for

additional information.~~The excore instrumentation system performs as described in Section 7.1.1.~~

5.2 The intermediate range and power range detectors generate neutron flux measurement signals as inputs to the protection system using simulated signals.

14.02-33

5.3 The excore instrumentation receives power from its respective Class 1E division.

5.4 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.11.18 Radiation Monitoring (Test #143)

1.0 OBJECTIVE

1.1 To verify the functional performance of the airborne radiation monitoring system.

1.2 To verify the functional performance of the area radiation monitoring system.

2.0 PREREQUISITES

2.1 Construction activities on the radiation monitoring system have been completed.

2.2 Radiation monitoring system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the radiation monitoring system are completed and functional.

2.4 Test instrumentation is available and calibrated.

2.5 Calibration check source is available.

2.6 Verify that factory acceptance testing has been completed.

2.7 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Verify the operation of the radiation monitor using a check source and external test equipment.

3.2 Check the self-testing feature of the radiation monitor.

3.3 Compare local and remote indications.

3.4 Verify as designed local and remote alarm actuations.

3.5 Simulate automatic initiation signals and record control actuations.

3.6 Verify that the radiation monitoring system operates over the design range using actual or simulated signals.

3.1 Verify calibration and operation of the monitor using a check source and external test equipment

3.2 Check the self-testing feature of the monitor.

3.3 Record the response time and control actuation signals produced by the monitor.

3.4 Simulate a high radiation signal to the appropriate radiation monitors to verify as designed control actuations.

3.5 Verify as designed alarm actuation in the MCR.

3.6 Simulate a high radiation signal to the radiation monitors.

3.7 Record alarm actuations in the MCR or local control room, as appropriate.

4.0 DATA REQUIRED

4.1 The monitor response to check source.

4.2 Technical data associated with the source.

4.3 Signal levels necessary to cause alarm actuation.

4.4 Response time of the monitor to perform control functions.

5.0 ACCEPTANCE CRITERIA

5.1 Verify that ~~T~~the process and effluent radiological monitoring system operates as follows: ~~described in Section 11.5.1.~~

5.1.1 Radiation monitors are installed on all effluent paths as shown on plant layout drawings.

5.1.2 The radiation monitors have been source checked to verify response.

5.1.3 Preliminary alarm setpoints have been established and calibrated in the equipment.

5.1.4 Upon activating the alarm setpoint, automatic actions (valve closure, pumps stopping, etc.) occur as designed.

14.2.12.11.20 Hydrogen Monitoring (Test #145)

1.0 OBJECTIVE

14.02-33

1.1 To demonstrate the proper operation of the safety-related hydrogen monitoring system.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the hydrogen monitoring system have been completed.

2.2 Hydrogen monitoring instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Electrical power systems required for the hydrogen monitoring system are available.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify hydrogen monitoring system logic and indication.

3.2 Verify hydrogen monitoring system response to sample hydrogen concentrations.

3.3 Verify that the hydrogen monitoring system operates over the design range using actual or simulated signals.

3.4 Verify that the hydrogen monitoring system responds as designed to actual or simulated limiting malfunctions or failures.

3.5 Verify that the hydrogen monitoring system response meets the accident analysis assumptions, such as time response, and accuracy.

14.02-33

3.6 Verify redundancy and electrical independence of the hydrogen monitoring system design.

3.7 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Response to hydrogen samples.

5.0 ACCEPTANCE CRITERIA

5.1 The low range hydrogen monitoring system (HMS) consists of hydrogen sensors arranged in the following containment areas: upper dome, upper pressurizer compartment, upper stem generator compartments 1/2 and 3/4, annular rooms.~~The hydrogen monitoring system operates as described in Section 6.2.5.~~

14.02-33

5.2 The low range HMS signal processing unit is located in Safeguard Building 1 and is powered from the Class 1E electrical power supply.

5.3 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.11.21 Protection (Test #146)

1.0 OBJECTIVE

1.1 To demonstrate the proper operation of the safety-related reactor protection system (RPS).

14.02-33

1.2 To determine the RPS response times.

1.3 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the trip circuit breaker and RPS have been completed.

2.2 RPS system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 External test instrumentation is available and calibrated.

2.4 Support systems required for operation of the following are functional:

2.4.1 Reactor trip circuit breakers.

2.4.2 Verify that factory acceptance testing has been completed.

2.4.3 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

3.1 Energize power supplies and verify output voltage.

3.2 Simulate ground faults and observe operation of the ground fault detectors.

3.3 Activate manual trips and monitor relay operation.

3.4 Simulate combinations of the two-out-of-four trip logic for each of the actuation systems (SIAS, CIAS, CSAS, CCAS, MSIS, EFAS) and observe actuation of the appropriate trip circuit and associated alarms.

3.5 Exercise the control functions to the safety depressurization and shutdown cooling system to verify as designed operations.

3.6 Simulate reactor trip signals and trip each reactor trip circuit breaker with the breaker in the test position. Observe circuit breaker operation.

3.7 Repeat the previous step with the reactor trip circuit breakers in the operate position.

3.8 Exercise the bistable comparators using internal and external test circuitry and observe the setpoints and operation of the appropriate logic.

3.9 Check the operation of trip channel bypass features including, where applicable, observation of the setpoints at which the trip bypasses are cancelled automatically.

3.10 Activate manual trips and observe relay operation.

3.11 Check that low pressurizer pressure and low SG pressure trip setpoints track the process variable at the prescribed rate and can be manually reset to the as designed margin below the process variable.

3.12 Verify as designed operation of the core protection calculator system by input/output and internal function tests.

3.13 Inject signals into appropriate sensors or sensor terminals and measure the elapsed time to achieve tripping of the reactor trip circuit breakers or actuation of the logical actuation relays. Trip or actuation paths may be tested in several segments.

14.02-33

3.14 Verify that the protection system operates over the design range using actual or simulated signals.

3.15 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Power supply voltages.

4.2 Resistance for ground fault detector operation.

4.3 Circuit breaker and indicator operation.

4.4 Point of actuation of bistable comparators.

4.5 Reset margin and rate of setpoint change of variable setpoints.

4.6 Maximum and minimum values of variable setpoints.

4.7 PS and trip and actuation path response times.

4.8 Local coincidence logic operation.

5.0 ACCEPTANCE CRITERIA

5.1 Physical separation exists between the four divisions of the protection system (PS).~~The plant protection system performs as described in Section 7.1.1.~~

5.2 The PS generates automatic reactor trip (RT) signals.

5.3 The PS generates automatically actuated engineered safety feature signals.

5.4 The PS provides operating bypasses for reactor trip functions.

5.5 The PS provides operating bypasses for the engineered safety features.

5.6 Communication independence is provided in the inter-division communication paths within the PS.

5.7 Bypassed or inoperable PS channels status information is retrievable in the MCR.

5.8 Setpoints associated with the automatic reactor trips and engineered safety features are determined using a methodology that addresses the determination of applicable contributors to instrumentation loop

errors, the method in which the errors are combined, and how the errors are applied to the design analytical limits.

5.9 The PS receives input signals as described in the equipment specification.

5.10 The PS provides signals to the non-safety-related control systems through electrical isolation devices.

5.11 Electrical isolation devices exist in the data communication paths between the PS and the non-safety-related displays and controls.

5.12 Controls exist in the MCR to allow manual actuation of reactor trip and engineered safety features.

5.13 Controls exist in the MCR and RSS to allow validation or inhibition of manual permissives.

5.14 The PS provides interlocks as described in the equipment specification.

5.15 The PS hardware and software are developed using a design process as described in the software development specification.

14.02-33

5.16 The total response time of each PS trip or actuation path is verified to be conservative with respect to the times used in the safety analysis.

5.17 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.11.22 Reactor Control, Surveillance & Limitation (Test #147)

1.0 OBJECTIVE

1.1 To demonstrate the proper operation of the non-safety-related reactor control, surveillance and limitation system (RCSL).

1.2 Verify electrical independence and redundancy of power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the RCSL have been completed.

2.2 RCSL software is installed and instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 External test equipment has been calibrated and is functional.

2.4 Support systems required for operation of the RCSL are functional.

2.5 Cabling has been completed between the RCSL and interface equipment.

2.6 Verify that factory acceptance testing has been completed.

2.7 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

3.1 Observe process monitor indications, outputs to interface equipment and alarm operation, utilizing the built-in test features.

3.2 Verify calibration of the process monitor, utilizing the check source.

4.0 DATA REQUIRED

4.1 Check source data.

4.2 Process monitor operating data.

4.3 Process monitor response to the check source.

4.4 Value of parameters required to actuate alarms.

5.0 ACCEPTANCE CRITERIA

5.1 The process radiation monitor of the process sampling functions as follows:

5.1.1 Radiation monitors are installed on process paths as shown on plant layout drawings.

5.1.2 The radiation monitors have been source checked to verify response.

5.1.3 Preliminary alarms setpoints have been established and calibrated in the equipment.

14.2.12.11.24 Reserved Test (#139)

14.2.12.11.25 Reserved (Test #157)

14.2.12.11.26 Reserved (Test #158)

14.2.12.11.27 Reserved (Test #160)

14.2.12.12 I&C Functions

14.2.12.12.1 Accident Monitoring (Test # 138)

Note: The Accident Monitoring is not a separate system but is a collection of functions provided by other systems.

1.0 OBJECTIVE

1.1 To verify proper operation of the postaccident and severe accident systems, which comprise the accident monitoring system. The systems that are used for accident monitoring consist of radiation monitoring,

reactor vessel water level indicating system, and selected instrumentation.

14.02-33

1.2 To verify that the accident monitoring system monitors the established parameters.

1.3 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the systems that provide the accident monitoring functions are complete.

2.2 Required special test equipment is available and functional.

2.3 Verify that factory acceptance testing has been completed.

2.4 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Simulate data that is indicative of normal and abnormal accident data.

3.2 Verify that accident monitoring systems alert and alarm setpoints have been defined.

3.3 Verify that various displays meet system requirements.

3.4 Verify that the I&C system operates over the design range using actual or simulated signals.

3.5 Verify that the I&C system responds as designed to actual or simulated limiting malfunctions or failures.

3.6 Verify that the I&C system response meets the accident analysis assumptions, such as time response, accuracy, and control stability.

14.02-33

3.7 Verify redundancy and electrical independence of the I&C design.

3.8 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Simulated normal and abnormal accident data.

5.0 ACCEPTANCE CRITERIA

5.1 The accident monitoring system provides the outputs described in the accident response procedures (Abnormal Operating Procedures, Emergency Operating Procedures, Severe Accident Mitigation Procedures, etc.).

14.02-33

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.12.2 Main Steam Relief Trains (Test #148)

1.0 OBJECTIVE

14.02-33

1.1 To demonstrate the proper operation of the MSRT.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the MSRT and interfacing equipment have been completed.

2.2 The MSRT pilot valves have been calibrated and are operating satisfactorily prior to performing the following test.

2.3 External test equipment has been calibrated and is functional.

2.4 Support systems required for operation of the MSRT are functional.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Simulate inputs to the MSRT and observe receipt of these signals.

3.2 Verify that the MSRT operates over the design range using actual or simulated signals.

3.3 Simulate varying system inputs and observe output responses at the MSRT and at interfacing equipment.

3.4 Verify response of the MSRT valves and position indicators.

3.5 Demonstrate dynamic operation of the MSRT valves during HFT.

3.6 Verify that the MSRT responds as designed to actual or simulated limiting malfunctions or failures.

3.7 Verify that the MSRT system response meets the accident analysis assumptions, i.e., time response, accuracy, and control stability.

14.02-33

3.8 Verify redundancy and electrical independence of the MSRT design.

3.9 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Input signal values.

4.2 MSRT output response.

5.0 ACCEPTANCE CRITERIA

5.1 The MSRT preliminary setpoints have been calibrated into the system.~~The MSRT performs as described in Sections 7.3 and 10.3.~~

14.02-33

5.2 The MSRT responds as designed to simulated signals.

5.3 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.12.3 Steam Generator Level Control (Test #149)

Note: The steam generator level control is performed by the PAS and is separated from other PAS functions in this test for clarity.

1.0 OBJECTIVE

14.02-33

1.1 To demonstrate the proper operation of the SG level control system.

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the SG level control system and interfacing equipment have been completed.

2.2 The SG level control system instrumentation has been calibrated and is functional for performance of the following test.

2.3 External test equipment has been calibrated and is functional.

2.4 Support systems required for the operation of the SG level control system are functional.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

3.1 Simulate inputs to the SG level control system and observe receipt of these signals at the non-safety control system.

3.2 Simulate varying input signals to the SG level control system and observe output responses at the non-safety control system.

3.3 Monitor the system during initial operation and verify as-designed operation, including control stability.

3.4 Verify that the steam generator level controls respond as designed to actual or simulated limiting malfunctions or failures.

3.5 Verify the redundancy and electrical independence of the I&C design.

14.02-33

3.6 Verify that the steam generator level control function operates over the design range using actual or simulated signals.

3.7 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Input signal values.

4.2 The SG level control system response.

5.0 ACCEPTANCE CRITERIA

5.1 The steam generator level control setpoints have been installed in the PAS computer.~~The SG level control system performs as described in Section 7.7.2 and Section 10.4.7.~~

5.2 The steam generator controls respond as designed to simulated high and low signals by opening and closing the feedwater regulating valves.

14.02-33

5.3 The steam generator level controls start the SSS and EFW pumps, as designed.

5.4 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.12.4 Reactor Partial Trip (Test #150)

Note: The partial trip function is performed by the RCSL system and is separated from other RCSL functions in this test for clarity.

1.0 OBJECTIVE

14.02-33

1.1 To demonstrate proper operation of the reactor partial trip (RPT).

1.2 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the RPT have been completed.

2.2 RPT instrumentation has been calibrated and is functional for performance of the following test.

2.3 External test equipment has been checked and calibrated.

2.4 Support systems required for the operation of the RPT are functional.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

3.1 Simulate signals to plant control system that are equivalent to hot full power.

3.2 Simulate loss of single RCP input to the RPT; observe response.

14.02-33

3.3 Simulate loss of single feedwater pump input to the RPT; observe response.

3.4 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Input signal values.

4.2 RPCS output response.

5.0 ACCEPTANCE CRITERIA

5.1 The reactor partial trip setpoints have been properly configured in the RCSL software.~~The RPT performs as described in Sections 7.1.1 and 7.7.2.~~

5.2 The reactor partial trip function sends the signal to drop the designated RCCAs upon receiving the appropriate simulated signal.

14.02-33

5.3 The reactor partial trip function sends the signal to runback the turbine load upon receiving the appropriate simulated signal.

5.4 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.12.5 Primary Depressurization (Test #151)

1.0 OBJECTIVE

1.1 To verify the flow paths of the primary depressurization system.

1.2 To verify that pressurizer safety valves and associated piping perform as designed.

1.3 To verify that pressurizer severe accident valves and associated piping perform as designed

14.02-33

1.4 To verify the proper operation of the reactor coolant gas vent system.

1.5 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the system to be tested are essentially complete.

2.2 Plant is at hot zero power (HZP) (pressure and temperature) conditions during HFT.

2.3 Plant systems required to support testing are functional, or temporary systems are installed and functional.

2.4 Permanently installed instrumentation is functional and calibrated, and is functional for performance of the following test.

3.0 TEST METHOD

3.1 Verify the performance of the pressurizer safety valves from the pressurizer to the pressurizer relief tank (PRT) by simulating an over pressurizer condition.

3.2 Verify the performance of the pressurizer severe accident valves from the pressurizer to the PRT by simulating an over pressurizer condition.

3.3 Verify that the reactor coolant gas vent system (both the pressurizer vent and the reactor vessel upper head vent) meets design depressurization rates.

3.4 Verify flow paths through the rapid depressurization system from the pressurizer to the PRT, using water or air.

14.02-33

3.5 Verify power-operated valves fail upon loss of motive power to the closed position.

3.6 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Valve position indications.

4.2 RCS temperature and pressures.

4.3 RCS depressurization rates.

4.4 PRT temperature, pressure, and level.

4.5 Reactors drain tank temperature, pressure, and level.

4.6 IRWST temperature, pressure, and level.

4.7 Position response of valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

5.1 The RCS allows venting of the pressurizer and reactor vessel through designed flow paths, as shown on the plant layout drawings~~described in Section 5.4~~.

14.02-33

5.2 The primary depressurization system provides a depressurization path through designed flow paths.

5.3 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.12.6 Rapid Depressurization (Test #152)

1.0 OBJECTIVE

1.1 To verify the flow paths of the rapid depressurization system.

1.2 To verify that MSRT and associated piping perform as designed.

1.3 Verify electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the system to be tested are essentially complete.

2.2 Plant is at HZP (pressure and temperature) conditions during HFT.

2.3 Plant systems required to support testing are functional or temporary systems are installed and functional.

2.4 Permanently installed instrumentation is functional and calibrated and is functional for performance of the following test.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

3.1 Verify the performance of the MSRT by simulating a safety injection signal.

3.2 Verify power-operated valves fail upon loss of motive power as designed.

3.3 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Valve position indications.

4.2 RCS temperature and pressures.

4.3 RCS depressurization rates.

4.4 SG pressure and level.

4.5 Position response of valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

5.1 The rapid depressurization system provides a depressurization path through designed flow paths.

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.12.7 Integrated Engineered Safety Features/Loss of Power (Test #153)

For the U.S. EPR design, the sequencer is not a stand alone component and this function is accomplished in the protection system. This test is not intended to be a comprehensive test of the sequencer.

1.0 OBJECTIVE

1.1 To verify the full functional sequence of the ESFs (protection system).

14.02-33

1.2 ~~To demonstrate electrical redundancy, independence, and load group assignment.~~

1.3 Verify electrical independence and redundancy of safety-related power supplies.

1.4 To demonstrate proper plant response to partial and full losses of offsite power.

2.0 PREREQUISITES

2.1 Individual system preoperational tests are complete.

2.2 Permanently installed instrumentation is calibrated and is functional for performance of the following test.

2.3 Test instrumentation is available and calibrated.

2.4 IRWST filled to normal operating level.

3.0 TEST METHOD

3.1 Verify the as-designed response of the following to partial and full losses of offsite power:

3.1.1 ESF functions~~systems~~.

3.1.2 Uninterruptible power supplies.

3.1.3 Instrumentation and control systems.

3.2 Verify the following under loss-of-power conditions:

3.2.1 Functionality of systems and components from energized buses.

3.2.2 Absence of voltage on de-energized buses.

3.2.3 Functional ESF systems.

3.2.4 Functional HVAC systems (where appropriate).

3.2.5 Functional decay heat removal systems.

3.2.6 Functional systems required under post-accident conditions.

3.3 Demonstrate the as-designed diesel generator response to loss of power including bus energization, load sequencing, and load carrying capability. Verify that full load is within diesel generator design capability.

14.02-33

3.4 Demonstrate as designed response to actual or simulated engineered safety features actuation signals (ESFAS).

3.5 Verify electrical independence and redundancy of power supplies for safety-related functions.

4.0 DATA REQUIRED

4.1 Response to ESFAS signals.

4.2 Diesel start times, load sequence times, frequency, voltage and current.

4.3 Verify by valve diagnostic testing (e.g., stroke time, developed thrust) that operation of power operated valves is within design limits.

5.0 ACCEPTANCE CRITERIA

5.1 The integrated engineered safety features function demonstrates the following features:~~The ESF systems respond as described in Chapters 6 and 9 and in Section 7.3.~~

5.1.1 Electrical redundancy, independence, and load group assignments are as designed.

5.1.2 Plant response to simulated partial and full LOOPs is as designed.

5.1.3 The diesel generators re-energize loads as designed and full load is within assumptions contained in the accident analyses.

14.02-33

5.2 Safety-related components meet electrical independence and redundancy requirements.

14.2.12.12.8 Safe Shutdown (Test #154)

1.0 OBJECTIVE

1.1 To demonstrate the proper operation of the safe shutdown function~~system~~.

2.0 PREREQUISITES

2.1 The instrumentation used during ~~S~~safe ~~S~~shutdown ~~system instrumentation~~ has been calibrated and is operating satisfactorily prior to performing the following test.

2.2 External test instrumentation is available and calibrated.

2.3 Support systems required for ~~operation of the~~testing safe shutdown ~~system~~ are functional.~~:~~

3.0 TEST METHOD

3.1 Verify that safe shutdown control signals override lower priority signals.~~Energize power supplies and verify output signals.~~

3.2 Activate manual trips and monitor operation.

3.3 Simulate safe shutdown scenarios and observe actuation of the appropriate trip circuit and associated alarms.

3.4 Exercise the control functions to the safety depressurization and shutdown cooling system to verify as designed operations.

2.2 Test instrumentation has been checked and calibrated.

2.3 Reactor vessel internals have been installed with full flow debris filters, dummy fuel assemblies, or equivalent that approximates the pressure drop across the core.

2.4 RCS operating at nominal HZP (pressure and temperature) conditions.

2.5 Desired RCPs are operating.

2.6 The associated digital DPS(s) are in operation.

3.0 TEST METHOD

3.1 RCS flow, pressure drops, and the data necessary to calculate RCS flows for four RCP operations shall be obtained for various RCP configurations.

4.0 DATA REQUIRED

14.02-33

4.1 ~~DPS~~Steam generator differential pressure.

4.2 RCP differential pressure.

4.3 RCS temperature and pressures at practical locations.

4.4 RCP speed (rpm).

4.5 Reactor vessel differential pressure.

4.6 Operating RCP configuration corresponding to data set.

5.0 ACCEPTANCE CRITERIA

5.1 The predicted RCS flow exceeds the value necessary to establish that post-core flow is in excess of that used for analysis in Chapter 15 and Section 5.0.

5.2 The predicted RCS flow is less than the design maximum ~~flowrate~~flow rate as described in Section 5.1.

14.2.12.13.11 Pre-Core Reactor Coolant System Heat Loss (Test #171)

1.0 OBJECTIVE

1.1 To measure RCS heat loss under HZP (pressure and temperature) conditions.

1.2 To measure the pressurizer heat loss under HZP (pressure and temperature) conditions.

2.0 PREREQUISITES

2.1 Test instrumentation is available and calibrated.

2.2 Construction activities on the RCS and associated systems are completed.

4.7 RCS temperature and pressure.

4.8 Regenerative heat exchanger inlet and outlet temperatures:

4.8.1 Shell side.

4.8.2 Tube side.

4.9 High pressure cooler inlet and outlet temperatures:

4.9.1 Shell side.

4.9.2 Tube side.

5.0 ACCEPTANCE CRITERIA

5.1 The CVCS performs as described in Section 9.3.4.

14.2.12.13.14 Pre-Core Turbine Overspeed (Test #174)

1.0 OBJECTIVE

14.02-33

1.1 ~~To verify that the mechanical overspeed trip protects the turbine as designed.~~

1.2 To verify that the two electronic overspeed trips protect~~s~~ the turbine as designed.

1.3 Verify electrical independence and redundancy of non-safety-related power supplies.

2.0 PREREQUISITES

2.1 Associated instrumentation has been checked, calibrated, and is functioning satisfactorily prior to performing the test.

2.2 RCS at HZP (temperature and pressure) conditions with the corresponding RCS pressure and temperature conditions.

2.3 Turbine is operating at normal speed but not synchronized to the grid.

3.0 TEST METHOD

3.1 Verify that the primary electronic ~~mechanical~~ overspeed trip is ~~operable~~functional, not bypassed.

3.2 Make the secondary overspeed trip not functional and verify that the primary overspeed trip remains functional.

3.3 Slowly increase turbine speed until the primary electronic overspeed occurs.

3.4 Verify that when the turbine trip occurs ~~and that~~ the turbine returns to turning gear.

3.5 Restore to functional the secondary overspeed trip that was previously not functional and make the primary overspeed trip that was previously tested, not functional.~~Verify that electronic overspeed trip~~

14.02-33

~~setpoint has been temporally set to a value that is greater than the mechanical trip setpoint.~~

3.6 Verify that the secondary overspeed trip remains functional.~~Slowly increase turbine speed until electronic overspeed occurs.~~

3.7 Slowly increase turbine speed until the secondary electronic overspeed occurs.~~Verify that turbine trip occurs and that turbine returns to turning gear.~~

3.8 Verify that when the turbine trip occurs the turbine returns to turning gear.

4.0 DATA REQUIRED

4.1 ~~Actual e~~Electronic turbine trip setpoints.

4.2 ~~Actual mechanical turbine trip setpoint.~~

5.0 ACCEPTANCE CRITERIA

5.1 Verification that the primary and secondary electronic ~~and mechanical~~ turbine trips occur within the design limits.

14.2.12.13.15 Pre-Core Safety Injection Check Valve Test (Test #175)

1.0 OBJECTIVE

1.1 To verify that the SI RCS loop check valves shall pass flow with the RCS at design pressure and temperature conditions.

1.2 To verify that the SI accumulator discharge check valve shall pass flow with the RCS at design pressure and temperature conditions.

2.0 PREREQUISITES

2.1 RCS at HZP (temperature and pressure) conditions with the corresponding RCS pressure and temperature conditions.

2.2 SI accumulators are filled and pressurized to their normal operating conditions.

3.0 TEST METHOD

3.1 Secure four of four SI accumulators by closing the discharge isolation valves.

3.2 Secure three of the four MHSI trains.

3.3 Simulate a SI signal and verify that the protection system reduces RCS pressure to the point that RCS pressure is less than that of the available MHSI pump.

3.4 Verify flow through each of the SI loop check valves as follows:

3.5 Pressurizer level increasing.

3.6 Secure the operating MHSI pump.

14.02-33

3.7 Place into service each MHSI pump one at a time and verify flow by increasing pressurizer level, terminating MHSI pump operation as soon as indication of increasing pressurizer level is observed.

3.8 Verify that RCS pressure is 50 to 100 psig greater than the accumulator pressure.

3.9 Open one of the four SI accumulator discharge isolation valves.

3.10 Slowly reduce RCS pressure until decreasing SI accumulator level is observed.

3.11 Verify flow through the SI accumulator discharge check valves by observing decreasing SI accumulator level and increasing pressurizer level.

3.12 Terminate the discharge flow from the SI accumulator by closing the discharge isolation valve.

3.13 Repeat steps 3.6 through 3.10 for each of the remaining SI accumulators until flow from each accumulator is verified.

4.0 DATA REQUIRED

4.1 SI accumulator level and pressure.

4.2 SI discharge header pressure during MHSI injection.

4.3 Pressurizer pressure and level.

5.0 ACCEPTANCE CRITERIA

5.1 Verification that the RCS loop check valves shall pass flow with the RCS at elevated pressure and temperature conditions.

5.2 Verification that the SI accumulator discharge check valves shall pass flow with the RCS at elevated pressure and temperature conditions.

14.2.12.13.16 Pre-Core Boration and Dilution Measurements (Test #176)

1.0 OBJECTIVE

1.1 To demonstrate the ability of the CVCS to control the boron concentration of the RCS by the feed and bleed method.

1.2 To demonstrate the ability of the CVCS to supply concentrated boric acid to the RCS.

2.0 PREREQUISITES

2.1 BAST is filled with borated water.

2.2 The reactor boron and water makeup system (RBWMS) (i.e., boron addition system) is functional.

2.3 The boron measurement system is functional.

3.0 TEST METHOD

3.1 Collect baseline data using the loose parts and vibration monitoring systems during plant heatup and at normal operating conditions.

3.2 Analyze baseline data and, if necessary, adjust alarm setpoints.

4.0 DATA REQUIRED

4.1 Baseline data using the loose parts and vibration monitoring systems.

4.2 Loose parts and vibration monitoring systems alarm setpoints.

4.3 RCS temperature and pressure.

5.0 ACCEPTANCE CRITERIA

5.1 The loose parts and vibration monitoring systems perform as described in Section 7.1.1.

5.2 The loose parts and vibration monitoring systems alarm setpoints have been adjusted using the baseline data.

14.2.12.14.4 Post-Core RCS Temperature Cross Calibration (Test #182)

14.02-33

1.0 OBJECTIVE

1.1 To normalize the RCS ~~flow~~ temperature transmitters.

1.2 ~~To determine the RCP flow coastdown characteristics.~~

1.3 To measure post-core RCS pressure drops.

1.4 ~~To collect flow related data on the operation of the RCPs for steady-state and transient conditions.~~

2.0 PREREQUISITES

2.1 Construction activities have been completed and the RCS is operational or functional as required by regulatory requirements.

2.2 Permanently installed temperature instrumentation is calibrated and functional or operable, as required.

2.3 ~~Temporary test instrumentation is calibrated and installed in a manner that complies with Technical Specification limitations. The test instrumentation shall be installed to collect RCS pressures at accessible locations around the RCS.~~

2.4 The RCS is operating at nominal ~~HZP~~ 350°F ~~(pressure and temperature)~~ conditions with RHR removed from service.

3.0 TEST METHOD

3.1 ~~Verify that the RCS flow indications are normalized at 100 percent RCS flow~~Collect Tcold and Thot data from RCS RTD.

14.02-33

3.2 ~~Record indicated RCS flow data for functionally allowed RCP combinations~~Collect core exit thermocouple data from each thermocouple located in the core area.

3.3 ~~Record RCS pressures that have been corrected for the same reference elevation as the permanently installed instrumentation. Coordinate data timestamps with permanent plant instrumentation~~Slowly increase RCS temperature and collect data at 50°F increments.

3.4 ~~Measure the RCS flow coastdown data while tripping various RCPs.~~

4.0 DATA REQUIRED

4.1 The following data shall be recorded with a frequent scan rate and time stamped.

4.1.1 RCS ~~flow related~~ Tcold data.

4.1.2 ~~RCP speed for pumps~~RCS Thot data.

4.1.3 ~~RCS pressure at permanent and temporary instrumentation locations~~RCS core exit thermocouple data for each functional thermocouple.

4.1.4 ~~RCS temperature.~~

4.1.5 ~~RCP breaker status.~~

4.1.6 ~~RCP coastdown speed.~~

5.0 ACCEPTANCE CRITERIA

5.1 ~~RCS flow loops indications are normalized to 100 percent~~The RCS RTD data has been incorporated into the RTD calibration procedures.

5.2 ~~The data from this test has been correlated with the RCS model that was used to predict RCS flow.~~

14.2.12.14.5 Post-Core Reactor Coolant System Flow Baseline (Test #183)

1.0 OBJECTIVE

1.1 To normalize the RCS flow transmitters.

1.2 To determine the RCP flow coastdown characteristics.

1.3 To measure post-core RCS pressure drops.

1.4 To collect flow related data on the operation of the RCPs for steady-state and transient conditions.

2.0 PREREQUISITES

2.1 Construction activities have been completed and the RCS is operational or functional as required by regulatory requirements.

2.2 Permanently installed instrumentation is calibrated and functional or operable, as required.

2.3 Temporary test instrumentation is calibrated and installed in a manner that complies with Technical Specification limitations. The test instrumentation shall be installed to collect RCS pressures at accessible locations around the RCS.

2.4 The RCS is operating at nominal HZP (pressure and temperature) conditions.

3.0 TEST METHOD

3.1 Verify that the RCS flow indications are normalized at 100 percent RCS flow.

3.2 Record indicated RCS flow data for functionally allowed RCP combinations.

3.3 Record RCS pressures that have been corrected for the same reference elevation as the permanently installed instrumentation. Coordinate data timestamps with permanent plant instrumentation.

3.4 Measure the RCS flow coastdown data while tripping various RCPs.

4.0 DATA REQUIRED

4.1 The following data shall be recorded with a frequent scan rate and time stamped:

4.1.1 RCS flow related data.

4.1.2 RCP speed for pumps.

4.1.3 RCS pressure at permanent and temporary instrumentation locations.

4.1.4 RCS temperature.

4.1.5 RCP breaker status.

4.1.6 RCP coastdown speed.

5.0 ACCEPTANCE CRITERIA

5.1 RCS flow loops indications are normalized to 100 percent.

5.2 The data from this test has been correlated with the RCS model that was used to predict RCS flow.

14.2.12.14.6 Post-Core Control Rod Drive Mechanism Performance (Test #184)

1.0 OBJECTIVE

1.1 To demonstrate that operation of the CRDMs at HZP (pressure and temperature) conditions meets design requirements.

14.02-33

1.2 To demonstrate the as designed operation of the RCCAs, including RCCA drop times, at ~~HZP~~cold conditions with all four RCPs in operation ~~(pressure and temperature) conditions~~.

14.02-33

1.3 To demonstrate the as designed operation of the RCCAs, including RCCA drop times, at HZP (pressure and temperature) conditions with all four RCPs in operation.

1.4 To demonstrate as designed operation of the RCCA position indicating system and alarms.

2.0 PREREQUISITES

2.1 The CRDM (Rod Pilot) pre–core performance test has been completed.

2.2 The CRDM (Rod Pilot) instrumentation is functional and calibrated.

2.3 The plant monitoring system is functional.

2.4 The CRDM cooling system (i.e., containment pit cooling) is functional.

2.5 CRDM coil resistance values have been measured.

3.0 TEST METHOD

3.1 Withdraw and insert each RCCA to verify as designed operation of CRDM.

3.2 Measure and record at least one to three drop times for each RCCA:

3.2.1 Perform three measurements of rod drop time for each of those RCCAs falling outside the two-sigma limit for similar RCCAs.

3.3 Withdraw and insert each RCCA while recording position indications and alarms.

4.0 DATA REQUIRED

4.1 RCCA drop time.

4.2 RCS temperature and pressure to be taken during measurement and recording of drop time for each RCCA.

4.3 RCCA position and alarm indications.

5.0 ACCEPTANCE CRITERIA

5.1 The CRDM, RCCAs and their associated position indications operate as described in Section 4.6.

5.2 RCCA drop times are in agreement with the limits specified in accident analyses, with margin or as specified in regulatory documents.

14.2.12.14.7 Post-Core Reactor Coolant and Secondary Water Chemistry Data (Test #185)

1.0 OBJECTIVE

1.1 To maintain the proper water chemistry for the RCS and SGs during post-core heatup.

5.1 The measured ITC when compared to the predicted ITC is within the acceptance criteria ~~specified in ANSI/ANS-19.6.1~~.

14.2.12.15.3 Rod Worth (Test #192)

1.0 OBJECTIVE

14.02-31

1.1 To measure the integral and differential worth of the reference bank (the test bank with the highest predicted worth).~~To measure the worth of rod groups. For the U.S. EPR, rod groups shall be measured by one of the approved methods . During initial criticality one of the methods that determine the worth of rod groups shall be used.~~

1.1.1 The worth of the reference bank will be measured from the nearly full withdrawn position to the fully withdrawn position, approximately 100 pcm from fully withdrawn, with the reactivity computer.

1.1.2 The integral and differential worth of the reference bank will be measured by the reactivity computer during a slow dilution that terminates with the reference bank nearly fully inserted, approximately 100 pcm from fully inserted.

1.1.3 The worth of the reference bank will be measured from the nearly full inserted position to the fully inserted position with the reactivity computer.

1.2 To measure the worth of the RCCA with the highest worth.

1.2.1 Measure the integral RCCA worth by rod swap.

1.3 To measure the worth of the Partial Trip Bank.

1.3.1 Measure the integral Partial Trip Bank worth by rod swap.

1.4 To measure the worth of the remaining RCCA test banks.

1.4.1 Measure the integral worth of the remaining test banks using rod swap.

2.0 PREREQUISITES

2.1 The reactor is critical.

2.2 All available pressurizer heaters are energized.

2.3 The reactivity computer is operating.

2.4 Reactor power is below the point of adding heat.

2.5 The reactivity computer is available for measuring reactivity (pcm).

3.0 TEST METHOD

3.1 Measure the worth of the reference bank from the nearly full withdrawn position to the fully withdrawn position using the reactivity computer.~~Measure the control rod worth in a known~~

~~reactivity configuration using an approved method described in ANSI/ANS-19.6.1.~~

3.2 Measure the integral and differential worth of the reference bank using the reactivity computer during a slow dilution that terminates with the reference bank nearly fully inserted.

3.3 Measure the worth of the reference bank to the fully inserted position with the reactivity computer.

3.4 Measure the integral worth of the RCCA with the highest worth using rod swap.

3.5 Measure the integral worth of the Partial Trip Bank using rod swap.

3.6 Measure the integral worth of the remaining test banks using rod swap.

4.0 DATA REQUIRED

14.02-31

4.1 Conditions of the measurement:

4.1.1 RCS temperature.

4.1.2 Pressurizer pressure.

4.1.3 RCCA configuration.

4.1.4 Boron concentration.

4.2 Time dependent information:

4.2.1 Reactivity variation.

4.2.2 RCCA positions.

5.0 ACCEPTANCE CRITERIA

5.1 The worth of the reference bank is within 10% of predicted value.~~The measured control rod worths when compared to the predicted rod worths is within the acceptance criteria specified in ANSI/ANS-19.6.1.~~

5.2 The worth of the highest worth RCCA is bounded by the value used in the rod ejection analysis.

5.3 The worth of the Partial Trip Bank is within 15% of the predicted value.

5.4 The worth of the remaining test banks is within 15% of the predicted values.

14.2.12.16 Phase IV: Power Ascension Tests, 5 Percent Power Ascension Plateau

Some of the following tests are performed in more than one plateau. In those instances the test is listed in the first plateau that it is recommended to be performed. The plant instrumentation shall be functional prior to each test.

14.02-33

5.2 Test criteria specified ~~in ANSI/ANS 19.6.1~~by the fuel designer.

14.2.12.21.2 Trip of Generator Main Breaker (Test #219)

1.0 OBJECTIVE

1.1 To demonstrate that the plant responds and is controlled as designed following a full-power turbine trip.

1.2 This procedure shall be performed at the following plateau:

1.2.1 ≥98 percent reactor power in accordance with RG 1.68.

2.0 PREREQUISITES

2.1 The following systems are in automatic operation:

2.1.1 Primary and secondary level controls (e.g., pressurizer, feedwater heaters, VCT, deaerator, SG).

2.1.2 Primary and secondary pressure controls (e.g., pressurizer, VCT, condensate).

2.1.3 Primary and secondary flow controls (e.g., CVCS letdown, feedwater).

2.1.4 Primary and secondary temperature controls (e.g., RCS T_{avg}).

3.0 TEST METHOD

3.1 The turbine is tripped from the MCR simultaneous with trip of each RCP.

3.2 Verify that RCPs cease to operate.

3.3 The plant behavior is monitored to establish that the control systems maintain the NSSS within operating limits.

4.0 DATA REQUIRED

4.1 Plant condition prior to trip.

4.2 The following acceptance criteria parameters are monitored prior to and throughout the transient:

4.2.1 Pressurizer parameters (i.e., pressure and level).

4.2.2 RCS temperatures (i.e., T_{cold}, T_{hot} and T_{avg}).

4.2.3 SG parameters (i.e., flow, pressure, temperature and level).

4.2.4 RCCA position.

4.3 Additional key plant parameters shall be monitored for ~~base-line~~baseline data.

5.0 ACCEPTANCE CRITERIA

4.2.4 RCS parameters (i.e., flow, pressure, temperature and pressurizer level).

4.2.5 RCCA position.

4.2.6 RCS boron concentration.

4.3 Additional key plant parameters shall be monitored for ~~base-line~~baseline data.

5.0 ACCEPTANCE CRITERIA

5.1 The plant responds as described in Section 10.2.

14.2.12.21.4 Loss of Offsite Load (Test #221)

1.0 OBJECTIVE

1.1 To demonstrate that the plant responds and is controlled as designed following a loss of offsite load.

1.2 This procedure shall be performed at the following plateau:

1.2.1 ≥98 percent reactor power in accordance with RG 1.68.

2.0 PREREQUISITES

2.1 The following systems are in automatic operation:

2.1.1 Primary and secondary level controls (e.g., pressurizer, feedwater heaters, VCT, deaerator, SG).

2.1.2 Primary and secondary pressure controls (e.g., pressurizer, VCT, condensate).

2.1.3 Primary and secondary flow controls (e.g., CVCS letdown, feedwater).

2.1.4 Primary and secondary temperature controls (e.g., RCS T_{avg}).

2.1.5 RCSL control of RCCAs.

3.0 TEST METHOD

3.1 The turbine-generator is removed from the grid by opening the output breaker.

3.2 Verify that RCPs continue to operate with power supplied from the offsite grid.

3.3 Verify that a partial rod trip occurs but the reactor remains critical.

14.02-33

3.4 ~~Verify that the turbine-generator continues to provide house loads.~~

3.5 The plant behavior is monitored to establish that the control systems maintain the NSSS within operating limits.

4.0 DATA REQUIRED